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Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2019-20 (Column 4)	2020-21 (Column 5)	2021-22 (Column 6)	2022-23* (Column 7)	2023-24* (Column 8)	2024-25* (Column 9)	(Column 10)
Australian Capital Territory								
The Australian National University								
DP200100004 Brocks, A/Prof Jochen J	This project aims to uncover the environmental changes that transformed the oceans 650 million years ago when complex algal cells started to replace bacteria as the dominant forms of life. Using a groundbreaking combination of molecular fossils and isotopes from ancient sedimentary rocks, the project aims to reveal how the flow of energy changed through Earth's ecosystems. The expected outcomes include new knowledge about our own origins and the events that led to the emergence of the first animals. Additionally, new insights about the mechanisms that generated the oldest hydrocarbon reserves may lead to a new biomarker tool to aid discovery of major new oil or gas reserves in Australia's Red Centre.	68,000.00	140,000.00	139,500.00	67,500.00	0.00	0.00	415,000.00
	National Interest Test Statement This project contributes to Australia's Science and Research Priorities towards "a fundamental understanding of the composition and processes governing the formation and distribution of resources in Australia". Oil fields in Russia and Oman hold large reserves of petroleum that are more than 550 million years old. Rocks of the same age are found in Australia's Red Centre and they likewise may hold vast fields of undiscovered oil. It is one of the largest and least explored basins of that age in the world. This has been recognised by Australia's exploration industry that is rapidly expanding into this territory. However, the exploration risks are extraordinarily high as little is known about the oil and gas potential of rocks that old. In this project we aim to deliver a tool based on hydrocarbon fingerprints that will provide information vital for exploration decisions: whether petroleum source rocks in the Red Centre generate natural gas or liquid petroleum. This knowledge will significantly reduce risks and costs for the exploration industry, and may point towards the discovery of major new reserves.							
DP200100053 Valentine, Dr Andrew	This project aims to develop novel mathematical frameworks for probabilistic geophysical imaging and inference, building on recent advances in statistics and machine learning. These will allow us to obtain a more detailed and robust understanding of structures and processes occurring within the Earth, including those relevant to the Australian minerals and/or energy industries. Outcomes of this research include mathematical and computational tools for imaging the subsurface, and greater understanding of Australian and global geoscience. This work can permit more effective exploitation of earth resources, as well as improving our understanding of how the Earth system has developed over geological history.	69,500.00	134,500.00	130,000.00	65,000.00	0.00	0.00	399,000.00
	National Interest Test Statement This research will improve Australia's ability to discover and make use of resources such as mineral deposits and energy reserves. It will allow us to build more reliable pictures of whatever may be hidden underground, giving decision-makers access to comprehensive information about the potential risks and rewards associated with resource exploitation. This will help maximise resource recovery while minimising wasted costs -- bringing clear benefits to the Australian economy -- and ensure that extraction operations can be carried out in a way that does not cause harm for the local community or ecosystems. It will also allow exploration activities to be better-targeted, ensuring these can proceed with the least environmental impact possible, and help us to learn more about how our planet 'works'. This project will continue Australia's history of innovation in geophysical exploration, ensuring that we maintain our reputation and pool of expertise in an area that is central to the long-term health of the national economy.							
DP200100067 Morrison, A/Prof Scott	This project aims to investigate fundamental mathematical structures in modern category theory, providing an algebraic description of physical systems including topological order and conformal field theory. The project will study quantum symmetry, and classify and construct new classes of conformal field theories, using novel tools from enriched category theory, modular forms, and lattice gauge theory. The main goal is to understand the landscape of topological and conformal field theories, laying the foundation for new technologies based on topological order. This timely project capitalises on the recent arrival of subfactor experts in Australia, and builds capacity in mathematical research and international links in a cutting edge field.	40,000.00	105,000.00	130,000.00	65,000.00	0.00	0.00	340,000.00

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	National Interest Test Statement							
	The project undertakes fundamental research in mathematics. It builds the mathematical foundations for advances in condensed matter physics, in particular the emerging new field of topological matter. Just as semiconductors provide the physical substrate for all modern computer technology, topological matter promises new classes of intrinsically quantum devices, such as topologically protected logical qubits. In the short term, the project boosts Australian research capacity in a core part of 21st century mathematics. In the medium term, the project trains a next generation of postdoctoral researchers, and provides new mathematical tools for researchers across mathematics and physics. In the long term, this project helps reveal fundamental aspects of quantum physics, and builds the theoretical framework underlying exotic new classes of materials and computational devices. Investment in this project keeps Australia at the forefront of these fields, and trains researchers who can support high technology commercial applications in quantum computation, topological phases of matter, and quantum devices.							
DP200100159 Liu, Prof Yun	This project aims to resolve critical, bottleneck issues in the development of photocatalysis and photoelectrochemistry - key technologies towards the realisation of a sustainable carbon-neutral society. This project expects to use an innovative strain-engineering approach establishing a built-in electric field within materials for highly efficient separation and transport of photoexcited carriers. Expected outcomes of this project are to create new, ground-breaking materials and/or nanosystems that overcome intrinsic weakness of conventional semiconductors and significantly improve their photocatalytic and photoelectrochemical performance, for the benefit of the utilisation of solar and light energy in energy, environment and health.	100,000.00	185,000.00	160,000.00	75,000.00	0.00	0.00	520,000.00
	National Interest Test Statement							
	This project will work in the Australian national interest in three main ways. Firstly, through the development of novel technologies for solar energy harvesting and conversion, it will contribute to using science and technology to harness new sources of economic growth, maximising Australia's opportunity in a globalised world. Secondly, by creating highly efficient light-driven catalysts it will enable new wastewater treatments and the reduction of fossil fuel carbon emissions, which will directly maintain Australia's environment and resources and enhance Australia's international environmental reputation. Finally, the international cooperation built into this project will facilitate the development of new biosensors to monitor and detect diseases, benefiting Australian society directly as well as enhancing Australia's global position as a leader in innovative technology. This project will bring enormous commercialisation opportunities for Australia whilst providing state-of-the-art research training to Australian researchers, producing internationally competitive research with genuine impact.							
DP200100338 Cox, Dr Nicholas J	The aim of this project is to characterise modifications to the light dependent reactions of photosynthesis of simple, single cell organisms that live under harsh environmental conditions including: i) elevated temperature; ii) low, variable and low energy (red) light; iii) arid and variable hydration; and iv) chemical stress e.g. low pH. In a changing biosphere brought about by anthropological climate change, a better understanding of existing adaptions of bacterial photosynthetic organisms may allow more resilient crops and other essential plants to be developed in the future. The project brings together an international consortium of world renowned experts across key aspects of photosynthesis.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement							
	We are living in a changing climate. Australia is becoming increasingly susceptible to more extreme weather. Growing food and other essential crops in this changing climate is becoming progressively more challenging, as plants do not necessarily have the properties to thrive in these conditions. There are however simple organisms, found on the periphery of the biosphere that can tolerate extremely hostile conditions growing in, for instance, boiling water, acidic lakes, dark and sheltered environs and in the desert. We seek to understanding how these species are adapted at the molecular level to cope with these conditions. Such knowledge will potentially provide a proof-of-principle strategy for introducing new favourable traits into crops and other desirable plants, thus building Australia's capacity to respond to environmental change and improve economic competitiveness into the future. The objectives of this proposal are an area of great current interest. As such, this project provides excellent training for Honours and PhD students and will enhance international links in this field of research.							

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DP200100341 Banwell, Prof Martin G	This project seeks to establish flexible methods of chemical synthesis for creating new molecular scaffolds capable of achieving selective enzyme inhibition. The approach aims to exploit the vast and biologically-programmed structural diversity associated with natural products. Unique, small molecule organic compounds will be obtained that reveal details of the operation of key enzymes in bacterial and mammalian systems. Such new knowledge would allow for the design of highly selective therapeutic agents relevant to the treatment of a range of diseases including bacterial infections, diabetes and cancer. The high-end scientific training and privileged forms of matter arising from this work would provide major benefit to the biotech sector.	105,000.00	175,000.00	140,000.00	70,000.00	0.00	0.00	490,000.00
	National Interest Test Statement Chemical synthesis is central to many aspects of science as it offers a unique capacity to provide new, otherwise inaccessible and clearly-defined/clean forms of matter with bespoke properties. As such, chemical synthesis underpins major parts of contemporary scientific activity and is, therefore, an essential aspect of a modern, research-competitive economy and a self-sufficient, fully-functional society. The present proposal seeks to combine the remarkable shapes and properties of Nature's molecules with new chemical reactions to be developed by the CI for purpose of rapidly and efficiently identifying and then constructing molecular systems capable of deployment in medical and/or agricultural settings. The processes to emerge from such studies are likely to be of broad utility and will provide new and distinctive forms of matter of both commercial value and societal benefit. They will help Australia become a key player in an internationally competitive area and enable the country to establish and maintain a distinctive technological and commercial edge within it.							
DP200100348 Otting, Prof Gottfried	This project aims to advance nuclear magnetic resonance (NMR) spectroscopy methods in the field of drug discovery. It addresses a long-standing bottleneck for medicinal chemists in drug development: the rapid determination of how ligand molecules bind to proteins, where they bind and their orientation in the binding site. The methods include techniques for the attachment of NMR tags to ligands and target proteins, installation of new unnatural amino acids in proteins, and software for automated assignment of NMR spectra and 3D structure modelling of proteins using sparse distance restraints measured by electron paramagnetic resonance (EPR) spectroscopy. The outcome is to benefit the early stages of drug discovery in the biotech industries.	85,000.00	174,000.00	178,000.00	89,000.00	0.00	0.00	526,000.00
	National Interest Test Statement The development costs for new drugs in the pharmaceutical industries are spiralling. This project aims to accelerate the early stages of drug discovery, when suitable chemical compounds need to be selected for further development. Specifically, the project will develop methods for obtaining the structural information needed to guide medicinal chemists in the design of new compounds with improved pharmaceutical properties. Experimentally confirmed information on where and how exactly a compound binds on the target offers dramatic savings in time and costs compared to the many misses associated with traditional random searches. Drugs are very high value-add materials. Their early-stage discovery phase is primarily conducted in small biotech companies. The present project will add value by accelerating the rate with which these companies can secure intellectual property.							
DP200100364 Lee, Dr Woei Ming Steve	Rapid and accurate quantification of live biological fluid properties at sub-cellular and molecular levels forms the bedrock of biofluidic sciences. Majority of the biofluidic devices rely on quantifying biological fluids after its removal from the body in an in vitro Flow Cytometer (FC). FC faces many caveats i.e. biological degradation and small volume etc. In this project, we shall engineer the first in vivo 5D imaging flow cytometer (5D IFC) capable of continuous assessment of potentially entire blood volume in a living mice without removing fluid out of the body. The project represents a major advancement beyond any existing flow cytometer and overcome the engineering limits of state-of-art laser scanning imaging devices.	85,000.00	160,000.00	150,000.00	75,000.00	0.00	0.00	470,000.00

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	National Interest Test Statement Biofluidic science aims to quantify biological cells and their multitude of interactions in living vessels. Biofluidics is the key to discoveries of fundamental biological antagonists responsible for vascular disorders that lead to major clinical sequelae such as heart attack and ischaemic stroke. Existing biofluidic tools can only quantify biofluids at sub-cellular level out of living vessels. In this project, we aim to build the first ever 5D imaging flow cytometry system to operate in a living organism. We shall overcome the intractable technical constraints of existing biofluidic tools and greatly amplify our ability to study cells in living vessels. In doing so, we facilitate the future development of therapeutic avenues to treat disorders of biological circulatory systems. The instrument will also enable studies of other living biological organisms such as plants where biofluidics plays a major role for plant growth and productivity. The concepts developed in the project will be a milestone in biofluidics sciences and could potentially impact other larger scale fluidic-related fields in earth sciences.							
DP200100387 Jones, A/Prof David A	Rust diseases threaten global food security. This cross-institutional project aims to discover how proteins secreted by rust fungi promote disease following their translocation into plant cells. It will use the interaction between flax and the flax rust fungus as a powerful model system to test the hypothesis that manipulation of host RNA metabolism is a fundamental mechanism underpinning rust pathogenesis. This research is intended to dramatically improve our understanding of the molecular mechanisms used by rust fungi to establish infection. The knowledge gained is expected to facilitate the development of new strategies for rust disease management in food crops by identifying pathogenic processes that can be targeted for intervention.	75,000.00	155,000.00	155,000.00	75,000.00	0.00	0.00	460,000.00
	National Interest Test Statement Rust diseases are a significant cause of lost food production in Australia and worldwide. In Australia, stripe rust alone is estimated to cause $127M p.a. in lost wheat production and to cost $102M p.a. to control using fungicides. Without fungicides and breeding for rust resistance, stripe rust would likely cause $994M p.a. in lost wheat production and stem rust a further $478M p.a. With mutations to fungicide resistance and mutations overcoming resistance, the rust fungi pose an ongoing threat to crop production. To help combat this problem, the proposed research will investigate the molecular processes underlying plant infection by rust fungi using the well-developed and powerful flax-rust model system to generate new knowledge and understanding about the mechanisms rust fungi use to manipulate their plant hosts. The aim is to then apply this knowledge to the development of new strategies and tools for the protection of Australian crops from rust diseases. Such strategies and tools have the potential to generate enormous economic and environmental benefits for Australia.							
DP200100388 Jones, A/Prof David A	Fusarium wilt is a devastating disease of many important crop plants, including banana, cotton and tomato. There are significant gaps in our understanding of this disease that need to be addressed to enable better disease management. This project aims to identify and analyse tomato proteins targeted by Fusarium effector proteins (virulence factors), determine how corresponding tomato receptors (resistance proteins) recognise these effectors, and identify the signalling pathways and critical defence responses activated by these receptors. The intention is to close the gaps in our understanding and use the knowledge gained to develop new strategies for disease control by interfering with fungal pathogenicity and enhancing plant resistance.	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00
	National Interest Test Statement Fusraium wilt diseases are a significant cause of lost crop production in Australia and worldwide, and a threat to food security. Fusarium wilt (Panama disease) has already destroyed the banana industry in the Northern Territory and recent outbreaks now threaten the industry in Queensland. Similarly, Fusarium wilt is an ongoing threat to the Australian cotton industry with some growing areas already taken out of production. Fusarium wilt also remains a threat to a number of other crops including tomato. The proposed research will use the tomato – Fusarium wilt pathosystem to investigate the molecular processes enabling the Fusarium wilt fungus to infect susceptible plants, and conversely, resistant plants to halt infection. It aims to generate the knowledge and understanding essential for the development of new intervention strategies to manage Fusarium wilt diseases. Such strategies have the potential to enable long-term chemical-free crop protection with both economic and environmental benefits for Australia.							

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DP200100406 King, Prof Penelope L	High temperature gases move from Earth's interior to the atmosphere at volcanoes, but little is known about how they react. Recent work shows that exceptionally rapid reactions occur between hot gases and the surfaces of solids. These reactions are instrumental in forming ore deposits. The proposed work aims to apply state-of-the-art chemical analysis of natural samples and investigate gas-solid reactions experimentally to determine how chemical elements, including metals, are distributed in these reactions. The study seeks to create robust geochenmical models for understanding geochemical and ore-forming processes. Improved understanding of ore deposition will enhance the long-term viability of Australia's metals sector.	84,000.00	168,500.00	164,500.00	80,000.00	0.00	0.00	497,000.00
	National Interest Test Statement Metals contribute to around 7% of Australia's export market and include significant copper and gold resources. This project is focused on how reactions between hot magmatic gases and solids can concentrate and form metal deposits. The examination of rocks that preserve evidence of past gas will provide chemical clues on how metals are concentrated and deposited in nature. Complementary experiments to simulate metal mobilisation in reactions between gases and solids will provide models to inform both ore deposit exploration and mining strategies. The project will develop advanced analysis protocols and novel synthesis approaches that are key to the Australian Academy of Science's UNCOVER initiative. The expertise of the team members is expected to have spin-offs for improving advanced material synthesis and analysis and clean energy research. The work is relevant to volcanic ash that disrupts air transport and may be a hazard to health and the environment. Finally, the techniques and the modelling used in the project will help build a cohort of scientists who can solve problems in space science.							
DP200100483 van Dooren, Dr Giel G	Parasites impose a major economic and medical burden on human societies. In order to grow and reproduce, parasites scavenge nutrients from their animal or human hosts. As they move within and between hosts they encounter different levels of nutrients; how they adapt to these differences is poorly understood. This project aims to investigate the mechanisms by which the model parasite Toxoplasma senses and responds to the nutrients in its environment, thereby shedding light on how they adapt to the different environments that they inhabit and, in the longer term, informing novel treatment strategies that aim to limit the parasites' nutrient supply.	75,000.00	155,000.00	155,000.00	75,000.00	0.00	0.00	460,000.00
	National Interest Test Statement Apicomplexans are important parasites of livestock, poultry, and other animals, and impose large economic costs on human societies, including in Australia. Eimeria tenella is a major pathogen of poultry, causing billions of dollars of losses in the poultry industry annually. Tick-borne pathogens such as Babesia and Theileria species are a major threat to the cattle industry in tropical areas, including in northern Australia. Neospora caninum and Toxoplasma gondii (the study species of this grant) cause >25% of abortions in cattle and sheep. Treatment options against these apicomplexans are limited, and are prone to drug resistance and inefficacy against particular stages of the parasite life cycle. Nutrient scavenging is central to the parasitic way of life, and this project aims to address major gaps in knowledge about how apicomplexans sense and respond to the nutrient conditions they encounter in their hosts. This may pave the way for novel treatment strategies that limit nutrient uptake in these nefarious pathogens.							
DP200100495 Piper, Prof Philip J	This project aims to investigate the missing millennium – a significant gap in our understanding of the arrival of food producing populations into northern Vietnam between 5000 and 4000 years ago, before their expansion across the rest of Mainland Southeast Asia. Substantial new insights will include information on cultural development and population ancestry, an enhanced archaeological chronology, and details of the subsistence economies of both farmers and hunter-gatherers in the region. Significant benefits are expected in understanding the population history behind modern Southeast Asia, especially Vietnam.	43,912.50	96,470.00	123,225.00	70,667.50	0.00	0.00	334,275.00
	National Interest Test Statement Australia’s relationship with Asia is a national priority; after all, the 21st century has been called the Asian Century due to predicted growth in Asia’s economies, populations and cultures. The Government is encouraging this growth through a $20-million-dollar Asian Innovation Strategy, and a new long-term Trans Pacific Partnership. Yet we know little of of the origins of Asian economies. This project reveals these beginnings: it combines archaeological discovery with cutting-edge science to reveal the foundations of Vietnam’s contemporary economy and cultures between 3000 and 2000 BC. The focus is on Vietnam because of its location between China and the rest of Mainland South East Asia, its well-preserved and accessible archaeological record, and our excellent collaborations. This project will benefit not only the Australian community but also the Vietnamese in terms of greater appreciation of the country’s cultural and economic origins. The project’s new techniques will also benefit those seeking to discover the early origins of other economies, populations and cultures of the world that exist today.							

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DP200100513 Smithson, Prof Michael J	Attributions of fake news and post-truth are symptoms of uncertainty arising from conflicting information. Little is known about human responses to conflictive uncertainty other than that people find it aversive. This project aims to identify the determinants of human attitudes towards conflictive uncertainty. The aims will be achieved via the development of measures of attitudes toward conflictive uncertainty, and studies identifying the major influences thereof. Expected outcomes include advances in knowledge of how conflictive uncertainty attitudes relate to risk orientations, personality, and situational factors. Anticipated benefits include improved strategies for decision makers and communicators faced with conflictive uncertainty.	43,249.00	94,882.50	103,321.50	51,688.00	0.00	0.00	293,141.00
	National Interest Test Statement Uncertainty arising from conflicting information has the worst effects on decisions and negotiations of any kind of uncertainty. It often is the basis of disagreements and it leads to distrust and indecision. People are more risk-averse and pessimistic under conflictive uncertainty than other kinds of uncertainty, even when risk-aversion is irrational. For the past several decades, the Australian public has increasingly been exposed to divergent risk messages about important issues, such as financial investment, health risks, terrorism, and climate change. This has increased polarisation of public opinions and decreased trust in experts and other authorities. Little is known about why and when people are averse to conflictive uncertainty. This project combines methods and insights from psychology and behavioural economics to develop valid measures of their attitudes towards it, find out why and when they find it aversive, and develop and test effective strategies for dealing with it and mitigating its negative effects. Project outcomes will have applications in risk management and risk communication.							
DP200100534 Jackson, Em/Prof Peter A	This project aims to understand how socially marginalised Thai gay men and transgenders draw on Buddhist healing traditions as alternative and complementary therapies in dealing with HIV/AIDS and other health emergencies. Through case studies undertaken in several culturally diverse Thai regions, this project expects to provide comparative insight into the intersections of religion and health in Asian societies suffering HIV epidemics and among Asian migrant communities in Australia. Expected outcomes include enhanced approaches to HIV education among vulnerable minority communities in Thailand and other Southeast Asian societies as well as among Asian gay men in Australia, whose recourse to alternative therapies is poorly understood.	42,547.50	119,842.50	136,599.50	59,304.50	0.00	0.00	358,294.00
	National Interest Test Statement Our project's findings on how religious involvement shapes recourse to alternative therapies in Buddhist communities will have social benefits for Australia in promoting the wellbeing of the many Southeast Asian gay migrants and students residing in this country. Because these migrants share similar religious and sexual cultures with gay men in Thailand, this project's cross-cultural understandings have the practical potential to be applied to enhance culturally appropriate responses to HIV and other health issues in Asian gay communities in Australia. This project's results will also benefit Australia's international health security initiatives by being applicable in Southeast Asian countries that share cultural similarities with Thailand and are major recipients of Australian aid. This project will contribute to DFAT's Health for Development Strategy 2015-2020, which identifies fighting AIDS as a central plank of an effective global health response, and the 2017 Health Security Initiative for the Indo-Pacific Region, which aims to apply Australia's unique strengths in health security in Southeast Asia.							
DP200100535 Connal, A/Prof Luke A	This project aims to develop new chemical methods and polymers inspired by nature. Enzymes are nature's catalysts: they recognise a substrate and bind with it to provide the optimal environment for a reaction. However, they are easily degraded, limiting their industrial use. This project aims to develop new, highly stable polymer designs that can perform similar functions. This will be achieved by using polymer and supramolecular chemistry to control the reaction environment, in combination with computational techniques to explore observed reactivity and guide nanoenvironment design. Expected outcomes include new polymers and materials capable of controlling a range of reactions and expanding the scope of bioinspired polymer design.	75,000.00	145,000.00	135,000.00	65,000.00	0.00	0.00	420,000.00
	National Interest Test Statement The polymers and materials prepared in this project will have a direct impact to increase the environmental efficiency of a number of industries. For example, applications such as household cleaners that can degrade stains in an efficient manner at low temperatures. This would decrease the energy required for Australians to wash their clothing, significantly reducing the cost and environmental impact of domestic and industrial laundering. The ability to prepare low cost, highly stable and scalable polymer catalysts as described in this proposal could have broad impact on a number of advanced manufacturing areas where enzymes are already utilised, such as pharmaceuticals, biofuels and environmental decontaminants. The industrial outcomes would put Australia at the forefront of efficient and sustainable manufacturing of high value chemicals.							

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DP200100601 Hinde, Prof David J	This project aims to characterise and quantify the quantum energy levels crucial in determining the mass and energy distributions of nuclear fission products, which recent results show are far from understood. Combining new techniques and concepts, distributions will be measured down to the fission barrier energies, maximising sensitivity to quantum effects. The project exploits newly enhanced Australian accelerator infrastructure, world-best detector capabilities, and the latest findings in reactions of light cluster nuclei. The results will test new high-profile quantum many-body predictions and guide fundamental model developments, with implications ranging from future energy to understanding production of heavy elements in the universe.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
	National Interest Test Statement This research project exploits recent investment of tens of millions of dollars by successive Federal Governments through NCRIS, and by the ARC and the ANU, in Australian accelerator-based research infrastructure. Innovative experiments and concepts will be developed to test new-generation quantum models of fission. The ultimate goal is a predictive understanding of this technologically important process. Worldwide, fission provides energy, medical isotopes and enables materials and biological research. It is important in determining the abundance of the heavy elements in the universe. The project aims to provide outcomes with high international impact, enhancing Australia's reputation in nuclear reaction dynamics. It will provide cutting-edge training opportunities for students and early career researchers at Australia's only top-line nuclear physics teaching and training program, at the ANU. This provides a workforce trained at the highest level in nuclear physics, important for issues of national interest in security, foreign affairs, medical and energy fields where expertise in nuclear issues are vital.							
DP200100693 Abhayapala, Prof Thushara D	This project aims to develop audio technology to enable unmanned aerial vehicles or drones to hear, use speech and sound to communicate with humans, acoustically sense their surroundings and make them less noisy. This project expects to generate new knowledge in acoustic signal processing and its application in drones using innovative approaches, such as use of miniature microphone and loudspeaker arrays, and active noise control. Expected outcomes include development of new theories, Intellectual Property, with potential commercial value, and training of next generation researchers. This should provide significant benefits with applications in life saving, search and rescue operations, transportation of goods, and creation of 3D media.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
	National Interest Test Statement This project will develop new technology that enables drones to hear, talk, acoustically sense their environment and operate quietly with minimal noise disturbance to bystanders. Audio enabled drones will reduce public resistance and complaints of use of drones and unmanned aerial vehicles (UAVs). This will be of benefit to a broad range of industry applications, such as search and rescue operations, delivery of goods, 3D media creation and defence related tasks. This new knowledge and real-life applicable technology are expected to result in world-leading research, drive commercial activities, including creation of start-up companies and collaborations with Australian government and private sector industries. The adoption of this project technology by end-users will benefit the Australian economy and society at large.							
DP200100765 Roberts, Prof Andrew P	Magnetic rock-forming minerals can record important information about Earth’s magnetic field and climatic changes. In rock magnetism, we seek to quantify magnetic property variations in geological materials. Existing quantification methods are limited and provide bulk characterisation of all magnetic particles in a material rather than diagnostic information concerning individual mineral components. This Project aims to develop a machine-learning framework to “unmix” and quantify each magnetic mineral component in single natural samples, and will unlock a new quantitative era in rock magnetism. It is expected to have impact beyond Earth science by enabling magnetic characterisation in physics, materials science, and industry.	67,500.00	137,500.00	144,500.00	74,500.00	0.00	0.00	424,000.00
	National Interest Test Statement This project aims to develop new techniques for characterising individual mineral components in natural magnetic samples using machine learning. The new approach will have applications in Earth sciences, physics, materials science, and industry, and will herald a new quantitative era in rock magnetism. For example, magnetic mineral quantification in marine sediments enables reconstruction of past dust activity on land, and informs studies of arid landscapes and their response to climate change. This information is crucially important for developing effective land management practices. Magnetic data inform the Resources Sector strategy, and enhanced ability to characterise magnetic constituents of ores can assist both mineral exploration and efficient ore excavation. These new techniques also hold potential to revolutionise global data storage. The emerging high-density recording media industry relies on prototype magnetic material characterisations in unprecedented detail, and successful project outcomes can be applied to the design process.							

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DP200100824 Jackson, Prof Ian	This project aims to determine the sensitivity of the seismic properties of Earth's upper mantle (to 400 km depth) to variations in the prevailing chemical environment. The unique capability of the ANU Rock Physics Laboratory for low-frequency measurement of wave speeds and attenuation will be exploited to clarify the newly discovered importance of redox conditions, and document the effect of varying proportions of the most abundant upper-mantle minerals olivine and pyroxene. The expected outcome will be a robust and comprehensive model to guide the interpretation of the complex architecture of the upper mantle, and thereby provide an improved understanding of the tectonic processes responsible for its evolution through geological time.	48,500.00	93,000.00	77,500.00	33,000.00	0.00	0.00	252,000.00
	National Interest Test Statement The expected outcome of the project is a laboratory-based model for the interpretation of the complex seismic structure of Earth's upper mantle, to enhance understanding of the tectonic processes responsible for its evolution through geological time. This model will add value to the Australian Government's substantial NCRIS financial support for AuScope in the seismological exploration of the crust and upper mantle in the Australasian region. Consistent with the goals of the UNCOVER initiative, fostered by the Australian Academy of Science, such seismological studies interpreted within a robust lab-based framework provide much of the pre-competitive broad context for resource exploration beneath sedimentary cover. Other benefits include maintenance and enhancement of Australian leadership and international collaboration in experimental rock physics, and ongoing commitment to the training and professional development of early-career researchers.							
DP200101084 Wang, Prof Xu-Jia	The Monge-Ampere equation is a premier fully nonlinear partial differential equation with significant applications in geometry, physics and applied science. Building upon breakthroughs made by the proposers in previous grant research, this project aims to resolve challenging problems involving Monge-Ampere type equations and applications. The project goal is to establish new regularity theory and classify singularity profile for solutions to Monge-Ampere type equation arising in applied sciences, by introducing new ideas and developing innovative cutting-edge techniques. Expected outcomes include resolution of outstanding open problems and continuing enhancement of Australian leadership and expertise in a major area of mathematics.	66,000.00	133,000.00	134,000.00	67,000.00	0.00	0.00	400,000.00
	National Interest Test Statement Many fundamental problems in modern science and technology are related to, or modelled by, equations of Monge-Ampere type, such as network optimisation, imaging processing, and reflector design. In particular optimal transportation, a useful tool in machine learning, can be formulated by Monge-Ampere type equations. In recent years there have been rapid developments in the study of these equations with major breakthroughs on the regularity theory made by the proposers. This project aims at new discoveries and findings in the theory and applications by resolving outstanding open problems. The high quality research will enhance Australian leadership and expertise, attract domestic and international students, and promote research training in this key area of mathematics and its applications.							
DP200101157 Rohling, Prof Eelco J	This project addresses the urgency in long-term infrastructure planning to understand the long-term "equilibrium" sea-level-change consequences from today's exceptionally rapid climate change. Understanding this requires detailed sea-level reconstructions back to warm periods with similar CO2 levels to today (~3.5 million years ago), but these remain insufficiently defined. To advance, the project will deliver a next-generation, multi-million-year sea-level reconstruction that includes dynamically evolving (time-dependent) interactions between critical climate factors. This will then be applied with other palaeoclimate data to reconstruct equilibrium relationships between sea level, temperature, and CO2 at currently unattainable precision.	71,000.00	149,500.00	153,500.00	75,000.00	0.00	0.00	449,000.00
	National Interest Test Statement By far, most Australians live near the coast, so that mean sea-level change - compounded by regional effects and storm surges - poses a large threat to livelihood and major infrastructure. Commonly, however, assessments ignore the amount of sea-level rise "locked into" any warming scenario beyond 2100, which is dominated by slow climate-system feedbacks (carbon cycle and continental ice volume). These slow feedbacks dominate the long-term (near) irreversibility of climate-change consequences, yet their interactions remain poorly understood. Humanity's carbon emissions impose a major carbon-cycle perturbation, and understanding the total long-term climate response requires that we quantify the likely impacts on ice-sheet (sea-level) change at precisions that cannot be attained today. This project therefore aims to provide a next-generation sea-level reconstruction for the past 3.5 to 5.3 million years, and to compare it with CO2 and temperature records to precisely portray the evolution of equilibrium relationships between sea level, temperature, and CO2 through climates both warmer and colder than today.							

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DP200101168 Kivshar, Prof Yuri S	The rapidly growing demands of information processing have launched a race for compact optical devices transmitting signals without losses. Topological phases of light provides unique opportunities to create new photonic systems with functionalities and efficiencies well beyond current capabilities. This project aims to develop new ways to generate and guide light at the nanoscale by merging fundamental concepts of nonlinear photonics and topological physics. The outcomes of this project will result in experimental demonstration of the world-first, highly efficient, compact, and lossless nonlinear photonic devices for advanced optical technologies.	100,000.00	200,000.00	175,000.00	75,000.00	0.00	0.00	550,000.00
	National Interest Test Statement Topological photonics addresses important problems at the frontier of modern physics, and it is one of the hottest areas of research in optics. Novel topological states of light underpin energy-efficient transmission and storage of light, meeting the increasing demands of digital technologies. This project will develop important concepts of topological photonics with the world-first demonstration of topologically-protected optical devices. It will reveal new methods to generate and control light in compact optical networks. The project will fill a major gap in the current research in Australia, by targeting a new and strategically important area that promises to advance the next-generation photonics applications. The expected outcomes of this research will benefit globally important photonic applications, ranging from secure data processing to cost-effective optical storage for defense technologies. This project will provide an innovative research environment for students and postdocs, creating unique opportunities to produce skilled people for academic research and upcoming industries in Australia.							
DP200101222 Hill, Prof Anthony F	Industrial applications of coordination complexes in catalysis reduce energy input and environmental impact but almost exclusively involve classical donors such as nitrogen, oxygen, sulfur and phosphorus. Boron, whilst prevalent and environmentally benign, is under-utilised in such applications, in part due to the high reactivity of the metal boron bond. This research will seek to tame and then exploit the unique features of boron within pincer ligand frameworks in metal coordination complexes, with particular attention focusing on, but not limited to catalytic alkyne metathesis.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
	National Interest Test Statement Industrial applications of coordination complexes in catalysis and materials almost exclusively involve classical donors such as nitrogen, oxygen, sulfur and phosphorus - elements also found in nature's metalloenzymes. The electron-deficient element boron, whilst prevalent and environmentally benign, is under-utilised in such technological applications, in part due to the high reactivity of the metal boron bond. The proposed research will seek to tame and exploit the unique features of boron within pincer ligand frameworks in metal coordination complexes, with particular attention focusing on, but not limited to, alkyne metathesis. The research will deliver new technologies that are directly applicable to the development of Australian polymer, pharmaceutical and agricultural chemical industries, using home-grown intellectual property to reduce energy input and environmental impact. The research will train early career researchers in sophisticated techniques for the manipulation and instrumental analysis of new air-reactive compounds in addition to skills in critical analysis and research strategy design.							
DP200101294 Hodgman, Dr Sean S	Antiparticles and antimatter have progressed from theory and science fiction to become an important and exciting area of pure and applied science. This fundamental atomic physics project aims to further study how antimatter and matter interact by providing the first comprehensive experimental results for the interaction of positrons (the electron anti-particle) with trapped rubidium atoms in an innovative combination of two cutting-edge atomic physics techniques. It aims to provide measurements of many fundamental interaction quantities and for collisions between matter and antimatter. This will look to test the latest quantum theoretical approaches and further our understanding of the uses of antimatter in medical and materials science.	115,500.00	195,000.00	175,500.00	96,000.00	0.00	0.00	582,000.00
	National Interest Test Statement The two main research fields identified in this proposal – positron physics and cold atom physics – are both recognised internationally as areas of excellence in Australian science. This proposal will further that international reputation by bringing these two areas of Australian scientific excellence together in a truly unique way. By using the controllable target provided by cold atom technology to study the interactions between positrons and rubidium, a novel system which has not been used in previous studies, new insights will be provided into some of the unique interactions between matter and anti-matter. The research program will also result in the training of young Australian researchers in front-line STEM research and give them the skills to either continue a career in these much-needed scientific research areas, or to take their skills into other areas of benefit to the Community. These are transferable skills that will be valuable in the modern workforce and will contribute to the expanding knowledge-based sector of the Australian economy.							

* Note - Indicative funding for approved projects will be made available through a funding variation under section 54 of the ARC Act

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DP200101353 Rahmani, Dr Mohsen	This project aims to develop a new generation flat screen that is lighter, more efficient and with higher resolution by replacing the traditional liquid crystals (LCs) with metasurfaces that are 100-times thinner than LCs. Metasurfaces are arrays of engineered dielectric and semiconductor nanoparticles, with extraordinary characteristics. The expected outcomes will lead to flat screens with resolution enhanced by 100 times and energy consumption reduced by half, as compared to current LC-based displays (e.g. LCD and LED). This novel technology will revolutionise the dimension and performance of displays and secure Australia's position in the billion dollar market of flat displays.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
	National Interest Test Statement This project addresses the Science and Research Priority - "Advanced Manufacturing". The expected outcomes will "de-risk, scale up and add value to Australian manufactured products". -> This project will generate a frontier technology in new flat displays with breakthrough performance, and potentially will place Australia in the leading position in the display market valued at $117 billion (2020). It will provide new opportunities for the Australian manufacturing industry (e.g. Fabtronics Australia, Hetech, etc.) in the global market. This technology will demonstrate Australia capacity to innovate and seize opportunities and sets the conditions for the rapid transfer of technologies from the Australian academic environment to the industry. -> The newly engineered metasurfaces will provide new capabilities to current display technologies. "Metasurface Display" has the potential to demonstrate the remarkable potential of the Australian Science and Technology, after many other world-changing inventions from Australia, including Ultrasound scanner, Wi-Fi technology, Frazier lens, etc.							
DP200101382 Nicotra, Prof Adrienne B	This project aims to deliver a comprehensive, integrated understanding of the capacity for resilience and drivers of response of highly vulnerable alpine species and communities to climate change. The project aims to determine how communities of interacting alpine plants, soil invertebrates and microbes can cope with or evolve to novel climatic conditions. The mountains are water towers critical to power supply and Australia's agricultural productivity. Understanding physiological tolerance and the potential for rapid evolutionary responses of plants, animals and communities is necessary to predict impacts of climate change on the future productivity of the vulnerable Australian Alps and to provide novel options for climate adaptation.	84,649.50	161,019.00	154,389.00	78,019.50	0.00	0.00	478,077.00
	National Interest Test Statement The Australian Alps cover a small fraction of the country but are a biodiversity hotspot of high economic, commercial and social value. The Alps are a crucial water source for hydroelectricity and irrigation of the Murray-Darling Basin as well as a tourism epicentre. But the Alps is one of Australia’s ecosystems most vulnerable to climate change. This project uses elegant field and laboratory experiments to assess the ability of plants, animals and the habitats in which they live, to tolerate and evolve to keep pace with a changing climate. The research will make fundamental contributions to Australia's national research priorities, as it works to improve accuracy and precision in predicting and measuring the impact of changes caused by climate on alpine systems. The cutting-edge approaches will place Australia at the forefront of global alpine and climate adaptation research. By identifying drivers of evolutionary response, it will contribute to providing options for responding and adapting to the impacts of environmental change, and maintain the diverse values of the region.							
DP200101573 Renzullo, Dr Luigi J	This project aims to overcome the scientific and technological challenges preventing soil water and vegetation forecasting at useful land management scales (eg. 25 m). The significance is in enabling an unprecedented hyperresolution modelling capability for Australia through the integration of new ecohydrological theory with a range of satellite observations. Outcomes include more accurate, spatially-detailed information of current soil water amounts, and reliable forecasts of vegetation condition several months into the future. This will greatly enhance timely decision making and forward planning by farmers, fire agencies, and other land and water managers, with corresponding increases in productivity, sustainability and community safety.	59,500.00	119,000.00	121,000.00	61,500.00	0.00	0.00	361,000.00

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	National Interest Test Statement							
	The proposed research aligns directly with the Australian Government's Science and Research priority of Soil and Water. Timely, accurate and detailed forecasts of soil moisture and vegetation response could return huge benefits in economic productivity, sustainability and community safety. They support agricultural operations, flood and drought prediction, and the management of livestock, natural resources and fire risk, among others. Importantly, the science and technology to achieve such forecasts have now come within reach. Weather forecasts have already been revolutionised by the exponential increase in satellite observation and computational power combined with new theory. This project aims to lay the foundations for a similar revolution in water and vegetation forecasting at the paddock scale (ca. 25 m). This project builds innovative statistical and computational techniques to combine very large amounts of satellite observations with new theory on the fine-scale relationships between weather, water and plants.							
DP200101761 Gunningham, Prof Neil A	This project aims to identify how financial market regulators might best incentivise financial institutions to shift from high to low carbon investments, thereby mitigating climate change. It expects to generate new knowledge identifying regulatory excellence in previously uncharted territory and to enable best practice policymaking. Its expected outcomes will be to identify the central roles that the design and implementation of regulation can play in fast tracking finance for climate action. Its benefits should include advancing climate change mitigation, facilitating the development of Australia as a competitive sustainable finance market and contributing to Australia's research on achieving a desirable energy future.	72,500.00	157,500.00	142,500.00	57,500.00	0.00	0.00	430,000.00
	National Interest Test Statement							
	Climate change is the single greatest challenge confronting our species, whose impact on Australia is likely to be dire. This research addresses a central mechanism for addressing that challenge: the roles that regulation can and should play in aligning the financial sector with the needs of a low carbon economy. In doing so, it directly contributes to Australia's research on achieving a desirable energy future: a National Science and Research Priority. It will provide insights concerning the nature, design and implementation of climate finance regulation. In doing so, it will develop new empirical knowledge and evidence-based solutions that will strengthen Australian policymakers' and financial regulators' ability to promote and strengthen their approaches to regulatory design, compliance and enforcement. By facilitating the fast tracking of finance for climate action the findings will assist the development of Australia as a sustainable finance market in an increasingly competitive regional environment.							
DP200101814 Fforde, A/Prof Cressida	This project will be the first to investigate the global commercial trade in Indigenous human remains. It will employ a multi-disciplinary approach involving history, economic anthropology, economic history, and data science. The project will generate new knowledge about the 19th century global marketplace in Australian Indigenous human remains, and will reveal whether and how these are involved in the trade's modern manifestations from 1950 to the present. The project will uncover an unknown history, assist repatriation practice, provide information to help reduce the modern trade, and contribute to truth-telling as a precondition of healing and reconciliation.	125,753.50	254,795.50	248,661.00	119,619.00	0.00	0.00	748,829.00
	National Interest Test Statement							
	This project is in the national interest because it contributes to reconciliation processes. The relationship between repatriation, healing, and reconciliation is emphasised by Indigenous communities, supported by research, and recognised by the Australian Government. Indigenous peoples have long asserted that those involved in the removal of their ancestors profited financially from this activity, yet this project will be the first to investigate the 19th century commercial trade. The project will generate new knowledge about this global marketplace and reveal whether and how Australian Indigenous human remains are involved in the trade's modern manifestations. Building evidence about how Indigenous remains were acquired, acknowledgement of this history, and redress through repatriation are necessary to unlock the reconciliatory potential of the return of Indigenous human remains. Our project is essential to elucidate this history, not only to assist in repatriation practice and help halt the modern trade, but also because understanding the truth is a critical precondition of healing and reconciliation.							
DP200101854 Tkalcic, Prof Hrvoje	This project aims to advance understanding of the Australia-Pacific plate boundary - the Macquarie Ridge Complex - in the Southern Ocean. It will be the first study to elucidate the processes generating the world's largest submarine earthquakes not associated with active subduction, which may lead to understanding of how subduction initiates, the mechanism of earthquakes occurring at convergent margins, and more accurate estimates of earthquake and tsunami potential. This study will put Australia at the forefront of Earth Science research into the evolution of tectonic plates and has the potential to better inform hazard assessment efforts in the region, benefiting policy-makers and at–risk communities along the Australia coastline.	88,500.00	226,000.00	224,500.00	87,000.00	0.00	0.00	626,000.00

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	National Interest Test Statement 3-D imaging of the central MRC and Macquarie Island will be of immediate benefit for understanding the tectonic evolution of the Australian plate and the mechanisms responsible for earthquake generation in the region. The latter will enhance monitoring of the earthquake belts around Australia and will provide more accurate estimates of tsunami potential; therefore the result will be relevant not only to the seismological research community, but also to national earthquake monitoring programs, such as those operated by Geoscience Australia and EQC/GNS New Zealand.							
DP200101884 Djordjevic, Prof Michael A	This project aims to transform our understanding of symbiotic nitrogen fixation in legume root nodules. Root nodulation sustainably fixes sizeable amounts of nitrogen to boost crop production worldwide yet its utilisation is waning in favour of using nitrogen fertilisers. The project applies cutting-edge tools to define how two hormone systems boost and limit nitrogen fixation, respectively. The project expects to reveal ways to reconfigure these hormone outputs to improve nodule number and the efficacy of nitrogen fixation. The findings will benefit agriculture by reducing the reliance on costly nitrogen fertilisers, thus mitigating the huge environmental damage they cause, and will provide more sustainable ways to ensure food security.	85,000.00	175,000.00	147,500.00	57,500.00	0.00	0.00	465,000.00
	National Interest Test Statement The desired goal for Australian and global farming is to raise the production of food, fibre, and animal feed in crops and pastures, whilst reducing the environmental impact of intensive agriculture. An intensification of farming is required to meet increasing food demand but this results in land degradation, deforestation, biodiversity loss, and excessive flows of nitrogen fertiliser into the environment. By contrast, symbiotic nitrogen fixation that results from using legumes delivers sizable amounts of nitrogen to farming whilst preserving the environment. Symbiotic nitrogen fixation occurs in root nodules. This project will define new ways to increase root nodule number and size as well as the efficacy of symbiotic nitrogen fixation so that our reliance on nitrogen fertilisers is mitigated. Success in this project would help to ensure food security in a sustainable manner, reduce the use of nitrogen fertilisers, and mitigate their environmental damage.							
DP200101885 Djordjevic, Prof Michael A	This project aims to transform our understanding of the relationship between root architecture and water and nitrogen acquisition, factors critical to determining yield. We have discovered that mutants affected in a peptide hormone receptor have unique root architectural features relevant to acquiring water and nitrogen. The mutants are drought tolerant and their roots are nitrate insensitive. The project aims to define the receptor's genetic outputs and expects to uncover new ways to improve water and nitrate acquisition and determine if our findings apply to crops. The application of these findings will reduce the severe environmental damage caused by poor nitrogen fertiliser uptake and provide sustainable ways to ensure food security.	100,000.00	185,000.00	165,000.00	80,000.00	0.00	0.00	530,000.00
	National Interest Test Statement A goal of agriculture is to boost the production of food, fibre, and animal feed in crops to meet rising global food demands. This requires a sustainable intensification of farming. This requires raising yields from extant farms whilst minimising land degradation, deforestation, biodiversity loss, and the excessive flows of uncaptured nitrate into the environment caused by using fertilisers. To achieve this requires that the two most important yield-limiting resources, water and nitrate, are acquired by crops more efficiently. A promising approach is to improve the root system architecture of crops to increase water- and nitrate-acquisition. We have discovered plant mutants that have three beneficial root architecture phenotypes that are relevant to water and nitrate uptake, and they are drought tolerant. These are exciting and novel discoveries. This project aims to define the underlying mechanisms behind these plant improvements so that the information is utilised to select for crops with root systems that improve agricultural sustainability.							
DP200101894 Fischer, A/Prof Tamas	The majority of our genome is converted to an extensive network of non-protein-coding RNA molecules (ncRNAs), but the function of these ncRNAs is unknown. This project aims to identify and determine the mechanism of action of nuclear ncRNA networks with a particular focus on nuclear ncRNAs that form RNA-DNA hybrids with the genomic DNA. These studies have the potential to lead to ground-breaking discoveries in our understanding of genome organisation and the mechanism of transcription control, and might provide an entirely new tool-box to manipulate genome function. This should provide significant benefits to efforts to develop innovative biotechnology and genome editing technologies in plants and animals.	85,000.00	170,000.00	165,000.00	80,000.00	0.00	0.00	500,000.00

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	National Interest Test Statement This project will position Australia at the forefront of discovery and innovation in the rapidly emerging field of noncoding RNA biology. Investigation of the fundamental aspects of genome organisation and stability is vital for developing future genome-editing technologies. RNA-based technologies are increasingly relevant in genetic engineering and biotechnology. The knowledge gained through this project will lead to advances in these areas and will be highly relevant to both basic and applied research fields. The work will also expand our research capability by providing training opportunities for young scientists, fostering international collaborations and producing high-impact publications and citations.							
DP200101963 Fry-McKibbin, Prof Renee A	This project aims to study why Australia differs from its OECD peers in that it has not had a recession for 27 years. It intends to generate knowledge by using economic models to solve 3 puzzles relating to Australia's success: (i) why did foreign financial market shocks not spill over to the economy?; (ii) how has the resource curse that affects economies with a booming resource sector been avoided?; and (iii) what makes Australia special? Expected outcomes include the development of theoretical and empirical models that reflect the unique features of the Australian economy. This should provide significant benefits, including guidance to Australian and international policymakers on macroeconomic policies for resource-rich countries.	35,000.00	69,000.00	69,000.00	35,000.00	0.00	0.00	208,000.00
	National Interest Test Statement Twenty-seven years is a long time for an economy to have avoided recession, but Australia has done just that. All other developed countries have had a recession in that time, causing their people to experience the loss of jobs and hard-earned assets. Understanding why Australia has avoided recession despite having been through economic events such as the Asian crisis in 1997 and the GFC in 2008, is a puzzle that needs an answer. Take the GFC, for example. Most developed countries went into a recession. Australia did not. Many would say that demand for iron ore from China sustained Australian growth, but Canada exports similar products to China. Others would say that the Reserve Bank's emergency lowering of interest rates or the stimulus package was responsible, but many other countries took similar steps. To protect Australia from recession in the future, we need to understand the reasons why Australia out-performed similar countries. Developing and protecting the factors that work and paying less attention to the factors that do not is clearly in Australia's national interest.							
DP200101985 Liang, Prof Weifa	This project aims to develop enabling technologies to provide reliable and seamless services in mobile edge computing environments. This project will develop advanced algorithms with performance guarantees and efficient mechanisms for such service provisioning. The project expects to lay theoretical foundations and generate new knowledge for the provisioning of reliability-aware and mobility-aware services in mobile edge computing. The expected outcome of the project is a set of solutions to the myriad of services relying on mobile edge computing including e-Health, autonomous vehicles, and Internet of Things. This project will develop key fundamental technologies to improve Australia's standing in the international research community.	64,500.00	129,000.00	133,500.00	69,000.00	0.00	0.00	396,000.00
	National Interest Test Statement This project aims to develop a suite of novel algorithms and core enabling technologies for reliable, continuous and uninterrupted services provisioning in mobile edge computing through resource optimisation and allocation. This innovation in mobile edge computing will play a key role in enabling Australia's competitiveness and sustainable economic growth, laying the foundation for innovative markets including e-Health, disaster monitoring, autonomous vehicles in smart cities, and the Internet of Things services. The support of fundamental research of mobile edge computing will return exceptional dividends to the nation and enable Australia to maintain a position of world leadership in the Information and Communications Technology field.							
DP200101994 Wallis, Dr Joanne E	This project aims to investigate how alliances operate and why they endure using an in-depth analysis of the Australia-New Zealand alliance in the Pacific Islands, the region where the alliance has focused and in which there is growing strategic and policy interest. It intends to build a micro-level analysis of the influence of the behaviors and beliefs of individuals onto existing conceptual accounts. Informed by extensive interviews, it expects to advance understanding of how the two states negotiate differences in approaches and interests while working together to preserve their security. It anticipates pinpointing strengths and vulnerabilities in the alliance and contributing to a more informed policy debate about how it should operate.	25,715.00	67,919.00	75,764.50	33,560.50	0.00	0.00	202,959.00

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	National Interest Test Statement It is crucial to Australia's national interest to better understand the dynamics of its alliance with New Zealand in the Pacific Islands. By announcing its intent to 'step-up' its role in the region in 2017 and then backing that announcement with significant development and defence commitments in 2018, the government has demonstrated that the Pacific Islands are a strategic priority. While there is presently no external power likely to use the region to attack Australia, the Japanese advance during WWII illustrated this vulnerability. The increased strategic posturing of China and the US demonstrates that the region is again emerging as a site of contestation. The alliance plays a central role in how Australia and New Zealand relate to one another and advance their security in the Pacific Islands. Through policy papers, media publications and workshops our project will provide both governments with knowledge to better understand how their alliance works in an everyday institutional and individual sense and how they can cooperate more effectively to pursue their strategic interests in the future.							
DP200102212 Nugent, A/Prof Maria L	The project aims to build knowledge about exceptional, but poorly-documented, Aboriginal objects from Sydney and NSW coast (c. 1770-1920s) in British and European museums. These objects have not been accessible to Aboriginal communities and other researchers. This project proposes a major innovation: to bring objects to Sydney for community-led and interdisciplinary interpretation. Outcomes will include strong relations between Aboriginal communities and overseas museums; a model for collaborative research about historic objects; and a material history of Aboriginal/colonial relations. It benefits communities, governments and museums by laying robust foundations for future projects seeking the return of Indigenous cultural heritage.	69,000.00	139,500.00	173,500.00	103,000.00	0.00	0.00	485,000.00
	National Interest Test Statement In 2018 the Federal Government committed national funding for its priority to 'scope and commence activity on the return of culturally-significant Aboriginal and Torres Strait Islander items from overseas'. However, gaining access to overseas museum collections of Australian Indigenous objects, and securing their return to Australia, does not have a one-size-fits-all solution. To overcome this obstacle to realising the nation's interest, this project facilitates a world-first collaboration between the La Perouse Aboriginal community in Sydney, and two museums in Britain, where objects belonging to the community are held. The project will develop a best practice approach for other museums and Indigenous communities returning Indigenous objects to their origins. Culturally, Australia will gain by reclaiming and re-presenting the material objects that help tell the stories of early Indigenous and colonial life in Sydney and coastal areas of NSW. Diplomatically, Australia will gain by leading the way with a model that resolves repatriation tensions between Indigenous communities and museums.							
DP200102274 Hartley, Prof Richard I	This project aims to develop a methodology for integrating the algorithms of 3D Vision Geometry and Optimization into the framework of Machine Learning and demonstrate the wide applicability of the new methods on a variety of challenging fundamental problems in Computer Vision. These include 3D geometric scene understanding, and estimation and prediction of human 2D/3D pose and activity. Applications of this technology are to be found in Intelligent Transportation, Environment Monitoring, and Augmented Reality, applicable in smart-city planning and medical applications such as computer-enhanced surgery. The goal is to build Australia's competitive advantage in the forefront of ICT research and technology innovation.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement The techniques developed by this project will contribute to building smart city plans in Australia. In particular, the methods of geometric scene understanding will enable intelligent vehicles to understand the geometric structure of the environment seen by an 'agent', to forecast the motion of other moving objects, and to anticipate evolution of the dynamic environment. It will contribute to the development of intelligent transportation system. The developed algorithms will help robots used for health care to understand the environment detect and predict human actions, and contribute to health care for the aged. In summary, the developed algorithms are intended to contribute to a wide range of applications in intelligent transportation, Autonomous vehicles, Aged-care Health Services, Environment Monitoring, and Augmented Reality. The project will benefit Australia nationally and enhance Australia's international competitive advantage in the technology innovation.							

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(Columns 1 and 2)	(Column 3)	2019-20 (Column 4)	2020-21 (Column 5)	2021-22 (Column 6)	2022-23* (Column 7)	2023-24* (Column 8)	2024-25* (Column 9)	(Column 10)
DP200102320 Bedford, Dr Stuart H	This project seeks to resolve the question of whether the mid-15th century eruption of Kuwae in Vanuatu can be confirmed as one of the largest global volcanic and climatic events of the last 2000 years. Through archival, field and laboratory research, an experienced transdisciplinary team from archaeology, volcanology and history aims to conduct collaborative research over three seasons in central Vanuatu. Project goals include dating the eruptive event, defining its scale, reconstructing Kuwae's local social and environmental conditions prior to and after the eruption, and developing practical volcanic risk reduction strategies together with local communities and authorities in Vanuatu.	55,709.50	114,416.50	108,684.50	49,977.50	0.00	0.00	328,788.00
	National Interest Test Statement This project will generate the first comprehensive account of the local consequences of the massive Kuwae eruption of 1452 AD in central Vanuatu. It will contribute to the development of policy in both Vanuatu and Australia relating to major natural disasters, disaster risk reduction and climate change. The project connects directly with Australian Government Policy in relation to the Pacific as outlined in the 2017 Foreign Policy White Paper and the Sustainable Development Goals (SDG 2030), which emphasise increased engagement with the Pacific. It relates specifically to the goals of strengthening community safety and resilience and building capacity in response to disasters. The project will build significant Australian research capacity in environmental history and in disaster risk reduction strategies for Australia and its immediate region. Planning for tourism opportunities arising from a Kuwae Festival are already under way as a means of addressing poverty alleviation in this cyclone-prone environment.							
DP200102383 Ireland, A/Prof Michael J	This project will prototype a new type of visible and infrared light interferometry: telescopes freely moving in a line 10s of metres in length and directing their light towards a central beam combiner. This is particularly well suited to sparse aperture optical interferometry from space, which can be used to resolve angular scales much finer than the world's largest monolithic telescopes. The ground based prototype will also be able to make a several key astrophysical observations of benchmark stars and stellar systems, including making precise polarimetric measurements of dust shells around bright stars.	95,500.00	178,500.00	122,500.00	39,500.00	0.00	0.00	436,000.00
	National Interest Test Statement Space technology, especially on small platforms such as cubesats and microsats, is undergoing a significant current expansion, driven by new technologies that can vastly decrease the cost of ambitious missions. This project will prototype an ambitious new technology, placing Australia at the forefront of world research in precision satellite constellations for remote sensing. This is one of the first steps in turning this technology into a commercial success, and will be conducted in parallel to other efforts both at ANU and collaborating institutions in space qualifying key hardware components. Remote high angular resolution sensing is needed not only for astronomy, but also for ground-based observations in agriculture, mining and defence. In addition to direct influences of this research, this project consists of several well-defined Science, Technology, Engineering and Mathematics (STEM) student-led Advanced Manufacturing subprojects that will train research students in building practical equipment for making measurements in a variety of industries.							
DP200102537 Neeman, Prof Amnon	This project in pure mathematics, more specifically in modern homological algebra, builds on work started by the chief investigator in the last five years. What has already been done has achieved striking results, solving very different problems that have been open for two decades. And there seem to be many directions in which it could be pursued further. The international mathematical community seems intrigued by what the chief investigator has achieved recently - judging by invitations to give prestigious talks and the feedback at these events. The expected outcome is major progress in our understanding of derived categories, as well as diverse applications. The benefit will be to enhance the international stature of Australian science.	85,500.00	171,000.00	171,000.00	85,500.00	0.00	0.00	513,000.00
	National Interest Test Statement The primary benefits of this project to Australia are cultural and economic. The cultural aspect is that the project would enhance Australia's reputation as a centre of cutting-edge research in mathematics - and mathematics is central to all of science. The project will also train young Australians to work and think as mathematicians, more specifically as modern algebraists. And the economic importance is that modern algebra underpins such vital economic interests as cybersecurity. To elaborate on the cybersecurity and economic aspects - modern mathematics enters into the way we store information on computers, the way we secure this information, the way we break into other countries' secrets and the way we protect our information from spies. As it happens the branch of mathematics I work in, homological algebra, is particularly relevant. I have never been directly, personally involved in cybersecurity, but my students have. Thus I have educated people who have been valuable to Australia in these ways.							

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DP200102615 Fu, Prof Lan	This project aims to demonstrate semiconductor nanowire based infrared avalanche photodetectors (APDs) with ultra-high sensitivity towards single photon detection. By employing the advantages of their unique one-dimensional nanoscale geometry, the nanowire APDs can be engineered to different device architectures to achieve performance superior to their conventional counterparts. It is expected that this project will make significant contributions to the development of next generation high performance, fast speed, small size and low cost infrared photodetector technology platform enabling numerous emerging fields in modern transportation, communication, quantum computation and information processing to revolutionise our life and society.	80,000.00	160,000.00	160,000.00	80,000.00	0.00	0.00	480,000.00
	National Interest Test Statement Our world is witnessing a new industrial revolution expedited by emerging technologies such as robotics, artificial intelligence, fifth-generation wireless networks and autonomous vehicles etc., which poses an increasing demand for development of ultra-sensitive, fast speed, small size and low cost infrared photodetectors beyond current technologies. In this project, we aim to develop high performance semiconductor nanowire based infrared avalanche photodetectors with ultra-high sensitivity towards single photon detection. The success of the project will lead to a new infrared photodetector technology platform for applications such as 3D imaging, remote sensing, long-range free-space communications, light detection and ranging (LiDAR), quantum cryptography and information processing. It will not only bring Australia to the forefront of cutting edge science and technology, but also lead to many commercialisation opportunities in numerous emerging fields of science and technology, defence, environment, transportation, communication and agriculture, bringing enormous social and economic benefits to our nation.							
DP200102623 Mercer, Dr Ben	This project aims to explore how the protest era of the 1960s in Western Europe transformed into a decade of political violence and terror in the 1970s. By undertaking an unprecedented transnational analysis of the history of political violence in France, Italy and West Germany after 1968, the project intends to generate a new understanding of the origins of home-grown terrorism in Europe and the precariousness of democratic stability. The project aims to place the rise and fall of political terror in a new perspective, via an analysis of a wide variety of forms of violence by individuals, political groups, social movements and states, with significant benefits to understanding similar challenges in the contemporary world.	18,152.00	46,402.00	49,520.50	21,270.50	0.00	0.00	135,345.00
	National Interest Test Statement Terrorism and political violence are among the most important challenges facing contemporary states and society, including Australia. This project will provide significant benefits to Australia by developing a detailed and innovative understanding of the origins and decline of political violence and terrorism in contemporary European history. The study of the history of terrorism in contemporary Europe is relevant to Australia, since France, Italy and Germany were, like Australia, electoral democracies when they confronted the challenge of terrorism in the 1970s. This project will advance ongoing policy conversations in Australia and around the globe on the issues of security and political unrest. It will provide historical depth to public and academic discussion on the subject of protest and terror. The project will also enhance Australia's international reputation for academic research.							
DP200102773 Morphy, Em/Prof Howard	The Yolngu peoples' land and sea Country in north-east Arnhem Land is densely named, as a consequence of the actions of ancestral beings who gave shape to Country and to Yolngu society in place. Placenames are sung in ceremony, and passed down through the generations as personal names. This project aims to document the placenames of two Yolngu regions and explore what they tell us about Yolngu society as a system that has been in place for thousands of years. In consultation with Yolngu, it aims to create an interactive map and database archive to which Yolngu historians can add in the future, providing significant benefits for a community for who consider these names to be central to their identity and wellbeing – past, present and future.	159,000.00	318,000.00	306,000.00	147,000.00	0.00	0.00	930,000.00
	National Interest Test Statement By mapping the relationship between placenames and personal names in Yolngu society in north-East Arnhem Land, we will demonstrate the ways in which Indigenous names can provide important insights into the history and prehistory of a region. Our research will show the mechanisms for knowledge transfer in Yolngu society. The project will lead to advances in the linguistic and anthropological analysis of Indigenous placenames that can be used as a model for analysis in other Australian regions. We will produce an innovative interactive map of placenames for use by the local Yolngu community for educational and cultural purposes. The map will be an important asset to Indigenous advancement in local economic development through cultural tourism and environmental land management through the local ranger programs – activities in which Yolngu are increasingly engaged.							

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DP200102812 Widmaier, A/Prof Wesley W	This project aims to explain recurring international economic instability. While global orders spanning the Classical Gold Standard, Keynesian Bretton Woods institutions, and contemporary Neoliberal order each provided key sources of stability, each also yielded to crises in the 1930s Great Depression, the 1970s Great Stagflation, and the Global Financial Crisis. To explain such instability, this project advances an innovative constructivist argument that ideas which initially enable policymakers to restrain market excesses can over time obscure new sources of instability. Over case studies of these crises, this project will produce high quality publications and contribute to debate over national interests in an era of populist challenge.	32,360.50	64,721.00	69,721.00	37,360.50	0.00	0.00	204,163.00
	National Interest Test Statement This project offers insight into the crises that have repeatedly disrupted the international economy. Its innovative thesis - that stable economic ideas can obscure new sources of economic instability - will provide a broader perspective on not only historical crises like the Great Depression but also recent events like the Asian Crises of the 1990s and the Global Financial Crisis itself. The resulting publications, in speaking to academic, policy and public communities, will contribute to more rigorous and relevant understandings of Australian national interests in global economic institutions and responses to economic shocks and crises in an age of Brexit, Trump and Global Populism.							
DP200102830 Corr, A/Prof Cormac S	This project addresses the interaction dynamics of high-flux helium particles with materials that drives surface nanowire growth. These dynamics are important to nuclear reactor materials and to developing new nanotechnology materials for high energy density lithium-ion battery anodes and water splitting catalysts. Through model and experiment, this project expects to generate new knowledge of processes that drive sub-surface nano-bubble formation and surface nanowire growth in materials exposed to helium particles. This project will result in improved understanding of material degradation during nuclear reactor operation and will make a new contribution to high-value manufacturing capabilities for next generation energy systems.	67,500.00	135,000.00	135,000.00	67,500.00	0.00	0.00	405,000.00
	National Interest Test Statement This project provides an opportunity to leverage unique Australian capabilities to further develop a strong engagement with the multi-billion dollar International Tokamak Experimental Reactor (ITER) project presently under construction in France. The ITER fusion reactor is one of the largest clean energy research programs on Earth with the goal of achieving 500 MW of fusion power from only 50 MW of input heating power. The linkages formed through the course of this project will provide a pathway for other Australian institutions and businesses to engage with the ITER program, for minimal public investment. In this proposal, the knowledge gained from the surface modification of fusion materials, which is a major issue for nuclear fusion reactor operation, will also be applied to grow nanowires on materials used in high energy density lithium-ion batteries for aerospace applications, or high surface area catalysts for solar hydrogen generation via water-splitting. The knowledge gained from this proposal will pave the way for new commercialisation opportunities for high-value manufacturing in Australia.							
DP200102850 Fforde, A/Prof Cressida	This project will re-conceptualise heritage from a standpoint of reconciliation. In doing so, it will generate new understandings about how heritage and its management can contribute to reconciliation processes. The project will combine Aboriginal, Maori and Western intellectual traditions in order to advance theoretical understandings of heritage and to examine its reconstructive power. It will produce models for practical implementation, including new conservation and management protocols. The project's investigation of a new approach to heritage has the potential for profound social benefit.	61,100.00	133,200.00	124,600.00	52,500.00	0.00	0.00	371,400.00
	National Interest Test Statement Reconciliation is an issue of national significance, in particular for the communities directly impacted by continuing inequality and racism. This project investigates the relationship between heritage and reconciliation. While the past is constantly referenced in materials and debates about how to achieve a reconciled future, the explicit role of heritage has been missed, thus limiting understanding about its contribution and potential. Although much has been written about heritage and conflict, the contribution heritage can make to reconciliation has been largely ignored. Bringing together Aboriginal, Maori and Western intellectual traditions, this project will rethink heritage from a standpoint of reconciliation in order to examine its reconstructive power. It will develop models for practical implication, including new conservation and management protocols. Its focus is Australia and New Zealand and it considers two case studies: the repatriation of Indigenous ancestral remains, and World Heritage.							

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DP200102872 Clark, A/Prof Geoffrey R	This project uses an interdisciplinary approach to examine the biological, cultural and environmental factors underpinning the Polynesian people through a study of their ancient homeland in Tonga. Early Polynesian society developed 2650-2350 years ago, but little is known about the people, their culture and how sea-level fall impacted subsistence and settlement. The proposed study's goal is to fill this gap in human knowledge about our Pacific neighbours using a unique skeletal assemblage, excavated cultural remains and advanced mapping of palaeo-sea-level markers that will improve understanding of the impact of environmental change on human societies in our region.	60,278.00	140,386.00	147,347.00	82,539.00	15,300.00	0.00	445,850.00
	National Interest Test Statement Australia is a key player in the Indo-Pacific and is currently strengthening its engagement with Pacific nations to assist with the region's economic, security and environmental challenges. People-to-people relationships in education and research foster mutual understanding and are instrumental in solving regional problems through new knowledge supported by Australia's excellence in Science and the Humanities. The project contributes to the national interest, as it will benefit Australia by maintaining and enhancing our important relationship with the Kingdom of Tonga and Polynesia, and expanding our knowledge of the societal and environmental effects of sea-level change in Australasia. Establishing and continuing a strong international network will lead to high-impact outputs and the training and education of young researchers that will benefit Australia.							
DP200102927 Cardillo, A/Prof Marcel	This project aims to strengthen biodiversity conservation using evolutionary biology. By using new DNA sequencing technologies the project aims to reconstruct the evolutionary history of the diverse and ecologically important plant family Proteaceae. This will be used to discover how past environmental changes have produced the biodiversity we see today, and forecast likely future changes to biodiversity under expected rapid environmental change. The key outcome will be a new methodology for a predictive, forward-looking conservation science that accounts explicitly for the dynamic, evolving nature of biodiversity. The key benefit will be a more robust scientific basis for strategic allocation of limited conservation resources.	75,000.00	135,000.00	120,000.00	60,000.00	0.00	0.00	390,000.00
	National Interest Test Statement This project will advance our understanding of the evolutionary history and diversity of Proteaceae, a prominent component of the Australian flora that includes such iconic, and culturally and economically significant, groups as Banksias, Grevilleas, and Waratahs. The project will provide a strong scientific basis for the management and conservation of this ecologically important group, and will develop an innovative methodology that can be extended to other groups of organisms. The project strengthens cross-institutional and international collaborations, providing access to substantial expertise and data resources for biodiversity analysis. By training early career researchers and students the project adds to Australia's research capacity in biosystematics and computational biology.							
DP200102979 Brueckner, Prof Markus	The transition to wider use of robotics and artificial intelligence may eventually make our citizens better off, yet effects on domestic income and wealth inequality remain uncertain, depending strongly on general governance and macroeconomic policy regimes. This project would help clarify income inequality effects, both abroad and in Australia, through (i) new numerical theory from calibrated economic models at the global and national levels; (ii) econometric testing of results from global and national data; (iii) the use of emerging insights to analyse economic policy responses and their global interaction as well as the implications for Australian economic policy	80,022.50	157,509.50	170,404.00	92,917.00	0.00	0.00	500,853.00
	National Interest Test Statement In an era of slowing economic growth the transition to wider use of robotics and artificial intelligence greatly increases uncertainty about how economic activity is distributed around the world and its implications for wages, employment and domestic income inequality. Australia's economy is increasingly dependent on China, yet China's future performance depends on outcomes from a technology race with North America, Europe and Japan. Australia's performance therefore also depends on strategic interactions between policy regimes in all four regions. This project will help clarify these effects through the application of new economic models at the global and national levels, the testing of their implications against global and national data and the use of emerging insights to analyse economic policy responses in each region. This new information will better equip the Australian government to address the implications of the technology transition by offering a vision of the future consequences of potential restorative changes to its fiscal, trade, financial and foreign policies.							

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DP200103030 Akami, Dr Tomoko	This project aims to revise the Euro-American-centric understanding of the history of international relations by incorporating the case of the first non-Euro-American modern power, Japan, and developing theory that internalises colonialism. Benefits to Australia and beyond include gaining a more historically accurate knowledge of this history, greater insights into the impact of this dominant understanding on the actions of non-Euro-American powers, and enhanced sensitivity of policy-makers and practitioners to their schemes to post-colonial societies. This revised history could also benefit general public debates on rethinking measures for dealing with issues arising from the diversity within Australian society and internationally.	28,066.50	73,731.50	73,107.50	27,442.50	0.00	0.00	202,348.00
	National Interest Test Statement One big challenge for societies in Australia and beyond is how to live with peoples of diverse backgrounds nationally and internationally, while developing common codes of conduct which secure the integrity of their members. This project sees the currently dominant understanding of the history of modern international relations as Euro-American-centric, which is an obstacle for formulating constructive policies and public debates to deal with this challenge. It revises this history by incorporating the case of the first non-Euro-American modern power, Japan, and developing theory that internalises colonialism. Benefits to Australia and beyond include gaining a more historically accurate knowledge of this history, greater insights into the impact of this dominant understanding on the actions of non-Euro-American powers, and enhanced sensitivity of policy-makers and practitioners in their schemes to post-colonial societies. This revised history also benefits general public debates on rethinking constructive measures on how to deal with the issues arising from diversity within Australia and internationally.							
DP200103151 Rodrigo, Prof Allen G	This project aims to develop new methods and software to infer the evolutionary history of organisms using genomic data. These new phylogenomic methods need to take account of the complexity of evolutionary processes and/or patterns in time (along the evolutionary tree) and space (along the genome). This project is significant because these methods must merge mathematics and statistics with High-Performance Computing to handle the huge quantities of genetic data and the complexity of evolution itself. An important expected outcome of this project will be the development and release of freely-available software that incorporates these new methods. This project expects to benefit scientists who need to infer phylogenies from genomic data.	78,274.50	143,061.50	133,074.00	68,287.00	0.00	0.00	422,697.00
	National Interest Test Statement Australia has a unique collection of animals and plants and, for this reason, some of the world's best biology is done in this country. New technological developments now allow the study of this biodiversity at the finest possible scale, at the level of each organism's DNA. As huge amounts of genetic information are collected, new ways to analyse the data are needed, as are sophisticated computer programs that link mathematics and statistics with the power of supercomputers. This project aims to develop new methods that help biologists understand the genetics of biodiversity. As a result, the project expects to provide scientists with the next generation of computing tools to study the complex ways that organisms cope with environments that change over time, and how species diversify or go extinct. The team members on this project have international reputations in computing and genetics, and are committed to sharing their research with other scientists in Australia and elsewhere: the aim is to provide the capability to unlock the genetic history of life in Australia and the rest of the world.							
DP200103440 Bordia, Prof Prashant	This project aims to track the trajectories of older workers' psychological contracts that shape their give-and-take with the organisation. Little is understood about how these psychological contracts change as older workers continue to pursue work through their fifth, sixth, seventh and eighth decades of life. This project tracks older workers over intensive, repeated in-depth interviews and a large-scale longitudinal panel study. The outcomes fill significant gaps in our understanding of older workers' needs and orientation toward work, and identify the age-related changes and organisational practices that spur older workers to sustain a strong trajectory of productive participation in the workforce.	22,000.00	61,550.00	73,350.00	64,550.00	59,750.00	29,000.00	310,200.00
	National Interest Test Statement With increasing opportunity (owing to improved longevity and health) and necessity (to fund an extended retirement), older workers are working well into the sixth—or even seventh and eighth—decade of life and there is a strong need to better understand this late-career stage. This project aims to examine how work needs and orientations of older workers change as a consequence of changes in personal and situational characteristics that accompany ageing. The project aims to benefit older workers—and their employers— by generating knowledge vital for improving their preparedness for continued and productive participation in the workforce.							

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DP200103576 Forsyth, Dr Miranda R	Our study investigates the widespread phenomena of 'community rule-making' in Pacific Island countries, in which local communities engage in deliberative processes oriented towards development of new normative orders. Occurring largely outside of state-sanctioned authority, such processes may address social problems such as gender based violence, crime and poverty, and frequently occur in the context of other locally-driven attempts at community regeneration. Through collaborative empirical research in PNG, Solomon Islands and Samoa, our project will build an evidence base to better understand the potential and the dangers of community rule-making, and develop 'responsive hybridisation' as a new analytical framework to theorise about it. **National Interest Test Statement** The 2017 Foreign Policy White paper gives prominence to the Pacific islands, acknowledging them as of 'fundamental importance' to Australia's security and prosperity. Australia's recent 'step up' in its relations with Pacific countries takes place against a backdrop of shifting geopolitics and growing strategic competition. By engaging with communities in PNG, Samoa and Solomon Islands that are actively seeking to reshape their local orders, our project will contribute to regional stability. It will provide a strong evidence base and theoretical understanding that can inform Australian security and development programs, as well as assisting our Pacific neighbours to address outstanding issues such as gender based violence, crime and social justice. In a period of considerable uncertainty, the stability and wellbeing of the Pacific Islands is crucial to advancing Australia's security and economic interests as a recognised regional leader and partner of choice.	98,080.00	196,365.00	196,565.00	98,280.00	0.00	0.00	589,290.00
	The Australian National University	3,931,370.50	7,958,771.50	7,801,334.00	3,819,983.00	75,050.00	29,000.00	23,615,509.00
	Australian Capital Territory	3,931,370.50	7,958,771.50	7,801,334.00	3,819,983.00	75,050.00	29,000.00	23,615,509.00

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New South Wales								
Australian Catholic University								
DP200101912 Lonsdale, Prof Chris	This project will examine Australian parents' number one concern about their children's health and behaviour – their interactions with electronic screens. Current screen time guidelines are based on low-quality evidence and lack the nuance required to address this complex issue. This project will use innovative technology to resolve these weaknesses. Wearable cameras will measure what children are doing on screens, and where, when, and how long they are doing it. The project will also investigate how screen time impacts children's development and how it is influenced by their environment. This evidence will benefit children by improving screen time guidelines, and help parents understand the impact of screen time on children's development.	111,906.50	191,346.50	161,240.00	137,925.50	56,125.50	0.00	658,544.00
	National Interest Test Statement Australian parents' number one concern about their children's health and behaviour is excessive screen time. The evidence to support parents' concerns, however, is lacking. This research will provide the first objective evidence collected in Australia about the effects of screen time on children's developmental outcomes. The existing Australian guidelines are based on low-quality evidence and lack the nuance required to address such a complex issue. As a path to research impact, the project will provide media outputs and use existing collaborations with partner investigators from the NSW Department of Education and NSW Ministry of Health to suggest policy revisions. This research may lead to improved quality-of-life for children, as well as better parent understanding and improved public policy around screen time behaviours.							
DP200102013 Turner, Prof Bryan S	This project will investigate male-dominated far right groups in Australia by looking at their intellectual underpinnings. The sociological focus is on how core ideas inflect tropes of masculinity and the phenomena of weak citizenship. This moves beyond a simple stereotype of angry, disenfranchised young men; to grasp the radical right-wing thinking that motivates them, and informs their hate rhetoric and actions. Using multi-methods, we will explore attitudes, and use of transnational far right ideas to 'imagine' Australia. The project will generate new knowledge of how bonds of citizenship have weakened amongst men who define themselves at the margins; yielding insights into how masculinity is actively utilised as a recruitment mechanism.	81,724.50	148,760.50	82,036.00	15,000.00	0.00	0.00	327,521.00
	National Interest Test Statement This project will explore why men in Australia are drawn to far right movements in increasing numbers. These movements, usually male-dominated, often adopt ideas and rhetoric from international sources. They take actions that arguably place them at odds with Australian values including: autonomy and dignity of the individual, freedom of religion, commitment to rule of law, democracy and gender equality. Furthermore, these groups consciously stand in contrast to longstanding Australian values of mutual respect and tolerance. The Federal Government Department of Home Affairs (2019) defines Australian citizenship as: a shared identity, a common bond which unites all Australians while respecting their diversity. Any threat to that ideal poses a serious risk to our democracy and the rule of law. This project addresses that core concern, which is aired daily in the popular press and on social media. The findings will provide some answers to the question of why some men are strongly drawn to joining or supporting far right groups.							
	Australian Catholic University	193,631.00	340,107.00	243,276.00	152,925.50	56,125.50	0.00	986,065.00

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Macquarie University								
DP200100257 Dixon, Prof Chris F	This project aims to provide the first detailed analysis of African Americans in the Korean War. In so doing it will generate new knowledge on the Korean War, the African American military experience, the Black struggle for civil rights, and the complex relationship between race and US foreign policy. Along with a deeper understanding of a conflict that has been overshadowed in popular memory by World War 2 and the Vietnam War, but which remains a source of international tension, expected outcomes include a deeper understanding of the intersection between the African American military experience and US international power. These outcomes will be disseminated via a scholarly monograph, journal articles, and a popular, non-scholarly book.	16,134.00	32,268.00	32,391.50	16,257.50	0.00	0.00	97,051.00
	National Interest Test Statement The security and economic well-being of the Australian community is influenced by actions of the United States, a close ally, in the Asia-Pacific, our region. Australia's ability to negotiate nuanced foreign policy, balancing the shifting commercial and economic imperatives of the Asia-Pacific, with our long-standing alliance with the United States, will be strengthened by this project's exploration of the Korean War, a conflict that has not officially ended. This conflict, which embodies many contemporary issues at the intersection of race, military power and foreign policy, remains a flashpoint in a region vital to Australia's security and economic prosperity. As American international power is tested in myriad ways, and as racial issues assume renewed urgency across the globe, this project provides cultural benefits to Australians through its contribution to understandings of race, anti-racism and foreign policy in the Asia-Pacific. It is vital that these insights are brought to bear as Australian foreign policy evolves to address ever more complex dynamics in the pursuit of Australian economic stability.							
DP200100310 Kennedy, Prof Martin J	This project will produce environmental records during ocean warming events in the geologic past to reveal processes associated with warm oceans similar to those anticipated in the coming century. New Australian technology allows investigation of sediment records at unprecedented time resolution providing insight into processes operating on societally relevant time scales of decades to centuries. This work will open an archive of climate information revealing feedback, thresholds and tipping points from past events previously inaccessible because of technical and conceptual limitations. It will provide critical inputs into models predicting future climate and to illuminate the risks and compensating feedbacks occurring with warming.	40,000.00	115,000.00	100,000.00	25,000.00	0.00	0.00	280,000.00
	National Interest Test Statement Black shale sediments hold key records of Earth's warm climate past, are the basis of the unconventional gas revolution providing lower greenhouse emissions than coal, and house some of Australia's largest base metal deposits. Despite their economic and scientific significance they remain one of the most poorly understood geological deposits because they are comprised of nano to micrometer grains too small to study with current analytical tools. This work applies new Australian technology specifically designed to image the nanocomposite materials making up these deposits. It will be applied to key sediment records of past ocean warming events that are analogous to changes anticipated for the coming century. This work will identify the processes, feedbacks and rates of environmental change associated with the transition to a warmer climate providing critical inputs for computer models predicting future climate used by policy makers. It will reveal the rock properties and processes that form base metals and control hydrocarbon prospectivity that is important to resource exploration in the Australian economy.							
DP200100311 Castles, Prof Anne E	This project aims to address the major unsolved problem of how children build their knowledge about printed words through their reading. This is important since, once children have been taught the basics of reading, the primary means by which they learn new words is through reading experience. The project will use innovative technology to monitor children's eye movements as they encounter new words during reading, examining factors influencing real-time cognitive processing and ongoing learning. Expected outcomes will be new insights into how to optimise children's word learning when reading, and the refinement of a new computational model. These will inform policy and practice in reading instruction, to the benefit of Australia's children.	79,006.00	156,657.50	143,190.00	135,559.00	70,020.50	0.00	584,433.00

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	National Interest Test Statement Becoming fluent and independent readers transforms children's lives. It opens up vast new opportunities for them to acquire knowledge and communicate, and maximises their potential to become productive, engaged members of society. However, many Australian children do not successfully make the transition to proficient reading, with up to 20% entering secondary school with low levels of literacy (OECD, 2016). This project seeks to identify ways to improve literacy outcomes in Australian children by discovering how to help them "take off" in reading and progress rapidly once they have acquired the basic skills they need to read on their own. It will provide insights into how to tailor children's instruction and the nature of their reading experiences so as to maximise learning at this key stage of literacy development. The outcomes will inform policy and practice in the teaching of reading, and guide the development of new interventions. In doing so, it will contribute to the national effort to reduce the social and economic cost of low literacy, with the ultimate beneficiaries being Australia's children.							
DP200100334 Neil, Prof Bronwen J	Armed conflict, the upheaval of social systems, and environmental crises cause citizens to question their leaders during periods of social change. They also increase religious extremism, including speculations about the imminent end of the world. The period 250-1000 CE reveals many examples of how such crises served leaders who knew how to profit from instability to expand their powers, and how they damaged the reputations of those who did not. Understanding how past leaders of the Roman world addressed these crises in practical and rhetorical ways may provide helpful and timely models of what works (and what does not) for contemporary community and political leaders, even in democratic political societies such as Australia.	99,447.00	207,988.00	148,909.50	40,368.50	0.00	0.00	496,713.00
	National Interest Test Statement In 250 CE, after Roman defeat in the Persian wars, the Roman empire seemed on the brink of destruction. By 1000 CE it had collapsed, due to multiple crises including: waves mass migration, increasing demands for Roman citizenship, populism in government, religious extremism and food shortages due to war and climate change. These crises arose from complex problems that required strong and strategic leadership. There is a convergence between the challenges faced by Roman leaders then and those facing Australian leaders today. The project will have the following social and cultural benefits for Australian citizens: 1) provide new knowledge about the successful and not so successful practical strategies adopted by leaders in times of crisis; 2) highlight rhetorical discourses used by leaders and those they led to exaggerate or minimize threats; 3) promote intercultural understanding of religious reactions to historical crises that are relevant to the issues facing political and community leaders in democratic societies such as Australia.							
DP200100482 Daczko, A/Prof Nathan R	Subduction zones and volcanic arcs are the most tectonically active regions on Earth and are crucial to understanding, geochemical cycles, tectonic-climate coupling, ore genesis and natural hazards. Bimodal volcanism is a long-recognised characteristic of arc crust that has never been satisfactorily explained, yet, it controls many of these processes. This project will test a new hypothesis that the two types of magmas originate from distinct mantle sources. It integrates novel high-pressure experiments with database analysis of natural volcanic rocks, covering magmatic systems from mantle source to volcano. This project will improve our understanding of arc processes, including the association of economic metals with bimodal arc volcanism.	29,495.00	73,661.00	81,655.50	37,489.50	0.00	0.00	222,301.00
	National Interest Test Statement The novel experimental and geochemical data provided will significantly improve our understanding of geological processes in volcanic arcs. The improved knowledge of the spatial structure and composition of arcs will provide key inputs into modelling the occurrence of volcanic eruptions, earthquakes, and the occurrence of economic metal deposits. Results will benefit the refinement of predictive mineralisation models that aid exploration strategies, and improve the basis for hazards policy decisions. The project will thus support industry innovation and develop Australia's competitive advantage by enhancing the fundamental understanding of the physical state of the Australian crust, its resource endowment and recovery. Therefore, the research complements strategic initiatives such as "Uncover", "AuScope" and "Resources 2030 Taskforce" and addresses key goals of the Geosciences Decal Plan. Additionally, the project trains a new generation of scientists in experimental techniques in melt-rock reaction. This builds future capacity to maintain Australia's leading role in high-impact geoscience research.							

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DP200100717 Williams, Dr Thomas C	This project aims to better understand genome complexity by engineering minimal yeast genomes that have fewer genes, and are therefore easier to characterise and engineer. Yeast is a model organism and industrial food, fuel, and chemical producer. This project expects to increase our basic understanding of yeast genomes, and develop new tools for engineering whole genomes. Expected outcomes of this project include the engineering and characterisation of the world's first minimal yeast genome, and the development of novel industrial yeast strains. This will provide significant benefits for both fundamental genetics and biochemistry research, and the industrial use of yeast for bio-manufacturing of sustainable foods, fuels, and chemicals.	92,516.00	186,967.00	184,001.50	89,550.50	0.00	0.00	553,035.00
	National Interest Test Statement Yeast is both an industrial workhorse and a model organism for human biochemistry and genetics. This project will therefore deliver significant benefits for the Australian environment, economy, and society. By engineering improved and simplified industrial yeast strains, products that are currently derived from oil can be produced from sugarcane using yeast. This will have benefits for the environment through the mitigation of waste products and greenhouse gases from the petroleum industry, and benefit the economy through value-addition to Australia's rich agricultural resources such as sugarcane. Society will benefit from enhanced fundamental understanding of yeast biochemistry and genetics, which will contribute to the discovery of basic cellular processes that underly disease mechanisms.							
DP200100726 Schofield, Prof Deborah J	The project aims to address one of the biggest gaps in health and productivity research by designing a novel composite national metric that will rank lost productivity due to chronic illness The project brings together tax/transfer modelling, health modelling and epidemiological modelling specialists to develop a highly innovative microsimulation model: Health&WorkMOD to then quantify the costs of health-related productivity loss. The proposed model, an international first, will be a powerful tool to comprehensively model the cost impacts of illness and simulate policy options related to health and productivity. This will provide answers to critical policy questions for government with potential significant economic benefits.	77,417.00	148,234.50	144,759.50	73,942.00	0.00	0.00	444,353.00
	National Interest Test Statement Although increasing productivity is identified by the Australian Government Treasury as a key agenda item, the impact of chronic illness and disability on productivity does not have the benefit of a comprehensive metric to guide government priority setting. There is no cohesive measure of the national productivity impacts of health, no way to rank the impact of health conditions on productivity and thus no mechanism for determining where investment in health might produce the greatest productivity gains. This project will fill a critical information void by (1) developing a novel comprehensive metric to rank chronic diseases by their productivity impacts, and (2) developing a new microsimulation model Health&WorkMOD to measure the cost of disease-related productivity loss incorporating the financial impacts to government and the economy including welfare, personal income taxation, and GDP, and impacts for individuals and families, including income, savings (including superannuation), income in retirement, and poverty.							
DP200100832 Griffith, Prof Simon C	Our research will characterise how contamination from the extraction of precious metals can spread through the environment and how it effects a highly urbanised bird – the house sparrow. In many cases, populations of these birds have been intimately associated with mining operations for over a century, and our recent work has provided evidence of adaptation over time. House sparrows provide a great natural system to understand the genetic potential of organisms to adapt to anthropomorphic change in the environment connected with the resources industry. Our work, will bring new insight into the future management of environmental contamination, and the mitigation of adverse effects arising from resource extraction.	87,500.00	170,000.00	172,500.00	90,000.00	0.00	0.00	520,000.00

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	National Interest Test Statement This research will enhance Australia's ability to remain as a global leader in the management and mitigation of adverse effects arising from resource extraction. Sustainability of the minerals industry relies on an understanding of the impacts of operations on human and natural systems so that they can respond in a timely and effective manner. The research will lead to insights that will increase knowledge and understanding of the ability for natural systems to adapt to anthropogenic environmental change. Our previous work in this area has been well received by the local community, and has resulted in investments by government and industry to improve environment and human health outcomes (of over AUD$1 billion).							
DP200100883 Johnson, Dr Amanda J	Medical device representatives provide crucial support to clinicians using complex medical equipment. However, their obligation to maximise sales conflicts with their support role. Increasing uptake of devices potentially impacts patient safety and healthcare costs, making it important to understand the involvement and influence of device representatives. The proposed research will investigate the ethical and legal impacts of device representatives in Australian hospitals, leading to new knowledge and innovative ethical and legal analyses of their activities. Benefits include a policy framework, new standards for managing device representatives' interactions, and clarity about ethical and legal obligations of clinicians and institutions.	50,500.00	110,000.00	105,000.00	45,500.00	0.00	0.00	311,000.00
	National Interest Test Statement Widespread use of vaginal mesh products led to devastating harm for many women. Medical device representatives (MDRs) played a key role in promoting and supporting the use of mesh, often being present at operations without patients' knowledge or consent. MDRs assist clinicians using medical devices, while also having commercial interests in increasing sales of these products. This conflicting role may compromise patient safety and inflate healthcare costs, raising questions about ethical practice and legal liability. By investigating the legal and ethical impacts of MDRs' hospital activities, the proposed research will lead to outcomes including a policy framework and industry standards for clinicians and institutions. These will contribute to commercial, economic and social benefits, supporting Australia's world leadership in the medical device field and ongoing prosperity in this sector. For the Australian community the risks posed by current MDR activities will be better understood, contributing to safer healthcare, with potential healthcare cost savings through decreased sales of unnecessary products.							
DP200101065 Sikora, A/Prof Adam	This proposal is devoted to linear and nonlinear harmonic analysis. It aims to unify the most significant attributes of harmonic analysis such as restriction estimates, dispersive properties of differential operators, spectral multipliers, uniform Sobolev estimates and sharp Weyl formula. Such unification will strongly improve tools for mathematical modelling in all areas of technology and science. Notable applications include medical imaging, fluid dynamics and subatomic modelling using quantum interpretation. It will solve several important open problems in spectral analysis of partial differential operators and develop new cutting-edge techniques in harmonic analysis with application to nonlinear partial differential equations.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
	National Interest Test Statement This project will enhance Australia's international profile in harmonic analysis and nonlinear partial differential equations, which are traditionally strong mathematical research fields. The particular knowledge discovered for partial differential equations has potential impact in modelling physical, environmental, engineering and economic processes. In particular, It will open up new opportunities for the development of technologies, conducive to Australia's economic growth, such as medical imaging and financial modelling. The research training of PhD students and Postgraduate Research Associates involved in this program will contribute to a higher quality of the workforce in Australia.							

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DP200101215 Throsby, Prof David	The aim of this project is to determine how the economic and cultural value of artistic and cultural enterprises is created, transmitted and received, with application to the live theatre. The project takes a novel theoretical approach to analysing these issues and develops new methods for empirical application. It expects to develop an innovative, multidisciplinary approach to analysing how theatre companies create value for their audiences, for theatre practitioners, for theatre as an artform, and for communities. The expected benefits include providing performing arts organisations and policymakers with new methods to demonstrate the full range of value yielded by the arts – enabling greater confidence in the allocation of funding. **National Interest Test Statement** Concerns about how to understand and measure the value generated by the creative arts in the economy and in society permeate policymaking in Australian governments and cultural institutions. This project will deliver significant economic benefit to the Australian community by enabling greater efficiency and transparency in the distribution of taxpayers' money to the arts, in circumstances where governments, funding agencies, and managers of cultural organisations are under increasing pressure to demonstrate the benefits of such funding. The project will contribute to cultural policymaking processes at Federal, State/Territory and local levels of government, and the benefits will flow through to arts and cultural organisations, informing their financial planning and overall economic management. At a broader level, the project outcomes will contribute new ideas to ongoing discussions in the Australian community about our culture and the role of the arts in everyday life.	68,788.50	137,194.50	140,074.50	71,668.50	0.00	0.00	417,726.00
DP200101627 Hanly, Prof Stephen V	This project will fundamentally characterise and optimize information gathering, dissemination, and communication capacities of airborne base stations to enable low latency communications in rural and remote areas. New technologies such as precision farming, safe remote equipment operation in mining, and wide area surveillance and security, require low latency communications that are an order of magnitude beyond what is currently available from satellite links. The expected outcome will be radically new base station deployment and flight path planning, and data transmission technologies. These will unlock new application technologies by enabling secure wide-spread communications coverage, delivering economic benefits to remote Australia. **National Interest Test Statement** This project will enable widespread Airborne Base Station (ABS) communication coverage for applications including data gathering from remote environmental and agricultural sensors, and low latency communications for precision farming with driverless tractors and other machinery, supporting operations and safety. These are productivity game-changing technologies, particularly in rural and remote Australia where existing communications infrastructure is limited to long-delay satellite links. There are also many low latency ABS applications in mining, defense, bushfire response, and the industrial Internet of Things, as well as in covering black spots or short-term hot spots in mobile cellular radio networks. It is critical that new ABS technology be deployed optimally to cope with Australia's harsh, and in many cases unique, conditions. There is massive potential, and clearly large economic productivity and safety benefits in enabling remote operations.	67,500.00	135,000.00	135,000.00	67,500.00	0.00	0.00	405,000.00
DP200101874 Gillings, Prof Michael R	Integrons have a major role in spreading antibiotic resistance genes among pathogens. They do so by capturing gene cassettes encoding resistance, yet how these cassettes are generated, the taxa in which they originate, and the range of traits that cassettes can encode have been outstanding questions for 30 years. This project addresses these long standing questions. The project will analyze single bacterial cells to detect newly generated cassettes and assign them to specific taxa, using an innovative method that links cassette DNA to bacterial 16S rDNA. Understanding cassette origins is the key to controlling their activity, both to harness integrons for biotechnology, and to prevent pathogens from acquiring new, dangerous traits.	88,500.00	183,000.00	176,500.00	82,000.00	0.00	0.00	530,000.00

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	National Interest Test Statement Antibiotic resistance poses a major crisis for medicine in the 21st Century, with significant economic, social and environmental costs. Bacterial DNA elements called integrons have had a major role in precipitating this crisis, by spreading resistance to important medical pathogens. Yet the origins and genesis of the resistance genes that they spread is still unknown. This project will help identify where, and how, the gene cassettes that integrons capture are generated. Understanding the dynamics of gene cassette genesis and transmission will help to develop strategies for controlling the spread of resistance, with significant outcomes for human and animal health. The ability of integrons to capture and express gene cassettes also holds great promise for biotechnology, and understanding how gene cassettes are generated is key to using integrons for industrial and agricultural applications. Integrons were discovered, and named, by Australian scientists, who also made many of the major advances in this research area. This project will maintain Australia's preeminence in this field.							
DP200102004 Wang, Dr Yuling	This project aims to develop a platform technology for multiplexed glycan mapping of the surface of a single cell to address challenges of functional glycomics by utilising a conceptually new approach. By combining newly designed plasmonic nanoparticles with surface-enhanced Raman scattering tags and multiple specific carbohydrate-recognising lectins, this project expects to produce a generic technology that is capable of non-destructive barcoding of the surface glycan signature of single cells in their native state and in response to metabolic perturbations. Expected project outcomes include advancing knowledge in nanobiotechnology, glycobiology and cell biology by being able to easily monitor changes to the surface of single cells.	68,739.50	136,047.50	136,800.00	69,492.00	0.00	0.00	411,079.00
	National Interest Test Statement The outcome of this project will significantly help us to understand the role of the sugar coating that exists on the surface of all cells. Our innovative, robust platform for analysis and mapping of cell surface glycan signatures down to the single cell level will provide a simple way to visualise the sugar barcode of the surface of every cell. This technology will allow us to measure how the cell changes in response to the environment, such as in inflammation, will provide new approaches to effectively control the response of the cell to metabolic changes and will enhance our understanding of the fundamental relationship of cell surface glycan structures to cell function. This knowledge will enable the detection of unique cell surface sugar biomarkers and drug targets that will ultimately impact on health and quality of life as well as give us the potential to commercialise the technology developed to discover these, which should provide significant economic and social benefits to Australia.							
DP200102131 Richards, Prof Deborah C	This Project will investigate ways to train reflective ethical decision making in cybersecurity management through the design of interactive social simulations. The Project will advance understanding and management of human factors in cybersecurity breaches and the field of serious game design for cybersecurity training by using new techniques for building artificially intelligent virtual agents, drawing on interdisciplinary expertise in ethics, artificial intelligence and serious game design. Expected outcomes of the Project include a new framework and technologies for cybersecurity training. This should provide significant benefits through deeper understanding of the ethical impact of new cybertechnologies and training solutions.	80,000.00	150,500.00	107,500.00	37,000.00	0.00	0.00	375,000.00
	National Interest Test Statement Managing threats to cybersecurity requires the design of information systems that take into account human factors such as the values of individuals that may drive the individual to override organisational norms, policies and regulations. Designers and developers of these systems must be trained to be aware of how users may use their systems and consider the social and ethical impact of their implementation decisions. This Project will provide artificially intelligent serious game technology to improve this training through exploration of simulated cyberethical scenarios that range from cyberhygiene (e.g not sharing passwords); software design (e.g. ISO 27001 certification) to system administration (e.g. social engineering attacks, authorisation protocols) and managerial policy making (e.g. investment in cybertechnology and risk management). Such simulations aim to make ethics integral to everyday decision-making.							

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DP200102241 McArthur, Prof Genevieve M	This Project aims to understand why children with reading impairments are at increased risk for emotional problems. By integrating the statistical power of large-scale longitudinal studies with the causal testing power of intervention case studies, it seeks to fast-track the development of a comprehensive evidence-based theory of the mechanisms linking reading impairments and emotional problems. The outcomes will pave the way for future diagnosis and treatment of concomitant reading and emotional difficulties in children. These outcomes improve our capacity to reduce the incidence of two common problems that limit the life success of Australian children - poor literacy and poor emotional health.	67,678.00	103,014.50	71,521.50	36,185.00	0.00	0.00	278,399.00
	National Interest Test Statement There is growing concern amongst educators, clinicians, and scientists that children with reading impairments are at increased risk for emotional problems - but we do not understand why. This ignorance is blocking our ability to help these children. Low literacy and poor emotional health put a huge burden on the Australian tax payer. It has been estimated that low literacy costs a developed country 2% of it GDP (31 billion Australian dollars), and that emotional problems cost Australia $11.8 billion in productivity, $1.23 billion in tax loss, and $12.9 billion in welfare payments. It has also been estimated that a 1% improvement in a nation's literacy level can translate into a 1.5% increase in GDP per person ($21 billion Australian dollars). Discovering why poor reading is linked to emotional problems will reveal how these concurrent problems should be identified and treated. This will reduce the incidence of literacy and emotional health problems in Australia, boosting its economy by reducing rates of school failure, unemployment, and poor physical and emotional health.							
DP200102269 Li, Dr Ming	This project aims to advance molecular understanding of antibiotic resistance in bacterial populations at the single-cell level, using an innovative approach integrating microfluidics, microscopy and genomics. The study of individual bacterial cell genetics is essential to provide fundamental insights into heterogeneous resistance, an important component of resistance development. Expected outcomes include a new platform technology for high-throughput multiplexed screening and improved knowledge of bacterial heterogeneity, informing antibiotic usage. This interdisciplinary project should yield significant benefits in society and economy by reducing healthcare costs, boosting health for Australians and commercialising advanced technologies.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
	National Interest Test Statement In Australia, almost half the population had at least one antimicrobial dispensed in 2015 and, shockingly, almost half of antibiotic prescriptions were noncompliant with guidelines or considered inappropriate. Clearly, antibiotic resistance is a nationwide and highly penetrant issue. Heteroresistance is emerging as an important player precipitating the antibiotic crisis, by allowing resistance mutations to go undetected and obscuring laboratory resistance tests. Thus, the proposed research will ultimately improve Australian health, as it will inform better antibiotic usage, improve laboratory testing of heteroresistant cultures and identify emerging novel resistance genes in pathogen Klebsiella pneumoniae. These outcomes closely align with Australia’s current National Antimicrobial Resistance Strategy. Further, the integrated platform "Cell-Sort MultiTool" produced from this project can be utilised for almost limitless potential applications, including large-scale commercial microbiological assays. This would benefit the Australian economy and support the emerging domestic biotechnology industry.							
DP200102298 Sheng, Prof Michael Q	This project will develop innovative techniques to efficiently and effectively distill truthful information from the inherently unreliable and large-scale Web environment, where misinformation has been widely regarded as a grand challenge for the next decade. The results of this project will not only maintain Australia’s leadership in this frontier research area, but also support many important applications that safeguard Australian people and economy such as emergency and disaster management and online healthcare. This project also serves as an excellent vehicle for the education and training of Australia’s next generation of scholars and engineers.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00

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	National Interest Test Statement							
	Individuals, businesses, and government agencies increasingly rely on the information available on the World Wide Web to meet personal needs and make decisions. Unfortunately, there is a significant rise of fake news and doctored, misleading narratives online. An urgent need is to develop novel solutions to detect true facts from unreliable and conflicting Web sources. The outcomes from this project will bring a technological breakthrough in truth discovery and contribute to the improvement of the trustworthiness of online information environment. The results from this project will benefit Australia's scientific knowledge base and help maintain its leading role in the Web technologies.							
DP200102332 Smith, Prof Tom	This project aims to develop and test a new methodology to determine the potential consequences of effective action on climate change for the asset values of fossil fuel firms. Taking into consideration policy signals from the UN Climate Change Meetings, such as the Paris Agreement, this project attempts to determine whether the market was already factoring in a significant probability of effective action on climate change, and whether this impacted firm value. The project intends to provide an assessment of risk associated with stranded assets to policymakers and executives in fossil-fuel and carbon-intensive sectors, and seeks to develop data, models and new analytical approaches that contribute to valuing environmental risk factors.	41,620.00	116,201.00	120,748.50	46,167.50	0.00	0.00	324,737.00
	National Interest Test Statement							
	International policy action on climate change has prompted financial economists and central bankers to examine the consequences of such action for the value of fossil fuel firms. The expected national benefit of this project will be to create knowledge about whether and how Australia's carbon-intensive industries will be impacted by international efforts to mitigate carbon emissions. Although Australia has not yet taken any stringent action on climate change, Australian resources companies are exposed to overseas market developments. Limits on carbon emissions imposed by overseas countries or jurisdictions are beyond direct Australian political control, but will have a direct impact on Australian companies; it is estimated that the ASX200 resources companies are holding about 80% of Australian reserves. Consequently, it will be important to have a detailed understanding of associated carbon risks. Additional outcomes and benefits of the project include the development of a new methodology and the training of graduate researchers.							
DP200102337 Cheng, Prof Ken	Desert ants with tiny brains learn to use their surrounding visual landscape to navigate. This project investigates in detail how they do that in a few carefully orchestrated trips around their nest called learning walks. Desert ants are known now to use magnetic cues to orient during their learning walks. The project also probes the role that magnetic cues play in the ants' learning, as well as the sensory basis of the perception of magnetic cues. Geomagnetic cues in the area of the nest will be artificially manipulated to test how ants use this cue. Probing the use of magnetic cues has potential benefits for projects of artificial autonomous navigation in situations when visual cues are unavailable, such as exploring a deep mine.	80,000.00	150,000.00	140,000.00	70,000.00	0.00	0.00	440,000.00
	National Interest Test Statement							
	The project's major national benefit is the training of higher-degree students and one highly talented postdoc who participate in the project. In addition, this line of work has links and applications in artificial intelligence and robotics. Past findings on ant navigation have already found application in autonomously navigating systems in silico or in vehicles. The proposed research will offer two new aspects to explore in artificial intelligence (AI): learning, and the use of geomagnetic cues. One mode of AI is to throw lots of information into the system and let the system sort it all out, in various forms of deep learning. But in some situations, copious navigational information is not available, and the autonomous agent needs to explore and learn the space on its own. The exploration of mines and underwater spaces furnish examples. Bio-inspired strategies for learning could help such enterprises. Geomagnetic cues may be useful as a compass cue in situations in which visual cues are poor, such as navigating at night or deep under water.							

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(Columns 1 and 2)	(Column 3)	2019-20 (Column 4)	2020-21 (Column 5)	2021-22 (Column 6)	2022-23* (Column 7)	2023-24* (Column 8)	2024-25* (Column 9)	(Column 10)
DP200102396 Ittner, Dr Arne	This project aims to understand the molecular principles that facilitate encoding, maintenance and retrieval of memories in the brain. To store memories in brain circuits, electrical and chemical signals are crucial. Brain cells can integrate signals into biochemical modifications of intracellular proteins. The nature of the protein modifications that represent memory within brain cells is unknown. This project uses innovative genome editing, mathematical modelling and proteomic approaches, to study how biochemical modifications of a key protein called tau help encode and retrieve memories. These molecular insights will make a significant advance in the current understanding of a brain function that is essential to all human activities. **National Interest Test Statement** Aging in a productive way is of utmost importance to individual and population health. Maintaining memory is crucial for healthy aging. This project will address a fundamental question – the basis of memory in the brain at the molecular level. This work will provide a deeper understanding of mammalian memory and thus will result in improved knowledge to maintain cognitive capacity in ageing. Furthermore, these insights will impact on brain performance and will help increase social and economic contribution of ageing Australians. Most human activities are based on memory of previous experiences. Understanding such an essential brain function as memory has wider implications beyond health, for example in education and information technology.	102,823.50	219,088.50	223,171.00	177,829.50	70,923.50	0.00	793,836.00
DP200102621 Benders, Dr Titia	Children with hearing loss experience continuing language difficulties, with major knock-on effects on educational and social outcomes. This project aims to uncover the connected perception and production processes that underpin these language challenges for children with hearing loss, focussing on a speech patterns also found in younger normal-hearing toddlers, and using innovative technologies that can generalize to the clinical practice. The project outcomes will significantly advance theories of child language development, and promise to inform more accurate and better-targeted intervention for children with hearing loss, providing social benefit by improving their listening and speaking skills. **National Interest Test Statement** Australia leads the world in hearing interventions, but children with hearing loss still lag behind their normal hearing peers in communication skills. This leads to lower academic success and poor social wellbeing, with substantial associated societal costs. This project aims to uncover the listening and speaking processes that underpin some of the communication challenge of children with hearing loss. The outcomes will provide clinicians with the much-needed tools to pinpoint the source of these challenges in order to develop evidence-based interventions that scaffold the natural learning process. Such improvements to Australia's speech, language and hearing interventions will provide significant health-economic benefit, including better educational and social outcomes for children with hearing loss, enabling them to more fully contribute to Australia's increasingly high-quality workforce and economy.	75,707.50	133,706.00	121,035.00	63,036.50	0.00	0.00	393,485.00
DP200102944 Paulsen, Prof Ian T	Marine cyanobacteria are abundant primary producers that underlie the entire marine food web. They encode a diverse range of predicted nutrient uptake systems that are highly conserved, suggesting these transporters play critical roles in their success in diverse marine ecosystems. However, there is very limited data regarding their function, specificity and ecological importance. Using our pioneering combinatorial approach, we will undertake systematic functional characterisation of these nutrient uptake systems and determine their physiological and ecological importance. Our integrative science will provide a molecules-to-ecosystems understanding of cyanobacterial nutrient acquisition. **National Interest Test Statement** Marine cyanobacteria are the most abundant photosynthetic organisms in the world's oceans, and occupy key positions at the base of marine food webs. This proposal aims to investigate how these photosynthetic bacteria acquire nutrients in the ocean, what they use these nutrients for, and how this lets them to adapt to different marine ecosystems. This will provide important information on what drives primary production in Australian oceans, which underpins our valuable commercial fisheries. Our research will provide a framework for development of biosensor capabilities for monitoring the health of Australian marine ecosystems.	88,500.00	178,500.00	188,500.00	98,500.00	0.00	0.00	554,000.00

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	Macquarie University	1,606,872.00	3,253,028.00	3,083,258.00	1,578,046.00	140,944.00	0.00	9,662,148.00
Southern Cross University								
DP200100546 Oakes, Dr Joanne M	Seagrass beds play a crucial role in global carbon (C) and nitrogen (N) cycles. It is unknown how this role is affected by nutrient inputs caused by humans. This study aims to determine, onsite, how elevated nutrients affect seagrass bed C and N cycling. A novel suite of cutting-edge methods will be used, including whole-ecosystem stable isotope labelling. This project is significant because seagrass beds affect the quantity and form of C and N exported to the ocean or buried, thereby impacting global budgets. The outcome will be major advances in understanding global C and N cycles. The benefit is that this will facilitate effective coastal management by improving our ability to predict how nutrients affect seagrass ecosystem services.	36,243.50	101,243.50	125,000.00	60,000.00	0.00	0.00	322,487.00
	National Interest Test Statement Coastal systems are of considerable recreational (social) and economic importance but are under threat due to impacts from humans. A major global impact is coastal nutrient enrichment, which has the potential to reduce the health of coastal ecosystems and alter the ecosystem services they provide. This project will contribute substantial environmental, commercial and social benefits to the Australian and international communities by adding significantly to our understanding of the role of carbon and nitrogen cycling in seagrass beds in maintaining the health of, and services provided by, coastal ecosystems. Furthermore, this project seeks to determine how this role may be impacted by increased nutrient inputs to coastal systems, which is recognised as a globally significant problem.							
DP200101311 Burton, Prof Edward D	Hexavalent chromium is a cancer-causing toxin. It can form via heating of natural (unpolluted) soil during bushfires. However, little is known of the processes and factors which govern its formation and behavior in fire-impacted soil. Using a combination of field-based investigations, innovative experiments and cutting edge analytical approaches, this project aims to systematically explore hexavalent chromium formation via fire-induced heating of soil and to examine its post-fire fate in soil systems. The results will transform our understanding of the chromium cycle at the Earth's surface, and will facilitate accurate assessment and mitigation of the risks posed by hexavalent chromium formation in fire-impacted soil.	80,000.00	150,000.00	115,000.00	45,000.00	0.00	0.00	390,000.00
	National Interest Test Statement Bushfires are a global phenomenon which impact extremely large areas of the Australian continent every year. Recent research indicates that heating of natural (unpolluted) surface soil during such fires can drive the formation of significant amounts of hexavalent chromium, a hazardous cancer-causing toxin. However, little is known of the processes and factors which govern the extent of hexavalent chromium formation or its associated fate in Australia's diverse fire-prone landscapes. By studying the fire-induced formation and subsequent fate of hexavalent chromium, we will gain new insights into the natural occurrence and environmental geochemistry of this cancer-causing toxin. The knowledge gained by this research will facilitate accurate prediction and mitigation of fire-associated risks to human health and environmental quality. The project will also grow research capacity, though the training of 2 PhD students and 1 Early-Career Researcher, in science and research priority areas ('health', 'soil and water' and 'environmental change') that are critical to Australia's future prosperity.							
	Southern Cross University	116,243.50	251,243.50	240,000.00	105,000.00	0.00	0.00	712,487.00

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The University of New England								
DP200102005 Paterson, Prof John R	This project aims to address one of the biggest questions about the early evolutionary history of complex life: was predation a driving force behind the major diversification of animals over 500 million years ago? This innovative study will extend the application of computational biomechanics and use extensive fossil collections to quantify the performance of predators and the evolutionary responses of prey species. Anticipated outcomes and benefits include a paradigm shift in knowledge of how predator-prey dynamics shaped the first animal ecosystems, new approaches for studying the functional morphology and microevolutionary patterns of extinct invertebrates, and highlighting the international significance of Australia's natural heritage.	44,500.00	116,500.00	131,401.50	59,401.50	0.00	0.00	351,803.00
	National Interest Test Statement This project will provide significant scientific and cultural benefits for Australia. Important outputs include interactive 3D anatomical atlases of modern animals that can be used for research and educational purposes, and will be freely available online. These digital resources will enhance knowledge on the Australian fauna and provide valuable learning tools for school and university students. A museum exhibit will be developed to showcase how technology can be used in natural history research, and will educate the Australian public on the evolutionary and ecological significance of modern and ancient animals, thus making a valuable contribution to the nation's STEM priorities. Outcomes of this research will also value-add to the South Australian Government's plan to nominate the Flinders Ranges as a UNESCO World Heritage Serial Site by providing vital new information on its unique geological and fossil heritage. Achieving such prestige for the Flinders Ranges will enhance the tourism industry and boost the economy in this region, whilst safeguarding a key part of Australia's natural heritage.							
	The University of New England	44,500.00	116,500.00	131,401.50	59,401.50	0.00	0.00	351,803.00
The University of New South Wales								
DP200100003 Palmer, Dr Colin J	This project aims to understand how the human visual system uses motion signals to detect the presence of other people and nonhuman animals. This question links vision science to social experience, and will be addressed using rigorous methods for studying human vision combined with 3D graphical modelling of interactive motion. The expected outcomes include an improved theoretical understanding of how rich, social information is extracted from motion signals in the brain and the introduction of new techniques for testing an individual's social perception. This is expected to provide the knowledge and methodological tools to progress research in clinical neuroscience, computer vision, and interactive robotics.	78,228.00	161,051.50	167,804.50	84,981.00	0.00	0.00	492,065.00
	National Interest Test Statement The project will contribute to Australia's capacity for research at the interface of vision science and social behaviour. It is a key task of modern neuroscience to build on our knowledge of how the human visual system extracts the most basic elements of our environment (e.g., colour, shape, motion) and develop a similarly quantitative and rigorous understanding of how we perceive the more complex properties of the world that underlie our interactions with other people. This is important for providing the knowledge and tools to drive research into neurological and psychiatric conditions that impair social function. For example, autism spectrum disorder affects >1% of the worldwide population, including many adults and children in Australia, with both sensory and social difficulties a core source of distress. The basic science outcomes of the project also have potential application in the improvement of computer vision systems that analyse human behaviour captured in video footage (e.g., for use in law enforcement or pedestrian safety) and in designing robots that can interact productively with humans.							

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DP200100062 Stephenson, A/Prof Niamh	The rapid uptake of big data is transforming disease prevention research, policy and practice. These changes could undermine work on health and social inequities, or they could enhance it. Informed by science and technology studies and social theory, this project will: investigate the current practices of Australian public health actors to realise big data's potential to tackle health and social inequities; and interrogate the factors that enable and constrain their practices. The research aims to identify how transformations in contemporary population regulation can be shaped to address social and health inequities; and to inform current work to develop Australian big health data expertise, infrastructure, and socially just regulation. **National Interest Test Statement** This project will provide new knowledge about how big data technologies can enhance or undermine disease prevention programs that target social and health inequities. The project will illuminate how Australian public health actors work to realise big data's potential to address the social determinants of health, and identify intervention points into the constraints they encounter. As big data expertise, health information infrastructure, technologies and regulation are being developed in Australia now, this research is urgently needed to ensure that future disease prevention actions can be rigorously designed to address social and health inequities. Moreover, the investigative team's interdisciplinary and international expertise will ensure that this study of Australian practices advances international sociological, policy and epidemiological scholarship on transformations in population regulation.	41,022.00	98,405.00	109,235.50	51,852.50	0.00	0.00	300,515.00
DP200100063 Nguyen, Dr Thanh Vinh	High-energy chemical species such as carbenes, nitrenes or free radicals are often used as reactive intermediates in organic reactions to rapidly generate new bonds, structures and structural complexities. Due to their reactive nature, traditionally only one type of high-energy chemical species can be featured at a time to avoid unwanted complicated side reactions. This project aims to develop novel synthetic substrates bearing multiple carbene and nitrene precursors of different types. These high-energy intermediates can be released in a relayed fashion by controlling orthogonal stimuli and therefore acting as linchpin reagents for quick construction of bio- or photo-active compounds and unprecedented complicated structures. **National Interest Test Statement** The key expected outcome of this Discovery Project is to advance the science of chemical synthesis through the development of highly applicable synthetic methods using novel reactive reagents. Through our combined synthetic/rational design of relaying the reactive intermediates with orthogonal stimuli, unprecedented chemical processes will be realized. This research project will be the background for future development of new cutting-edge chemical processes with lower cost, less waste, lower energy consumption and higher productivity, which will lead to economic and environmental benefits. Compounds and materials produced in this project will have potential applications in pharmaceutical and opto-electronic materials industry. This project will also have additional economic and social benefits in that the majority of its budget will be spent on training PDRA/HDR students for the job market and advancing their careers in an emerging scientific area. It will encourage the exchange of knowledge as well as increase national research capabilities via international collaborations in a multidisciplinary project.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
DP200100124 Roshchina, Dr Vera	This project aims to resolve mathematical challenges arising from problems with specific structure typical for key modern applications, such as big data optimisation, chemical engineering and medical imaging. We focus on developing new mathematical tools for the analysis of projection methods and accompanying fixed point theory, specifically targeting the refinement of the geometric intuition for algorithm design techniques to inform the implementation of optimal methods for huge-scale optimisation problems.	20,000.00	42,500.00	40,000.00	17,500.00	0.00	0.00	120,000.00

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	National Interest Test Statement This project will contribute to strengthening Australia's international standing in fundamental science by harnessing deep mathematical ideas to inform the design and implementation of new efficient optimisation algorithms for modern industrial problems. The collaboration with Australian industry and interdisciplinary research via formal linkages, regular meetings such as AMSI Optimise, and teaching of specialised courses allows for early penetration of high-quality homegrown ideas into the practical domain, giving a competitive edge to the Australian industry. Industry may lack the incentives for the kind of theoretical breakthroughs anticipated as the outcome of this project. This expectation is consistent with the historical record of major advancements in mathematical optimisation originating within academia. The project involves collaboration with Chile and China. The Chilean economy shares significant structural similarities with Australia, and China is our most important trading partner. Successful scientific collaboration is key for building friendly and productive relations between nations.							
DP200100129 Wilkins, Prof Marc R	This project aims to discover how cells regulate histone methylation enzymes. This process ultimately affects which genes can be turned on or off inside cells; something which is central to growth and development in all animals, all plants and some microbes. Expected outcomes include new knowledge on the regulation of histone methylation, improved techniques for the study of this process and enhanced capacity for international collaboration. New avenues for the artificial regulation of genes may also emerge for synthetic epigenetics. The project should provide significant new findings for the research community, generate research citations and contribute to a highly skilled workforce by the training of staff and students.	77,351.00	153,762.00	158,234.50	81,823.50	0.00	0.00	471,171.00
	National Interest Test Statement This project will generate significant new knowledge concerning how cells regulate histone methylation; this process ultimately affects which genes can be turned on or off in the cell. Results will be published in high quality journals, leading to the outcome of research citations. Innovative methods from the project will, through the CI's professional network, be disseminated to other Australian researchers. Novel insights into the regulation of histone methylation will be considered for patenting; the industry experience of the CI will ensure that any commercial value of the project is identified and exploited. Training of staff and students in the fields of proteomics and systems biology will generate a higher quality scientific workforce in Australia.							
DP200100134 Splinter, Dr Kristen D	Through a series of controlled laboratory experiments and numerical model development, this project aims to determine and quantify for the first time the role of water infiltration on sandy soil stability at actively eroding coastal sand dunes. This project expects to generate much-needed understanding of fundamental dune erosion processes using innovative instrumentation to obtain continuous measurements of wave-dune interactions, dune profile evolution, and water infiltration. Expected outcomes of this project include improved coastal engineering models to predict dune erosion under waves and increasing water levels. This should provide significant benefit to the future management of coastal assets using nature-based solutions.	75,000.00	135,000.00	110,000.00	50,000.00	0.00	0.00	370,000.00
	National Interest Test Statement It is clear from both the impacts of episodic and chronic coastal erosion, Australia’s dynamic coastline is one of the most demanding and challenging matters to society. Currently, Australian infrastructure valued at more than $226 billion is vulnerable to erosion due to the combined and ongoing impacts of waves and sea level rise (SLR) by 2100. Our beaches also play a key role in tourism, including the iconic beaches of the Gold Coast (QLD) and the Great Ocean Road (VIC) and must be properly managed. While sandy beaches and dunes provide a natural buffer to the impacts of coastal erosion, they also support a biodiverse environment. Through new understanding of fundamental dune erosion processes and improved predictive modelling, this project will directly benefit coastal management and planning around Australia.							

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DP200100143 Tilley, Prof Richard D	Magnetic Particle Imaging (MPI) is predicted to be the future of imaging and will outperform all current imaging techniques by having 'colours', improved resolution and 3D precision. This project aims to create 'multi-coloured' high-performance MPI tracers by synthesising a range of the most effective magnetic nanoparticle structures. The expected outcome is the fundamental understanding of the relationships between nanoparticle structures and their magnetic properties for the formation of MPI signals with distinct ‘colours’. The benefits will be a library of MPI tracers that are able to provide ‘coloured’, high intensity, precise signals beyond what can be achieved with other imaging technologies.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
	National Interest Test Statement This research will benefit Australia by strengthening and enhancing Australia’s standing in the international scientific community in the fields of materials synthesis and bio-imaging and lead to high impact publications. The research will contribute to the broader societal need for improved imaging technologies. The development of Magnetic Particle Imaging tracers will produce valuable and seminal intellectual property. The proposed research aligns with the strategic research priorities of “lifting productivity and economic growth" and the goal of "maximising Australia's competitive advantage in critical sectors.” There is a strong benefit to Australian science through the international linkages in this grant. This multidisciplinary research will contribute to the training of Australia’s future, highly skilled workforce required by academia and materials and biotechnology industries. The training will contribute to Australia’s innovation capability in our important nanotechnology and biotechnology sectors.							
DP200100147 Hamilton, Prof Alexander R	Future advances in computer technology will exploit quantum physics to deliver increased computational power, either through new materials or quantum information approaches. However although half of the 100 billion transistors in your iphone use holes to operate, most semiconductor quantum research has focussed on electrons. Holes have completely different quantum spin properties than electrons; recent advances show holes have highly desirable properties for spin based quantum information. This project will work with leading European laboratories to develop quantum computer components based on hole spin in quantum dots in industrially relevant semiconductors, and demonstrate a pathway towards a scalable quantum computer architecture.	103,000.00	195,000.00	188,000.00	96,000.00	0.00	0.00	582,000.00
	National Interest Test Statement The outcomes will advance the fundamental knowledge base of quantum electronics in an area with enormous potential for the trillion dollar semiconductor industry, and with significant implications for the development of future quantum information technologies. The project involves real collaboration with major international semiconductor research groups, attracting world-leading experts to Australia to conduct research, providing unique opportunities for Australian researchers to work in leading European laboratories, and strengthening the reputation of Australia in the future quantum technologies arena. This proposal fits in the National Research Priorities of Cybersecurity and Advanced Manufacturing, and will not only build Australian research capacity but also provide a quantum trained workforce in an area that Google, Microsoft, IBM and Intel are investing in and actively recruiting staff in.							
DP200100150 Flambaum, Prof Victor	Violation of the fundamental symmetries is predicted by unification theories of elementary particles. The aim of this project is to propose new enhanced effects of parity, time reversal and Lorentz invariance violations and perform their calculations needed to test unification theories in atomic and nuclear phenomena. By-products of this project include development of high precision computer codes for atomic calculations and theory of processes involving atoms and nuclei in chaotic excited states. These codes and theory are expected to have numerous applications (e.g. search for Dark Matter and atomic spectra of superheavy elements, atomic clocks and electron and photon processes).	70,000.00	140,000.00	135,000.00	65,000.00	0.00	0.00	410,000.00

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	National Interest Test Statement							
	The outcomes of this project are expected to help in solving one of the most important scientific problems: unified theory describing the Universe. This theory is expected to explain the origin of matter in the Universe (bariogenesis), unification of electromagnetic, weak and strong interactions into one theory which is valid on all distances, from subatomic to cosmic scales, and the reason for the violation of the fundamental symmetries in nature. We will produce personal with the broad research experience trained in several areas of physics and establish collaboration with the world leading scientific centres. Computer codes for high precision atomic calculations developed in our group will be used by our students, research associates and colleagues in their future work. These codes and our theory are expected to have numerous applications to fundamental and applied problems including search for Dark Matter and spectra of superheavy elements, high precision atomic clocks and their applications.							
DP200100203 Baker, Prof Andrew	Fire represents a major natural hazard, and its impact on Australian communities and ecosystems is increasing. Representing a world first, this project aims to calibrate the paleofire signal from stalagmites in shallow caves, and to construct annually resolved stalagmite records of paleofire frequency and intensity for the last millennia. The project aims to use stalagmites from south west Australia to determine the relationship between fire and climate and assess the robustness of stalagmite hydroclimate proxies in fire-prone regions. This project expects to establish a new research field for speleothem science, enhancing capacity for the Australian Quaternary and speleothem research communities, as well as benefits to land managers.	81,000.00	160,000.00	155,000.00	76,000.00	0.00	0.00	472,000.00
	National Interest Test Statement							
	Wildfires are a major natural hazard. Over the last few decades there has been a long-term increase in extreme fire weather, and in the length of the fire season, across large parts of Australia (BOM/CSIRO, State of the Climate 2018). However, our knowledge of wildfire recurrence and our scientific understanding of fire and climate interactions is largely limited to the last few decades, when satellite imagery is available. Stalagmites from shallow caves offer an untapped opportunity to reconstruct past fire and climate events. We will establish new methodologies that can be used to produce long, high-resolution datasets of fire events and associated hydroclimate conditions from stalagmites. Such datasets will provide the evidence base for future land management policy, with associated economic, cultural and environmental benefits. Here, we will generate them for the first time in south west Australia, providing highly needed paleofire frequency and intensity data for this region which has experienced a sustained drying trend in recent decades.							
DP200100211 Bilston, Prof Lynne E	This project will determine how an individual person’s muscle activity, muscle structure and mechanical properties, and the local mechanical conditions around the muscle interact as muscles move and deform, by using experiments and personalised computational models that can examine these factors and their interactions concurrently. To achieve this, we will develop novel magnetic resonance imaging methods to measure the mechanical properties of muscles in humans and methods for modelling muscles. As well as answering fundamental scientific questions about muscle function, these new techniques will provide a platform for studying other muscles, and for future development of muscle training methods and technologies to optimise muscle function.	125,000.00	225,000.00	200,000.00	150,000.00	50,000.00	0.00	750,000.00
	National Interest Test Statement							
	This project aims to understand how signals sent to muscles (neural drive), mechanical properties, and muscle structure and composition interact to change the shape of muscles as they work. To achieve this, we need to develop new noninvasive methods to measure muscle mechanical properties in humans and new computational modelling methods for simulating muscle function by integrating muscle biomechanics, structure and neural drive into the models. This research is at the cutting edge of biomedical engineering internationally, and in addition to the major gains in understanding how muscles work, the results and new methods will provide a platform for studying other muscles and activities. There is potential for future commercial use of the models in designing biomedical, sporting, automotive and other technologies that can benefit Australia's high tech industries. The project will also provide the highest quality research training for postgraduate students and postdoctoral scientists, and bring the expertise of our international partner investigators to extend Australia's scientific capacity.							

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DP200100345 Angstmann, Dr Christopher N	Standard mathematical models for particles that diffuse and react are based on assumptions that improving technologies have revealed do not always hold. This project aims to create a mathematical framework that generalises existing approaches, taking into account observations of complicated transport behaviour at many scales, and including the impact of this anomalous transport on reactions. The development of the framework will involve innovative approaches utilising mathematical techniques, including dynamical systems, fractional calculus, and stochastic processes. This project aims to deliver new mathematical models that can be adopted in applications across different discipline areas, and especially in biological systems. **National Interest Test Statement** This project will deliver new applied mathematics, involving fractional calculus and stochastic modelling for improved; understanding of, predictions of, and decision making for, systems involving transport and reactions in complex media such as that in, biological cellular systems, and in fluid contaminants flowing in porous media. The methods developed in this project will have a wide applicability and greatly impact the ability of the derived models to be taken up and used by the wider Australian and international scientific community. This knowledge could provide competitive advantages for Australian technological developments in industrial applications in many different areas, including of pharmaceutical development, financial pricing, nanotechnology, and environmental engineering. This project will involve training of Australian researchers with internationally competitive skills at the forefront of applied mathematics, including skills in fractional calculus.	62,500.00	127,500.00	130,000.00	65,000.00	0.00	0.00	385,000.00
DP200100355 Ostafe, Dr Alina	This project aims to develop new methods of investigating fundamental number theoretic notions of torsion and multiplicative dependence between objects of great interest such as rational functions and their values. This includes investigating such celebrated objects as torsion points on elliptic curves and torsion subgroups on algebraic varieties. The goal is to develop new methods and make pivotal advances towards solving several fundamental problems where multiplicative dependence plays a crucial role. The expected outcome is to provide deeper understanding of the intriguing nature of torsion and multiplicative dependence and thus open new perspectives for their applications in number theory and beyond. **National Interest Test Statement** The project aims to enrich the arsenal of number theoretic techniques suitable for solving most fundamental number theoretic problems. It will also establish new perspectives for a range of fundamental problems in number theory and cryptography. As a result, the national benefits from this project will be in promoting international collaboration and networking in mathematics in Australia and in a very cost-effective way (as no major equipment is required) for enhancing reputation, visibility and international standing of Australian science. It will attract attention, interest and direct involvement of many world leaders in this area and will allow them to share their results and expertise with Australian researchers. This project will be of interest to many leading researchers which in turn will create a multi-level international research network of both junior and senior collaborators and will produce several highly trained and knowledgeable PhD students and postdocs. It has a high potential to enrich the Australian intellectual climate while cryptographic applications will benefit Australian technology.	72,500.00	145,000.00	145,000.00	72,500.00	0.00	0.00	435,000.00
DP200100367 Nakagawa, Prof Shinichi	The project aims to deliver an integrative overview of behavioural, evolutionary and environmental epigenetics. In particular, by studying why stress-related experiences of organisms (e.g. exposure to toxins) can be passed onto the future generations regardless of its seemingly fitness-reducing impacts. It also aims to test if the seemingly beneficial effect of non-stress related experiences (e.g. environmental enrichment) can be inherited transgenerationally. This project involves both research synthesis (e.g. meta-analysis) and experiments on zebrafish employing cutting-edge statistical, computational and molecular methods along with behavioural assays. Also, the outcomes of the synthesis are expected to guide future work in the field.	71,266.50	155,325.00	165,624.50	81,566.00	0.00	0.00	473,782.00

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(Columns 1 and 2)	(Column 3)	2019-20 (Column 4)	2020-21 (Column 5)	2021-22 (Column 6)	2022-23* (Column 7)	2023-24* (Column 8)	2024-25* (Column 9)	(Column 10)
	National Interest Test Statement Our project will benefit Australia's national interests at least in three ways. First, our project will address two of national scientific priorates in the area of both 'environmental change' and 'health'. This is because our work on behavioural and environmental epigenetics will improve our predictive abilities for the impact of changing environments on non-human animals as well as humans. Second, we will train promising and highly thought-after scientists (graduate students and a postdoctoral associate) via this inter-disciplinary project. This will increase Australia's pool of highly-skilled scientists. Third, Australia is currently leading the world in the field of behavioural ecology and evolutionary ecology. Our project will maintain or even further Australia's high world status in these fields and related areas, by producing high-quality scientific outputs. Therefore, we will continue to attract academic talents from all over the world to our tertiary education sector. Furthermore, the excellent reputations of our universities will maintain or increase the flow of overseas students to Australia.							
DP200100492 Bryant, A/Prof Joanne	This project aims to understand the resourcing opportunities and needs of young people in the first year after exiting alcohol and drug (AOD) treatment. AOD treatment is successful for many people, yet it is also common for people to 'relapse' or return to treatment and to experience multiple periods of engagement, drop-out and re-engagement. Drawing on sociological concepts, and using a longitudinal qualitative design, this project aims to provide new evidence about the resourcing needs of young people – their perceptions of the resources available to them, and how they use these to maintain their AOD treatment outcomes. This will support the design of continuing care services that are responsive and relevant to young people's needs.	36,546.00	97,158.50	117,605.50	56,993.00	0.00	0.00	308,303.00
	National Interest Test Statement Substance use is estimated to cost Australians $55 billion (AIHW, 2018) in expenses related to the health care system, loss of productivity, road accidents and crime, and these costs are expected to rise over the coming years. This is despite many years of policy and program interventions, and signals a potential breakdown in current institutional responses. This study will use sociological concepts and design (rather than conventional epidemiological and psychological approaches) to understand the resourcing opportunities and needs of young people after exiting AOD treatment. This innovation in approach brings the potential for significant impact – to inform new approaches to AOD policy and service delivery that are responsive to the resource needs of marginalised young people during 'post treatment'. In doing so, this project will contribute significantly to the practical challenge of building better, more relevant models of service delivery to reduce disparity and increase social participation.							
DP200100555 Falster, Dr Daniel S	Australia's giant Eucalypt trees are an amazing phenomenon and resource; underpinning unique ecosystems, rich in timber, stored carbon, and animal habitat. While tree height generally arises via an evolutionary arms race for light, the race has escalated dramatically in some locations and species. Using a computational framework that simulates adaptation driven by size-structured competition, this project will quantify how distinct factors-including climate, recruitment, and disturbance-enhance the race for light and can thereby explain the origins of Australia's giant Eucalypt. With calibrated models of species evolution, coupled with targeted fieldwork and big data, this project clarifies key forces shaping present and future vegetation.	79,600.00	160,966.50	162,388.50	81,022.00	0.00	0.00	483,977.00
	National Interest Test Statement This project aims to provide new theory on the environmental and ecological factors promoting and maintaining Australia's tall eucalypt forests. Species of Australian eucalypt trees include the tallest flowering plants on earth. Tall eucalypt forests underpin national forestry production, form habitat for unique and endangered fauna, store vast amounts of carbon, while captivating a curious public. Given their social, economic and ecological importance, it essential that we understand the processes that have maintained these species. This project will identify how features of the environment and species biology have promoted the incredible size of some eucalypts, by intensifying competition. By integrating data with computational models, the project will improve simulation of future vegetation. This will underpin effective ecosystem management and restoration based on new theory, consistent with observations.							

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DP200100597 Boydell, Prof Katherine M	Women impacted by mental illness, disability or refugee status are among society's most vulnerable and disenfranchised groups. Such women can experience significant social exclusion, marginalisation and stigma, associated with reduced help seeking, deprivation of dignity and human rights, and threats to health, well-being and quality of life. However, many women demonstrate resilience and agency, associated with positive health outcomes. This research will identify how women negotiate stigma and potential marginalisation, to inform health policy, and target interventions for vulnerable women, generating much-needed insight on women's embodiment of stigma, and strategies used to cope with, negotiate and resist their stigmatised identities.	30,625.50	74,125.50	70,800.00	27,300.00	0.00	0.00	202,851.00
	National Interest Test Statement This research contributes to Australia's national interest through its potential for social, cultural and health benefits to the Australian community. Understanding the lived experience of vulnerable and marginalised women in a richly-textured, visual manner will encourage empathy for individuals too often invisible to practitioners and policy makers, allowing for humanity to re-emerge as primary to social policy deliberation. Involving women as co-producers of knowledge using creative arts-based methods has the potential to contribute to social capital; the social relations of women via feelings of community inclusion, and is also associated with empowerment and self-esteem. Sharing research results via public art installation contributes to the cultural capital of Australian communities.							
DP200100615 Woo, A/Prof Jae Kyung	This project aims to develop aggregate risk models by utilizing shock models in reliability theory. It intends to provide a new alternative approach which is more realistic and also mathematically tractable in order to estimate various types of quantities in (re)insurance and operational risk management. The expected outcome includes enhanced capacity by advanced analytical tools to assess correlated and large risks, thus assisting in the management of key risks and improving the effectiveness of risk management. This should benefit the stability of the financial and regulatory systems where large and dependent risks are concerned.	54,000.00	111,000.00	113,000.00	56,000.00	0.00	0.00	334,000.00
	National Interest Test Statement To ensure that a sufficient level of capital is strategically allocated in order to avoid the insolvency of the business, the estimation of the aggregate loss (or risk) is one of the important main tasks in the insurance industry and other businesses. In particular, the high-impact and low-frequency events (calamities) can cause multiple types of losses (e.g catastrophes such as floods cause damages to automobiles and properties such as houses) and a good understanding of the nature of such events is important to correctly model the aggregate loss. Utilizing the ideas of shock models and incorporating the heterogeneity aspect of loss events such as extreme weather events and environmental states, this project intends to support the sustainability and financial welfare of the insurance industry as well as the supervision by government agencies in Australia and overseas.							
DP200100630 Birznieks, A/Prof Ingvars	Every touch sensation from our fingertips is conveyed to the brain through the nerves by means of electrical impulses similar to any digital device. Using unique technology developed in our lab we can intercept this neural communication and insert our own messages to test how these signals are interpreted and converted into perceptual experiences. We aim to reveal the rules by which timing of neural signal patterns shapes the perception of touch - specifically intensity and frequency of vibration. By recording signals from neurons and by testing human perception, we will learn about neural processing mechanisms. The new knowledge generated about sensory coding will be essential for rendering a virtual sense of touch.	105,000.00	205,000.00	170,000.00	70,000.00	0.00	0.00	550,000.00

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	National Interest Test Statement Recent reports in fields of robotic technologies and hand prosthetics about successfully implementation of tactile sensory feedback via direct neural or brain machine interfaces have created unprecedented demand for fundamental knowledge in neural code and neural stimulation-communication techniques. Our research being in the forefront of this field builds upon previous investment aimed to contribute to the key knowledge enabling advancement of technologies related to robotics, prosthetics, virtual reality, and teleoperated haptic devices. Those technologies are essential for increasing Australia's advanced manufacturing capability aligned with Australia's research strength in robotics automation resulting in added value of products. The gained fundamental knowledge will encourage development of bionic technologies aimed to improve quality of life of individuals to gain independence and manage their own day-by-day care. From academic point of view this study will provide a solid knowledge base and technological foundation for high-quality research training supporting the growth of national research capacity.							
DP200100710 Merrick, A/Prof Kathryn E	This project aims to develop algorithms to permit groups of robots to evolve coordinated, collective, swarm behaviours. Groups of robots will be conceptualised as developmental swarm organisms with an initially limited set of behaviours, but equipped with structures and processes to permit them to evolve new behaviours. This project expects to deliver the next generation of computational intelligence technologies to enable humans to harness large groups of robots for new kinds of transport and inspection tasks in smart cities, smart farming and defence. The expected outcomes of the project include new software frameworks for distributed developmental learning, extending developmental robotics to evolutionary robot swarms.	57,000.00	124,000.00	129,500.00	62,500.00	0.00	0.00	373,000.00
	National Interest Test Statement With the emergence of driverless and drone technologies, many industries will be able to invest in different autonomous vehicle platforms. In addition, hardware for large numbers of autonomous ground and aerial vehicles is becoming increasingly accessible. This project will deliver the next generation of computational intelligence to permit large numbers of heterogeneous robots to form swarms autonomously, and coordinate their group movements. This will permit us to scale up the use of autonomous vehicles for such tasks as transport and inspection in smart cities, smart farming or defence. Swarm formations offer the advantages of efficient movement for large groups; a level of protection for the group; and potential for human guidance of a single swarm organism containing large numbers of vehicles. This will contribute to Australia's practical research challenge of "Transport" through the design of software for coordinating groups of autonomous vehicles.							
DP200100860 Martinac, Prof Boris	The major aim of this project is to determine evolutionary conserved physical principles of mechanotransduction in living cells through structure and function studies of PIEZO mechanoreceptor channels playing a crucial role in senses such as touch and pain in animals and humans. Mutations in these channels can cause numerous genetic disorders, including hereditary anaemias and joint contractures. Since they have been shown to respond to mechanical stimuli in the same manner as mechanoreceptor channels of organisms from bacteria to humans the intended outcome of this project is to uncover the unifying principles of mechanotransduction anchored in the laws of physics and chemistry that have guided the force-dependent design of all life forms.	105,000.00	220,000.00	220,000.00	210,000.00	105,000.00	0.00	860,000.00
	National Interest Test Statement This project provides a platform for future diagnosis and treatments of mechanopathologies (e.g. pain and hereditary anaemias) and skeletal disorders (e.g. arthrogryposis, osteoarthritis) that result from dysfunctional mechanoreceptor channels. The project promises to contribute to Australia's national interest by aligning well with the Science and Research Priority "Improved prediction, identification, tracking, prevention and management of emerging local and regional health threats", given that musculoskeletal disorders, for example, which amount to 17% of the total burden of disease in Australia, represent a significant financial and social burden. Furthermore, the project also promises to contribute to nanotechnologies, such as drug delivery systems based on mechanosensor channels, where bacterial MscL channels are already leading the way.							

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DP200100909 Ritter, Prof Alison	This project aims to study whether the design of illicit drug policies can be enhanced with participation. As a complex social problem, the development of new policy design solutions requires participatory processes which engage multiple stakeholders and make explicit the underlying values and goals. The project aims to study the effects of participatory policy design and generate new innovative technologies of participation. The expected outcomes are new knowledge and practices for policy design, including policy design solutions for three current policy dilemmas for Australian governments. The benefits of more effective and participatory illicit drug policies include the economic, social and health gains accrued when policy works. **National Interest Test Statement** A priority action in the Australian Government National Drug Strategy (2017-2026) is to “increase participatory processes”. This project is the realisation of this government priority, harnessing participatory processes to deliver three new illicit drug policy design solutions for Australian state/territory governments. Within this, it will also generate new knowledge about how governments can better design illicit drug policies that are both effective and supported by the community. The extent to which policy is supported by the public is an essential element in its effective implementation. Better illicit drug policies in turn increase the likelihood of improved economic, social and health outcomes for those affected by illicit drugs. The economic burden of illicit drugs is estimated at $8.1 billion each year. Improved policies, which are built from participatory policy design processes, can reduce this substantially.	53,092.50	116,884.00	96,974.50	33,183.00	0.00	0.00	300,134.00
DP200100963 Wolfe, Prof Joe A	This project aims to understand the non-linear physics underlying how musicians produce beautiful, expressive phrases. Elegant, expressive playing is much more than just the right notes. Using techniques unique to this team, we will give a deeper understanding of how breath pressure, mouth geometry and forces, tongue action and finger motions interact to communicate expression in musical phrases on a wind instrument. The outcome will be the understanding of how varying control parameters interact at the physical level and how this communicates expression to listeners. Understanding interactions that expert players perform unconsciously will have significant benefits to music learning and teaching. **National Interest Test Statement** This project will produce an understanding of hidden and subtle physical complexities involved in expressive performance of music. Music is widespread throughout Australian culture with most people enjoying it for several hours per day. Music is also a major industry, in which Australians often excel. • Over 20% of Australian students learn to play music, often a wind instrument. This project will answer important questions about expert playing, with practical benefits for music learning. The lab’s very popular web sites already contribute best practice guidelines to musicians. This project will add to them and thus influence music learning and teaching, with future cultural and economic benefits here and abroad. • The project will provide a strong incentive to study STEM subjects as many school students have an intrinsic interest in the science of music and find it exciting. • This project will further enhance the very high reputation of Australian research in music acoustics. • It will support a research training lab whose graduates have been recruited by major Australian medical device export industries.	65,000.00	135,000.00	135,000.00	65,000.00	0.00	0.00	400,000.00
DP200101027 Tretiakov, Dr Oleg A	Skyrmions – nanoscale topologically protected spin textures, are considered as ideal candidates for encoding and transmitting bits of information. This burgeoning research field, however, suffers from the same limitations of all spintronic concepts – the high currents needed to move skyrmions. Magnonics is yet another emerging approach, which main aim is to investigate the behaviour of spin waves in magnetic nanostructures. In essence, spin waves are a propagating re-ordering of the magnetisation and therefore use the least amount of power, making them perfect for driving skyrmions. This project fuses skyrmions with magnonics. The central goal is the formulation of model for the magnon assisted manipulation of skyrmions and their lattices.	60,000.00	120,000.00	130,000.00	70,000.00	0.00	0.00	380,000.00

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	National Interest Test Statement							
	By developing novel physical concepts for low-cost and ultra-low-power consuming emerging non-volatile memory based on skyrmions, this research intends to enable high performance data storage technologies that are less expensive, consume much less power and exhibit higher speeds and longer lifetimes. A key potential benefit is the opportunity for Australia to lead in the development of this advanced data storage technology in the World. This market is predicted to have revenues of over 160 billion dollars by 2026. Additionally, these devices offer reduced energy consumption, which results in cost-saving economic benefits and a reduction in the negative effects of climate change. This work is therefore expected to provide impact through economic and environmental contributions to Australia's national interest.							
DP200101045 Valaris, Dr Markos	This project aims to develop and defend a theory of skill. From everyday activities like riding a bicycle or carrying on a conversation to the extraordinary achievements of top artists, athletes, and thinkers, skill permeates human life and defines its possibilities. And yet we lack an adequate understanding of its nature. On the one hand, we think of skilled action as flexible and intelligent, while on the other we think of it as unreflective and automatic. How can these claims be reconciled? This project aims to resolve this tension by developing a novel account of how knowledge can be embodied in action. In doing so, it seeks to advance our understanding not just in philosophy, but also in areas such as the arts, education, and sport.	20,000.00	40,000.00	51,153.00	31,153.00	0.00	0.00	142,306.00
	National Interest Test Statement							
	This project will tackle the hotly contested topic of skill. In doing so, it will advance cutting-edge research in philosophy of mind and action and their interface with epistemology, moral theory, and cognitive science. Through top-tier publications, presentations at elite international conferences, and the organisation of an international conference, this project will reinforce Australia's established excellence in philosophical research, thereby enhancing our universities' ability to attract the best students and scholars. But the topic of skill matters beyond the academy. We rely on it to think about what we can be as human beings, as when we admire the skilles of elite athletes or artists. We rely on it to debate what contributions our schools and universities can make to the flourishing of our communities. Yet as recent research shows, it is unclear that we truly understand the nature of skill. By advancing our understanding of this crucial topic, the project will deliver broader cultural benefits.							
DP200101116 Zhang, A/Prof Wenjie	This project aims to develop novel technology for efficient and scalable cohesive subgraph discovery on big bipartite graphs, including new theories, indexing techniques, and data processing algorithms. We anticipate addressing key challenges and laying scientific foundations of big graph computation, as well as delivering high-impact technologies. The success of the project will directly benefit the key applications in Australia such as cyber-security, health, bio-informatics, social networks, and E-commerce. The success of the project will also facilitate the training of PhD graduates and postdoctoral research associates in the area of Big Data.	70,000.00	142,500.00	145,000.00	72,500.00	0.00	0.00	430,000.00
	National Interest Test Statement							
	Cohesive subgraph discovery over big bipartite graphs is a fundamental problem to a broad spectrum of applications. The success of this project will bring breakthroughs in technology advances in the processing of big graphs including novel indexing, scalable processing techniques, complexity analysis, and system development. This will ensure Australia to take a leadership and be in the forefront of this research field. The project also has a great value to the development of local industry including e-commerce systems to detect clicking farm behavior and predict customer preferences, cyber-security to measure the network attack vulnerability, and social network analysis to conduct recommendation of products. Moreover, the project will also facilitate the training of national most wanted IT professional talents.							

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DP200101211 Abbass, Prof Dr Hussein A	Transforming data assets into organisational knowledge assets sits in the hands of a few, highly specialised, data scientists. The aim of this research is to design educational instruments to support non-experts to teach artificial intelligence (AI) systems in a similar way to educating human teachers to teach human learners. The significance of the project lies in affording the wider smart, but not necessarily AI expert, community the ability to contribute to growing our knowledge-based society in a safe, transparent and trustworthy manner. Outcomes will include innovative instruments to teach machines, novel knowledge creation, trusted and transparent AI systems, and a new generation of human teachers specialised in educating AI systems.	68,000.00	145,000.00	154,000.00	145,000.00	68,000.00	0.00	580,000.00
	National Interest Test Statement Artificial Intelligence (AI) benefits the community through its data and decision analytics technologies that improve the delivery of public and private services such as health and education, expands Australia's international export market-share, and solidifies Australia's knowledge-base in a strategic area of significant international growth. However, AI systems may learn the wrong thing and are only designed by AI specialists; thus, the public lacks transparency to understand what they are learning. Guided with the methodologies used by educators when teaching foreign language teachers, this multidisciplinary project will create the educational instruments for non-specialists to teach AI systems. Due to the mathematical and computing nature of AI, the project will develop the algorithms and tools needed to fill the gap between the high-level skills of a human teacher and the low-level skills required for AI systems. The knowledge created by this project could open new job markets to Australians, anchoring Australia's international leadership in AI, and making the Australian society AI-ready.							
DP200101306 Jakimow, Dr Tanya	This project aims to assess the success of satellite cities, conceived as possible solutions to the urgent challenge of rapid urban growth in today's megacities. Through an ethnography of an Indian satellite city, Mahindra World City, this project aims to generate knowledge on new urban formations and the consequences of experiments in urban development for different socio-economic groups. Understanding the lived experiences of residents/workers in satellite cities aims to form a robust evidence base for research driven dialogue with policy makers, planners and developers. Lessons derived are expected to inform policy and practice as to how to achieve wellbeing for urban residents, while providing indications of Asia's urban futures.	32,152.00	60,139.50	60,019.00	32,031.50	0.00	0.00	184,342.00
	National Interest Test Statement This project that evaluates Satellite Cities as a means to address problems associated with urban growth will have environmental, social and cultural benefits for the Australian community. As one of the most highly urbanized countries in the world with four cities with a population over 4 million, Australia seeks to benefit from advances in knowledge as to the viability of Satellite Cities, and the consequences of experiments in corporate-state partnerships in urban planning. Informing global debate as to the success or failure of current strategies adopted to relieve pressure from Asian mega-cities will indirectly benefit Australia through new knowledge of the environmental, social and cultural implications of new urban formations, while directly informing policy and practice through research-driven dialogue with Australian policy makers and urban planners. An analysis of Mahindra World City as a microcosm of ongoing changes and developments will accrue additional cultural benefits through enhanced understanding of contemporary India: a country with significant cultural and economic links to Australia.							
DP200101314 Le Pelley, A/Prof Mike	We spend our lives surrounded by stimuli relating to reward and risk (adverts, games, social media etc). Recent research suggests that learning about reward and risk influences our attention, often despite our best efforts. This project will build on recently developed procedures using eye-tracking to investigate how learning about reward and risk modulates what we pay attention to, and what we ignore. Findings will be used to develop computational models of 'attentional economics' that account for, and predict, when we will be distracted by reward- and risk-related stimuli. This research will enhance the world-class status of Australian cognitive psychology, and will shed light on processes implicated in addiction and related behaviours.	57,551.00	116,671.00	121,368.00	62,248.00	0.00	0.00	357,838.00

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	National Interest Test Statement							
	This project represents an opportunity for Australian research to be at the forefront of knowledge-creation at an international level. The idea that reward and risk influence attention has far-reaching consequences. Investigating 'attentional economics' will help us understand when people's attention becomes hijacked by stimuli, and shaped by previous experiences of reward and risk. This has implications across a range of areas, including health, safety and financial decision-making, and will shed light on cases in which reward/risk-related stimuli exert a pathological influence, as in addiction and related behaviours (gambling, obesity etc). This is an important national issue: Australians have the highest per capita rate of gambling losses globally. Our team is well constituted to pursue both the basic science and translational implications of this project. Furthermore, our project will strengthen a successful international collaboration, and will provide research training for postdoc, postgrad and undergrad students with world-leading researchers, enhancing Australia's future research capacity.							
DP200101324 Edwards, Prof Louise P	This project intends to explore the connections between political programs promoting social change and cultural and commercial activities in China since 1900. It intends to generate new knowledge about the factors that influence people's perceptions of desirable male and female behaviours by examining the evolution of ideals of beauty and ugliness and how they are used by political, cultural or commercial actors. The expected outcomes include deepening Australia's knowledge of what constitutes a positive or negative attribute in the Chinese marketplace (both the commercial market of products and the political market of ideas) and enabling Australians to promote their products/ideas more effectively in the global powerhouse that is China.	24,904.00	48,313.50	45,160.00	21,750.50	0.00	0.00	140,128.00
	National Interest Test Statement							
	The project advances Australia's national interest by making us more effective in influencing China by improving Australia's knowledge of deep motivators for change within Chinese culture. This knowledge will be useful in the political, economic and cultural spheres because it will enable Australians to position their products, policies and ideas more effectively in a crowded global arena where all nations around the world are active in seeking better ways to cooperate with, benefit from and engage with China. It promises to lift Australia's effectiveness by dismantling the out-dated notion that the Chinese are motivated only by profit or are passively compliant to authority. Vanity, and the desire to have a good reputation, are also major motivating factors prompting change, choice and decisions.							
DP200101326 Sharma, Prof Ashish	About 25% of the global population currently has inadequate access to safe and secure water. This number is expected to rise to 50% by 2050 due to increased populations and reduced river flows. While a visible water crisis (such as the one in Cape Town in 2018) can culminate in the funding of new water supply infrastructure, a planned push for infrastructure augmentation often stalls due to contradictory projections of how much water will be available in the future. To address this, a novel alternative for assessing water security is proposed. Our approach assesses change using historical information on river flow and water demand, adapting these to form projections that exhibit greater reliability than currently existing alternatives.	62,500.00	112,500.00	110,000.00	60,000.00	0.00	0.00	345,000.00
	National Interest Test Statement							
	A "Water Crisis" represents the largest global economic risk over a 10 year planning horizon as per a recent World Bank report. A water crisis is more likely in fragile economies, and can even increase the chance of an economy turning fragile were it to occur. Such crises will occur with greater intensity and frequency as global populations surge and flock to urban centers while river flows reduce. Reductions in flow are even more significant in drier continents like Australia, where aridity is already on the rise. Actions to combat this crisis are perpetually in limbo as projections of the extent of change in water security with time remain inconsistent. We propose an innovative framework to address this inconsistency that exists in water security projections of the future. We present an approach that relies on carefully collected data on water demand and flow, modified using a stable indicator of change, to reflect the changed water security one would see in the future. Our approach will be tested using data from major Australian water supply systems, giving validity and confidence to the outcomes derived.							

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DP200101338 Lin, Prof Xuemin	Structure search on heterogeneous information networks (HINs) has many applications including cybersecurity, crime detection, social media, marketing recommendation, and public health. The project aims to develop novel techniques for efficiently conducting structure search on large scale HINs and lay the scientific foundations. The anticipated outcomes include novel computing paradigms, algorithms, indexing, incremental computation, and distributed solutions. The success of the project will directly contribute to the scientific foundation of Big Data computation. It will also contribute to the development of local industry involving cybersecurity, social media-based recommendation, network management, knowledge graphs, and E-business.	90,000.00	180,000.00	180,000.00	90,000.00	0.00	0.00	540,000.00
	National Interest Test Statement Structure search over heterogeneous information networks is strongly demanded by and is also fundamental to a broad spectrum of applications. The success of the project may bring a number of technological breakthroughs including new computing paradigms, scalable algorithms, effective indexing strategies, incremental maintenance techniques, and distributed solutions. This will place Australia in the forefront of Big Data research worldwide. The success of the project may also guide and help to boost the growth of local industry involving social media analysis, cybersecurity, public health, criminal detection/prevention, network monitoring, and E-bussiness. Moreover, the project will facilitate the training of national most wanted IT professional talents.							
DP200101470 Schmidt, Dr Michael A	This project aims to investigate how new physics impacts on the puzzling threefold replication of the elementary particles known as quarks and leptons; these particles provide the foundations for the structure of atoms. This theory project seeks to do so in the context of a concentrated worldwide experimental program whose objective is to produce hugely more information about the mysterious replication. Expected outcomes include the construction of new theories that deepen our understanding of elementary particles and their interactions. This should provide significant benefits to intellectual culture and the training of early-career researchers as flexible problem solvers able to innovate in any context in industry or government service.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
	National Interest Test Statement The Project aims to benefit the intellectual culture and global prestige of Australia through scientific publications, conference presentations and outreach activities addressing humanity’s deepest yearnings to understand our physical universe, especially the fundamental structure of matter. In the conduct of the research, it aims to provide advanced training outcomes for research students and early-career researchers in readily transferrable creative problem-solving and mathematical-modelling skills, thereby seeking to contribute to a higher quality Australian workforce that can innovate beyond academia in any context in the commercial world and government service. The outreach activities aim to inspire school-level students to undertake studies in science and mathematics to help underpin the Australian economy, and to help inform the general public about the fundamental laws of nature that constitute the foundations of our universe.							
DP200101500 Tian, Dr Fangbao	This project aims to produce a deeper understanding of the role of wingtip feathers in the remarkable abilities of birds to fly in unsteady and unpredictable aerodynamic environments, and in some cases to do so almost silently. This is achieved by developing novel numerical methods integrating fluid, structure and acoustics interactions for large deformations and complex geometries. The numerical results are validated and complemented by using flow, structure and acoustics experiments on dynamically scaled models. The insight gained provides design guidance for more efficient, robust and stable flight of bio-inspired micro air vehicles, and in reducing the noise impact of wind turbines by innovative blade leading edge and tip shaping.	100,000.00	182,500.00	167,500.00	85,000.00	0.00	0.00	535,000.00

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	National Interest Test Statement The intended research outcomes will benefit Australia scientifically, technologically, socially and economically. Scientifically, this project will enable the development of innovative computational models to unravel the physics underpinning the remarkable flying abilities of birds, placing Australia in the forefront in this field. Technologically and socially, results obtained will have direct application to bio-inspired micro air vehicles, multi-rotor drones and wind turbines. Smaller bio-inspired designs will allow an even greater range of utility and operating environments. Aerodynamic features that allow higher efficiency, greater stability and reduced noise are key to their further development. Insights gained from the wingtip aerodynamic and acoustic studies in this project will translate directly to wind turbines and drone rotors, guiding potential noise reductions which are central to greater public acceptance of both technologies. Economically, the research capability developed has the potential to increase the global competitiveness of wind turbine and drone industry in Australia.							
DP200101578 Bowrey, Prof Kathryn A	The use, creation and dissemination of the products of research is a core function of Australian universities, and critical if research is to have impact in the real world. It is regulated by intellectual property laws, sector-wide grant conditions, licensing agreements with libraries and university policies on intellectual property ownership, authorship, open access and engagement. International law and practice creates another layer of regulation. Navigating this terrain is the responsibility of every academic and manager, but it is a complex, incoherent framework. Mapping it with an eye toward harmonization and coherence will better advance public goals, in particular improve access to research for impact and engagement.	80,000.00	137,500.00	100,500.00	43,000.00	0.00	0.00	361,000.00
	National Interest Test Statement To reclaim value from publicly funded research, and to ensure that research has real world effects and is conducted in a way that engages external stakeholders, we need to better understand the way intellectual property laws and licensing decision-making are currently operating in the university context. We also need to manage their interaction with funding conditions, sector-wide management and other policies that regulate what academics can do in the classroom and as researchers, public speakers and writers. The current policy framework is incoherent, which creates the serious risk that university research will fail in meeting its objectives; that globally, Australia's research impact will be reduced, and that universities and funders will waste public resources paying unnecessary copyright fees. This project maps the existing regulations, licence conditions and practices, assessing them with a view to harmonization across the sector and in line with UK and EU university policies that have proven effective in supporting broader public access to research.							
DP200101612 Zhang, A/Prof Jianqiang	Heat resisting chromia-forming alloys passivate successfully in clean, dry air at temperatures up to about 950°C. However, this performance is degraded by secondary oxidants (carbon, sulphur, chlorine, water vapour), leading to corrosion failure in important industries. The project aims to investigate the effect of these secondary oxidants on corrosion behaviour of chromia-forming alloys, to identify interactions between multiple oxidants within the scale, to establish the mechanisms of oxide scale penetration by foreign species, and to evaluate scales on different alloy types. The results will provide a basis for improved design/selection of heat resisting chromia-forming alloys, key to power generation industries.	94,500.00	187,000.00	182,500.00	90,000.00	0.00	0.00	554,000.00
	National Interest Test Statement Power generation from coal, and the export of coal for that purpose, is a key industry for the Australian economy. However, its continued exploitation is likely to require carbon emission controls and therefore new advanced power generation technologies. The problem is that the new technologies produce hot gases containing not only oxygen but also other oxidant species, such as carbon dioxide, sulphur dioxide, chlorine-containing gas or water vapour. These oxidants (carbon, sulphur, chlorine containing species and water vapour) penetrate otherwise protective oxide scales, leading to material failure. Therefore, there is a pressing need to develop improved heat resisting alloys for use in new power stations, waste-energy conversion plants and related industries built to provide long-term service at higher temperatures and efficiencies, whilst reducing CO2 emissions. This project identifies the mechanism of this corrosion attack, thereby assisting the design (and selection) of more corrosion-resistant alloys for Australian new power generation industries.							

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DP200101626 Moreau, Dr Danielle J	This project aims to understand and predict the noise produced by turbulence interacting with an airfoil to advance the design of aeroengines, wind turbines, marine vessels, cooling fans and drones. A novel anechoic wind tunnel experiment is proposed to link complex turbulent in-flow with the behaviour of the flow as it interacts with the airfoil and the noise-producing physics. The intended outcomes of this project are new semi-analytical noise prediction models and scientific knowledge that can be harnessed for practical noise control. Anticipated benefits include quiet aerospace, naval and renewable energy technologies, reduced environmental noise pollution and better quality of life.	85,000.00	165,000.00	160,000.00	80,000.00	0.00	0.00	490,000.00
	National Interest Test Statement The project will provide industry with the means to design new quiet aircraft, wind turbines, marine vessels, drones and ventilation fans. This will benefit the community by reducing environmental noise pollution, leading to better public health, improved airport operation and enhancement of the quality of life in our cities. Quieter wind turbines will permit their placement closer to communities and electrical transmission infrastructure, thus assisting the roll out of renewable energy. This project is of great benefit to Australia's maritime industry, where the reduction of radiated noise is a major focus in the design and operation of ships and submarines. Quieter marine vessels will significantly improve the stealth of Australia's navy, as well as the comfort of passengers and crew. This project also provides high level research training for PhD students and a Research Associate in aeroacoustics and turbulent flow thus developing new research talent that can take on the next set of scientific and industrial challenges.							
DP200101708 Powell, Dr David A	This project aims to investigate how sound waves exert forces on objects, and how these forces can be controlled by artificially engineered structures known as acoustic metamaterials. The project is expected to lead to a new understanding of acoustic radiation forces, and how they can be efficiently manipulated with high resolution. The expected outcome is a new capability for the measurement of delicate mechanical structures, which avoids the cost, complexity and side-effects of existing systems. This should benefit many high-tech areas, including inflatable space structures, micro-mechanical sensors and actuators and precise optical components, as well as biological areas such as the study of insect flight and communication.	70,000.00	135,000.00	130,000.00	65,000.00	0.00	0.00	400,000.00
	National Interest Test Statement The ability to mechanically characterise delicate structures, without causing damage, is a much-needed capability. Current approaches were developed to meet the needs of 20th century mass-production, as epitomised by automotive manufacturing. Bespoke, high value-add manufacturing areas ranging from foldable space structures, sensors based on micro-electromechanical systems, medical implants and integrated optical systems, require new testing techniques. Increasingly such structures are tailored for each end-user, and are fabricated in small batches using 3D printing technologies. The ability to precisely excite forces on such structures, with a scalable, low-complexity system, will greatly facilitate the design and testing process in developing new technologies and products. This capability could also be applied to biological systems such as insects. The ability to characterize insect wings may have applications ranging from advanced robotics to wind energy harvesting, while understanding their organs for sensing sound and vibrations has potential benefits in pest control.							
DP200101714 Beves, Dr Jonathon E	The aim of this project is to use cheap, abundant transition metal ions and visible light to enable challenging synthetic chemical reactions. The significant problems addressed are that most synthetic reactions using visible light currently require expensive precious metals, and fundamental reaction pathways used by Nature remain inaccessible. Both of these problems limit the scope of synthetic applications. The outcomes will be new knowledge and sustainable technologies that can better harness visible light for useful synthetic chemistry applications. The benefits will be more efficient and cost-effective routes to valuable molecules ubiquitous in everyday life.	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00

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	National Interest Test Statement This project aims to use cheap, abundant metal ions such as copper, nickel or iron to harness the energy of visible light (e.g. from the sun) and use this energy to form new molecules. Through this research valuable compounds will become more accessible, and cheaper to produce. This will benefit Australia by improving the commercial viability and the environmental sustainability of methods for the preparation of important molecules including pharmaceuticals. The project will reinforce Australia's international reputation as a leader in sustainable synthesis using visible light, and will provide cross-disciplinary training for the next generation of scientists in the latest tools to advance cutting edge science.							
DP200101744 Pinnegar, A/Prof Simon M	This project aims to investigate the emerging phenomenon of residential collective sales - where neighbours come together to sell their properties in one line - and the implications for urban residents and governments at local, metropolitan and national levels. It intends to provide the first ever detailed empirical analysis of this phenomenon, including mapping, case studies and stakeholder and expert interviews across Sydney and Vancouver, two cities at the forefront of collective sales activity. The project aims to make significant contributions to both policy and academic debates, by advancing knowledge on how shifting dynamics of neighbourhood change will affect the planning and development of global compact cities in the 21st century.	43,639.50	109,037.50	117,661.00	52,263.00	0.00	0.00	322,601.00
	National Interest Test Statement The project will generate crucial knowledge on an emerging change agent in Australia's fast growing cities, which poses significant risks for individual property owners, urban planning frameworks and growth imperatives. While densification and the renewal of aging housing are key urban planning goals for Australian cities, resident-led collective sales may variously support and inhibit the achievement of these goals. Despite this, the complex phenomenon is not well understood, particularly in the Australian context. This project proposes a world-first program of in-depth empirical work to map, analyse and conceptualise the collective sale process, incorporating both national and international perspectives to produce robust findings and best-practice recommendations. For academics, the research will contribute to key debates over meanings of home, property rights, the financialisation of housing and new dynamics of neighbourhood change. For policymakers, the research will offer valuable insights into managing urban renewal, planning tensions and housing supply issues at local and metropolitan scales.							
DP200101845 Denson, Prof Thomas F	Alcohol has many adverse effects on social behaviour and emotion regulation. Aggressive behaviour is one of the most common social behaviours that intoxicated people display. Using neuroimaging and brain stimulation technology, this project aims to identify how alcohol disrupts brain networks implicated in anger and emotion regulation. Expected outcomes of this project include discovery of how the brain responds to social provocation, supports emotion regulation, and produces aggressive behaviour when intoxicated. Benefits include identifying how the intoxicated brain contributes to the millennia-old phenomenon of alcohol-related aggression and how brain stimulation may protect against aggression.	63,511.50	128,369.00	113,577.00	48,719.50	0.00	0.00	354,177.00
	National Interest Test Statement This project has the potential to provide economic and social benefits to Australia. Alcohol-related aggression costs Australia billions of dollars per year. Within a 12-month period, nearly 1 in 4 Australians aged 14 years and over reported being the victim of physical or verbal abuse or being put in fear by someone who was intoxicated. Alcohol affects the brain and the brain produces anger and aggression, but exactly how this happens remains unknown. By discovering this process, this project will open up the possibility of new brain-based medical and psychological treatments that may help intoxicated individuals gain better control over anger and aggression. Thus, the knowledge gained here could greatly benefit Australia’s economy and social fabric.							

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DP200101859 Tang, Prof Qihe	Recent decades are marked by numerous significant natural (climate change) or man-made (financial crises) catastrophes, which have significantly altered the landscape of the insurance industry. These have potentially significant negative impacts on the availability and affordability of insurance, and hence on the capability and capacity of households and businesses to take risks and be competitive. This project endeavours to establish progressive approaches (using extreme value theory) to the challenges faced by insurance in such a catastrophic environment. They will enhance the financial stability and competitivity of the Australian economy, and further establish its global leadership in dealing with climate changes and catastrophes. **National Interest Test Statement** Typical natural catastrophes in Australia include heatwaves, bushfires, droughts, floods, storms, cyclones, earthquakes, tsunamis, and landslides, many of which are reportedly on the rise in both frequency and severity. Australia's damage bill over the past decade came in at USD 27 billion, ranked 10th in the world's natural disasters. The consequences of these catastrophic events go well beyond material losses to e.g. health threats and credit risk. Highly motivated by newly emerging issues in nowadays insurance practice, the project is expected to add value to Australian insurance business decision-making and lend insights to Australian insurance practitioners and regulators. It offers immediate implications for the welfare and financial stability of Australia. Moreover, because of its exposure to catastrophes, Australia should be at the forefront of the research in related fields including extreme value theory. The completion of the project represents important original contributions to the field in both theory and methodology. This will help further establish Australian leadership globally.	35,000.00	95,000.00	120,000.00	60,000.00	0.00	0.00	310,000.00
DP200101872 Lewis, Dr Sophie	Loneliness is a serious and rapidly growing social problem in Australia. Although the negative health effects and mounting healthcare costs of loneliness are known, effective responses to loneliness are not. Taking a sociological approach, this project aims to generate new knowledge about the experience and meanings of loneliness for people and communities, and the social factors implicated in the rise of loneliness in contemporary Australia. By focusing on loneliness in people with long-term health conditions, this knowledge will be used to develop policy and practice recommendations for the health- and community-care sectors in how to support people and communities experiencing loneliness. **National Interest Test Statement** Loneliness is a rapidly growing social problem in Australia, with significant social, health and economic implications for people, communities, and society. Loneliness also presents an increasing burden on Australia's healthcare system. People living with long-term conditions are at high risk of loneliness. Yet, ways to effectively respond to loneliness have so far been lacking. This project will have significant benefit for the growing number of Australians adults who are vulnerable to loneliness, and Australian society, by gaining insights into how loneliness is experienced by people and communities, and what it means to people. It will indicate new ways to support and care for diverse people and communities who are vulnerable to loneliness across healthcare and community settings, and identify where gaps in support exist. This will have significant benefit at the individual, community, healthcare and societal levels.	62,933.00	130,453.50	128,004.50	60,484.00	0.00	0.00	381,875.00
DP200101918 Stenzel, Prof Martina	Viruses are nature's nanoparticles that have evolved over millions of years into intelligent nanoparticles. The unique structure of viruses with their patchy surface has inspired the design of a new drug carrier by employing the power of polymers to self-organize. The project aims at mimicking nature’s nanoparticles with intelligent polymers while enabling the design of a platform that can entrap therapeutic proteins and enhance their delivery. The focus will be to gain in-depth understanding on the polymer self-assembly process in order to design a synthetically robust system that can be applied to various payloads. As a result, novel nanoparticles with virus-inspired structures for the delivery of therapeutic proteins will be created.	67,500.00	140,000.00	151,000.00	78,500.00	0.00	0.00	437,000.00

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	National Interest Test Statement Therapeutic proteins are increasingly used to treat diseases such as cancer and diabetes and the market share of therapeutic drugs is increasing steadily. However, the fragile structure of these molecules can result in low stability and low biological activity. As a result, many proteins may not display their full potential and they lose activity over time. In this proposal, proteins are packaged into novel polymer nanoparticles that have a unique surface structure, simulating structures naturally found in nature. These nanoparticles not only protect the payload against deactivation, but they can also enhance the efficacy compared to the free drug. The main outcome for this project will be a thorough understanding on the formation of nanoparticles and how they can be loaded with therapeutic goods. In the end, a versatile technology platform for various proteins can be created that helps enhancing the therapeutic efficiency and storage.							
DP200101971 Bonduriansky, Prof Russell	Despite over a century of research, it remains unclear why most animals can reproduce only via sex. An exciting new hypothesis proposes that sexual conflict can promote sexual reproduction and inhibit asexual strategies, suggesting a potential solution to this long-standing paradox. Building on my research expertise, and using a native Australian insect species in which the role of sexual conflict can be studied in natural populations, this ambitious project aims to test this hypothesis for the first time. This research will expand knowledge in the biological sciences by helping to answer one of the most challenging questions in evolutionary biology. This work will also contribute to efforts to monitor Australia's unique insect fauna.	70,663.50	138,030.50	141,593.50	74,226.50	0.00	0.00	424,514.00
	National Interest Test Statement Australia’s unique fauna forms an important part of our national identity, and attracts thousands of tourists each year. Yet, while Australia’s native vertebrates are well known, Australia's fascinating insect fauna remains less well-studied and poorly known to non-experts. Australian insects are well represented by the stick and leaf insects--large, charismatic animals that are hyper-diverse in Australia, and possess unique traits that fascinate lay-people and scientists alike. This project aims to take advantage of the unusual biology of these animals to test an exciting new hypothesis that could help resolve one of the most important questions about animal evolution. This research will contribute to Australia’s reputation as a leading centre for evolutionary biology, and address the Socio-Economic Objective of Expanding Knowledge in the Biological Sciences. In addition, by establishing a detailed, long-term monitoring program of natural insect populations, this work will address the Science and Research Priority of understanding the impacts of Environmental Change.							
DP200102087 Clemens, Dr Kelly J	This project studies why memories encoded in the presence of nicotine are stronger and longer lasting than other types of memories. Its goal is to use an innovative interdisciplinary approach, including sophisticated behavioural analysis and advanced genetic tools, to show that nicotine ‘switches on’ genes that are important for long-term memory formation. The anticipated outcome is an improved understanding of basic memory consolidation processes and how they are influenced by nicotine. It is expected that this outcome will provide new insights into the persistence of cravings in tobacco dependence, and a novel perspective on epigenetic modifications that influence memory consolidation processes.	35,145.00	92,112.00	125,345.00	68,378.00	0.00	0.00	320,980.00
	National Interest Test Statement This project examines how nicotine makes short-term memories long-lasting. Specifically, it proposes that nicotine primes the transcription of genes that are important for long-term memory formation. The outcomes of this project will improve our understanding of the basic mechanisms that control memory consolidation, and how they are influenced by nicotine. The impact of this knowledge will be to support new strategies for reducing relapse in tobacco dependence, and novel insights to the role of epigenetic regulation in other memory-based disorders.							
DP200102091 Klein, Prof Natalie S	The use of maritime autonomous vessels (MAVs) is creating regulatory and enforcement opportunities and challenges under international law. The aim of this project is to fill a critical gap in current responses in international law in focusing on the challenges posed by MAVs to international maritime security law. MAVs are increasingly useful for states in peacetime military operations, in response to transnational crime, maritime cybersecurity, and in promoting broader national security goals, but non-state actors may also use them for terrorist and transnational criminal activity. International law has not kept up with this technology so this project will redress that problem and propose law reform to enhance global maritime security.	15,000.00	37,565.00	64,315.00	41,750.00	0.00	0.00	158,630.00

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	National Interest Test Statement							
	Australia's national interest is served by this project because of the fundamental importance of the oceans to Australia's security. Threats to Australia's maritime security are increasingly addressed through the use of maritime autonomous vessels, and those vessels are also being deployed by terrorists and criminals. The technology has advanced faster than the national and international legal frameworks so this project will identify the shortcomings in that legal framework and propose reforms. The project will draw on important work being undertaken in relation to the safety of commercial shipping and the law of naval warfare but fill a gap that has emerged in considering the use of maritime autonomous vessels in relation to transnational crime (such as drug trafficking and people smuggling), piracy, terrorism, maritime cybersecurity, intelligence gathering and military uses of the sea during times of peace. The investigators and their national and international collaborators are well-placed to develop important policy reforms to maintain Australia's maritime security both nationally and internationally.							
DP200102114 Gilbert, Em/Prof Raymond I	The project aims to quantify the initial and long-term cracking and deformation of fibre reinforced concrete structures such as tunnel linings and slabs under sustained in-service loads and conditions. Concrete structures with and without conventional steel reinforcement and containing either steel or polypropylene fibres mixed in the concrete will be tested experimentally and modelled analytically and numerically. Expected outcomes are benchmark experimental data on structural behaviour under sustained loads, development of reliable simulation models and robust design procedures for the control of time-dependent cracking and deformation in fibre reinforced concrete, with reduced maintenance costs and more sustainable concrete structures.	82,500.00	152,500.00	120,000.00	50,000.00	0.00	0.00	405,000.00
	National Interest Test Statement							
	Total construction works in Australia exceeds 220 billion dollars per year (about 17% of GDP). A significant proportion of this construction involves reinforced concrete, including bridges, buildings, tunnels, wharf structures and the like. Conventional reinforced concrete often cracks excessively and significantly deteriorate with time requiring regular and often costly maintenance. By including steel and/or polypropylene fibres in the concrete mix, control of cracking and long-term deformations may be significantly improved. This project will quantify these improvements and reliable models of structural behaviour and sound design methodologies will be developed resulting in increased service life and reduced maintenance and whole of life costs. The potential economical, social and environmental benefits of the resulting improvements in serviceability and durability of concrete structures are enormous. In addition, replacement of some conventional steel reinforcement with fibres will result in further efficiencies and more economical and more sustainable structures.							
DP200102118 Schief, Prof Wolfgang K	This project aims to address in an innovative manner a long-standing open problem in nonlinear mathematics, namely the determination of the algebraic and geometric origin of integrable systems. It is expected to make a fundamental contribution towards integrable systems theory. The latter provides unique access to the analytic treatment of nonlinear phenomena not only in physics but also a remarkably diverse range of areas in mathematics. Expected outcomes include extended, unified and novel key mathematical concepts in a discrete setting and their applications in algebraic and geometric contexts. Due to the choice of participants, it is anticipated that Australia will benefit from strengthened research collaborations with Germany.	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00
	National Interest Test Statement							
	This project will allow Australia to demonstrate leadership by creating fundamental new insights. Its potential additional impact on the Australian community resides in the fact that it focusses on an area which has been demonstrated to have societal benefits through concrete applications in, for instance, computer graphics and architectural design. The outcomes of this project will be achieved in collaboration with a major research centre in Germany funded by the German Research Council. This link is intended to help Australian science keep current with new developments in this expanding area and to place it at the forefront. Australia's international reputation and visibility is expected to benefit through publication in highly regarded research journals and associated citations, and addresses at international meetings.							

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DP200102121 Amal, Prof Rose	Solar photocatalysis is recognised as an environmentally sustainable process for production of Hydrogen. The adaptation of sophisticated machine learning to innovate solar photocatalysis hydrogen evolution is under question. We aim to harvest scientific principles and integrate with robust protocols to obtain a machine-augmented rational workflow guiding and accelerating discovery of optimal catalysts for solar hydrogen production – solving a major bottleneck. The project will contribute largely to Australia's renewable energy sector; fundamental knowledge-based cognitive photocatalysis platform would be conveniently scalable and transferable to mechanistically relevant processes, such as ammonia synthesis and greenhouse gas reduction. **National Interest Test Statement** The proposed project targets the Practical Research Challenge of 'Specialised, high value-add areas such as high-performance materials, composites, alloys and polymers' associated with 'Advanced Manufacturing' which is identified by Australian Government as one of Science and Research Priorities. Hydrogen is a desirable energy carrier which will be produced sustainably through solar photocatalysis, contributing to priority area of 'Energy' by meeting the challenge 'New clean energy sources and storage technologies that are efficient, cost-effective and reliable'. The discovery of cost effective and active photocatalysts will promote environmental sustainability; extensive understanding of structure-property-activity mapping will enable process optimisation through efficient pathways leading to sizeable economic impact. Successful implementation of augmented intelligence will reduce decision-making errors facilitating chemical/process industries in waste management and preventing threats to human health and global resources. The project will allow job creation in Australian research and development sector.	90,000.00	180,000.00	180,000.00	90,000.00	0.00	0.00	540,000.00
DP200102195 Henderson, A/Prof Rita K	Climate change is driving a proliferation of nuisance and harmful algal blooms in our water supply systems, which urgently require cost efficient and effective control strategies. Paradoxically, algal biotechnology is a growth industry with application in food, agriculture and energy; realising this potential requires state-of-the-art technology to optimise production, harvesting and extraction. The aim of this proposal is to develop cutting edge technology that uses cold plasma activated microbubbles to control algal populations. We propose that by tuning the plasma composition, this technology could both selectively disrupt and destroy algal matter and enhance algal cell growth, benefiting both water and biotechnology industries. **National Interest Test Statement** In 2000, algal blooms were estimated to cost the Australian water industry $95M/annum. Climate change has since increased the frequency and severity of toxic blooms in Australian water sources. Robust, cost-effective and efficient technologies are urgently required to safeguard water supplies from the risk that harmful algal blooms present. Paradoxically, many species of algae are recognised as a valuable resource, with potential for biofuel or bioplastic generation or use as a sustainable food source for aquaculture and livestock. The algal biotechnology industry is booming globally but is in its infancy in Australia, presenting a potential growth area in the coming decade. However, a limitation is lack of cost effective technologies for the production, harvesting and extraction of those beneficial species. The cutting edge "cold plasma activated microbubble" (cPAM) technology that will be developed in this proposal could both selectively disrupt and destroy algal matter and enhance algal cell growth, benefiting both water and biotechnology industries.	75,000.00	136,000.00	121,000.00	60,000.00	0.00	0.00	392,000.00
DP200102366 Kessissoglou, Prof Nicole J	Ducted marine propellers are becoming an increasing alternative to conventional open propellers. Understanding flow-induced noise generated by ducted propellers is a key consideration in the design process to minimise noise emission. This project aims to develop new methods to identify turbulent flow sources of a ducted marine propeller that dominate sound. High-fidelity numerical methods will be developed to study the complex interaction between inflow turbulence, support struts, propeller blades and duct structure. Successful identification of the dominant sources of noise will allow for targeted noise mitigation strategies with significant impact for stealth of military vessels and reduction of underwater noise pollution on marine life.	72,164.50	136,373.00	130,574.50	66,366.00	0.00	0.00	405,478.00

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	National Interest Test Statement Ducted marine propellers for underwater vessels are becoming an increasing alternative to conventional open propellers due to greater thrust for a given rotor diameter, greater propulsive efficiency, and underwater noise characteristics that can be more favourable. This project will develop a new method to identify turbulent flow noise mechanisms of a ducted marine propeller that dominate far-field sound. The flow noise source contribution technique will (i) identify the different sources of flow noise generated by a ducted propeller, (ii) identify the dominant noise sources that have the greatest contribution to far-field sound, (iii) investigate the interaction of the flow noise sources with the blades, support struts and duct structure, and (iv) identify the structural regions of the ducted propeller system with the greatest contribution to far-field sound. The successful outcomes will generate significant new knowledge on flow-induced noise of ducted marine propellers and will provide an invaluable predictive capability for maritime platforms in Australia.							
DP200102517 Regenauer-Lieb, Prof Klaus	We address the scientific question of the nature of gas extraction from nominally impermeable rocks such as shales. Our main aim is to develop a fully coupled microstructurally enriched thermodynamic continuum model to predict the Multiphysics behaviour of shale reservoirs during gas production and verify the model with representative experiments conducted on formations from three Australian Basins including Cooper, Perth and Beetaloo, where the samples are available to the investigators. We approach this problem in a hybrid theoretical-numerical-experimental study. This is the first international attempt to develop such experimentally verified thermodynamic based model, particularly for Australian shales.	70,000.00	135,000.00	125,000.00	60,000.00	0.00	0.00	390,000.00
	National Interest Test Statement Shale gas development around the world has been welcomed with prospects of cleaner energy supply to many nations. Where scalable production of gas from these resources is available, the CO2 emission from fossil fuel industry has been significantly reduced. Australia is one of the countries with the greatest shale gas plays and without a doubt, the development of such resources is of interest to our national gas security and future energy supply. Due to the rapid development of these resources, fundamental research was outperformed by operational advances. Models used in industry practices are usually based on empirical correlations specific to US shale plays. Australian shale gas resources are vastly different and a lack of understanding of the physical processes controlling the gas flow has led to low success in unlocking Australian shale gas reservoirs. We address this problem by developing a thermodynamic fully coupled model to describe the gas flow in these reservoirs and verify the developed model with representative experiments from several Australian shale gas samples from different basins.							
DP200102540 Vandenberg, Prof Jamie I	This project aims to use cryo-electron microscopy to determine atomic resolution structures of open, closed and inactivated states of an ion channel important for regulating activity in the heart and the brain. This work will provide fundamental insights into how ion channel proteins utilise electrochemical energy to mechanically open and close gates that regulate ion flow across cell membranes. Electrical signalling is ubiquitous in biology but is of particular importance in the brain and heart where ion channels are important therapeutic targets for cardiovascular and psychiatric diseases.	77,048.00	156,256.50	161,708.50	82,500.00	0.00	0.00	477,513.00
	National Interest Test Statement Electrical signalling is fundamental for communication in biological systems and is of particular importance for co-ordinating information processing in the brain and regulating the rhythm of the heartbeat. Many drugs on the market target ion channel proteins to produce significant health benefits. Unfortunately, some drugs also have unintended off target effects that inhibit electrical activity with potentially severe side effects. This project aims to determine high resolution structures of ion channels, which should provide fundamental insights into how drugs bind to these proteins which could have long term impacts for the health and economic well-being of the country. There could also be commercial interest in applying the knowledge gained to develop more efficient and effective pathways for drug development. This project will also provide an excellent opportunity for training of a highly skilled workforce in state-of-the-art techniques for determining protein structure using cryo-electron microscopy and for studying electrical signalling in cells.							

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DP200102576 McNally, Prof Gavan P	This project aims to map the mechanisms by which motivational conflict shapes our behaviours, decisions, and choices. By combining state of the art approaches from neuroscience with theoretically driven approaches from experimental psychology and associative learning, this project expects to provide new mechanistic knowledge about how the brain resolves motivational conflict, from cells to circuits to behaviour, and it expects to enhance Australia's research capacity in psychology. This should provide significant benefits including providing a new knowledge base advancing theories of associative learning, motivation and decision-making, as well as laying a new basic science platform for understanding emotional resilience. **National Interest Test Statement** We frequently face conflict in our decisions, such as being forced to choose between two desired alternatives, choosing something that has both positive and negative consequences, or choosing between two undesirable alternatives. This Discovery project maps how the brain resolves these conflicts. It expects to deliver new, world-leading research by achieving a mechanistic understanding of factors influencing our behaviours, decisions, and choices. It expects to contribute significantly to the international reputation of Australian psychological science via quality academic publication and presentation on the world stage, as well as to training and development of the next generation of professional psychologists. It aims to shape the next generation of theoretical approaches in the field. It intends to provide a new knowledge base for understanding associative learning, decision making and motivation as well as provide new insights for future work into enhancing emotional resilience.	90,488.00	181,671.50	186,024.50	94,841.00	0.00	0.00	553,025.00
DP200102825 Lovell, Prof Nigel H	We will design, implement and characterise a disruptive multi-channel optrode array (MOA) to record and stimulate excitable living tissue. The MOA will be a combination of individual optical electrodes (optrodes) that either comprise a new class of liquid crystals, used to passively sense extracellular biopotentials, or microphotovoltaic cells that will be used for electrical stimulation of excitable tissue. By employing light for communication with optrodes, this new approach alleviates many of the wiring, packaging and encapsulation issues associated with existing devices. Computational modelling and in vitro testing in cardiac tissue and retinal neurons will demonstrate the utility of the MOA to sense and control electrical activity. **National Interest Test Statement** This work contributes strongly to the national interest in terms of potential economic, commercial and social benefits. It is directly aligned with the science and research priority area of Advanced Manufacturing. Successful realisation of the technologies described herein will revolutionise the way multi-site recordings are made from and stimuli delivered to and used in a closed loop manner to interact with and control living tissue. This novel technology comprised of totally passive optical transducers and microphotovoltaic cells without the need for additional electrical circuitry will herald the next generation of brain-machine interfaces, demonstrating new methods for bionic devices to interact with the body for sensing, diagnostic and control purposes. This integrated sensing and stimulation technique will have immediate application in the burgeoning neurotechnology market, cementing Australia's place as a world leader in this market sector.	76,218.00	156,055.00	171,244.50	91,407.50	0.00	0.00	494,925.00
DP200102945 Ougrinovski, Prof Valeri	The project aims to develop an innovative systems theory and optimisation methods to enhance the design of components for next-generation quantum communication networks. It will advance new theoretical knowledge and efficient algorithms that can be applied to make networks more efficient and less costly. New technologies set to emerge within the next decade including specialised quantum processors and transformative cyber security systems will require ultra-fast networks, and the project will contribute significantly to advancing these technologies. This will benefit the Australia's economy and reinforce Australia's leadership in the quantum technological revolution through innovative engineering approaches.	90,000.00	180,000.00	180,000.00	90,000.00	0.00	0.00	540,000.00

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	National Interest Test Statement							
	Quantum technologies have created previously unseen opportunities across a wide range of industries including defence, as they enable processing of information at an unprecedented speed. Several Australian companies already commercialise such technologies, and new technologies with enormous impact are anticipated to emerge within the next decade, including specialised quantum processors and transformative cyber security systems. These emerging technologies will rely on new generations of ultra-fast quantum networks, creating the revolutionary quantum internet. The systematic optimisation methods and efficient algorithms developed in the project will enhance the capacity of the Australian academia and industry to advance these significant technologies. This will benefit the Australian economy and reinforce Australia's leadership in the quantum technological revolution through innovative engineering approaches. Also, the project will train skilled quantum engineers to satisfy the Australia's anticipated need in the quantum-smart workforce.							
DP200102951 Voineagu, A/Prof Irina	Circular RNAs (circRNAs) are e a novel class of RNA molecules produced in a wide spectrum of eukaryotic organisms, from yeast to humans. Their expression is particularly high in the nervous system in the fruit fly, mouse and humans. What mechanisms are responsible for the tissue-specific enrichment of circular RNA expression? What are the consequences of circular RNA production on gene expression? The overall goal of the proposed project is to elucidate these important aspects of circRNA biogenesis. Specifically, the project aims to (a) discover proteins that regulate circRNA expression, (b) elucidate how circRNA expression interacts with alternative splicing, and (c) identify circular RNAs that play regulatory roles in gene expression.	85,000.00	155,000.00	150,000.00	80,000.00	0.00	0.00	470,000.00
	National Interest Test Statement							
	By elucidating how circRNAs are formed and their role in the complex gene expression network required for human brain function, this project aims to advance our understanding a novel class of RNA molecules, and their contribution to gene expression regulation. The expected outcomes of this project would enrich human culture, by advancing our understanding of how genes function in the brain. In addition, this new knowledge has the long-term potential to influence public health policy. It can change professional and lay understanding of the role of genes and their regulation in cognitive functions and aging.							
DP200102969 Holmes, Dr Nathan M	This project aims to advance our understanding of how fear memories are encoded and stored in the mammalian brain. It seeks to achieve this aim through the use of an animal model, second-order fear conditioning in rats. It is significant in providing the first systematic assessment of different types of fear memories, such as those that form during encounters with innate (e.g., involving suffocation or pain) or learned sources of danger (e.g., being threatened with a gun). The expected outcomes include new information regarding how different types of fear memories can be controlled or inhibited. This information is needed for the development of a comprehensive theory of fear, and improved fear regulation strategies in its various disorders.	65,111.00	133,504.50	138,376.50	69,983.00	0.00	0.00	406,975.00
	National Interest Test Statement							
	This project examines how different types of fear memories are encoded and stored in the brain. The first type forms during painful experiences. Their characteristics are well described, including the processes through which they can be controlled or inhibited. The second type forms during experiences that involve threat of pain without actually being painful (e.g., being threatened with a gun). The characteristics and neural substrates of these memories are largely unknown, which is surprising, as they represent a large portion of our fears. This project uses an animal model to address this gap in our knowledge. It specifically examines the neural circuits and molecular processes involved in the inhibition of both types of fear memories. The knowledge it provides will help us to develop a more comprehensive account of fear and how it is processed in the brain. This knowledge is needed for the development of better fear regulation strategies in people, and has the potential to generate both societal and economic benefit by advancing our understanding of fear-related disorders.							

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DP200103006 Ahmed, Dr Beena	Automatic speech recognition is an essential attribute of mobile devices and consumer electronics. Unfortunately, as these systems are trained with adult speech, they perform poorly when used by children and people with speaking difficulties. The lack of available training speech from these groups makes developing models for them difficult. We will investigate efficient model adaptation methods that use minimal training data to adapt existing adult speech recognition models for use with children and people with speaking difficulties. The intended outcomes will improve access to automatic speech recognition systems for Australians whose communication with speech-controlled environmental and educational devices is currently restricted.	55,000.00	115,000.00	120,000.00	60,000.00	0.00	0.00	350,000.00
	National Interest Test Statement Most importantly this project will trigger exciting technological advances that will result in accurate, automatic speech recognition models for use by Australian children and people with speaking difficulties. This will address their desperate need to independently communicate with speech-controlled assistive technology, improving their autonomy and inclusion, plus exponentially increasing equitable, timely access to the automated training required to normalize their speech, tackling the world-wide shortage of trained professionals and high cost. The project will also develop capacity within Australia in the increasingly important, automatic speech recognition area. The methods developed in this project will also help improve the performance of computational systems currently limited in the wild due to their data-hungry supervised learning approaches. These insights forged here will be directly transferrable to other areas with data scarcity issues such as health, raising the profile of Australia in a field that has become a research priority across the world both for industry and governmental agencies.							
DP200103127 Ramer, Prof Rodica	We propose a conceptually new method of manufacturing high-performance microwave components at the low-cost and short lead time using liquid form conductors and 3D printing technology. Innovation consists in developing surface roughness free waveguide- and coaxial-based RF and microwave devices, in one-single-piece. This technique can be further extended to create high-performance reconfigurable RF and microwave devices such as filters, antennas, directional couplers, phase shifters and switches by manipulating the locations of the liquid conductors. Furthermore, the method will enable the management of heat generated in high-power applications. Australian telecommunication industry and defence will benefit from the outcome of this project.	70,000.00	141,500.00	145,500.00	74,000.00	0.00	0.00	431,000.00
	National Interest Test Statement The present project with its commercial, space and defence communications applications has the potential to advantage Australia in a multitude of ways including the economic benefit from licensing of new technology and large variety of different new performant microwave components. It will enable companies to develop a production line and new applications methods with significantly lower cost (~$) and manufacturing time (~ hours) without the need for substantial capital investment in the fabrication equipment. The project will permit the manufacture of high-performance RF and microwave waveguide- and coaxial-based devices in a not labour-intensive manner and with short lead-time. It will provide training to a new generation of electrical and telecommunications engineers and will create a platform for collaboration with local and international telecommunication industries on a large variety of microwave passive devices.							
DP200103152 Munroe, Prof Paul R	Hard coatings are frequently applied to equipment operating in harsh environments. Often such coatings are highly brittle and so fragile under stress, especially at high temperatures or in corrosive environments. Premature failure can affect safety and lead to negative economic and environmental consequences. The objective of this project is to combine bioinspired microstructural design with an emerging alloying concept to produce a breakthrough in the development of engineering coatings; for example, overcoming the long standing trade-off between hardness and toughness. Such an innovative coating is expected to be highly durable in extreme conditions, and in so doing will help transform manufacturing, mining and desalination industries.	100,000.00	200,000.00	200,000.00	100,000.00	0.00	0.00	600,000.00

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	National Interest Test Statement							
	The lack of durability is the Achilles' heel of many hard ceramic coatings that hinders their widespread application. To address pressing material challenges faced by advanced manufacturing, mining and energy generation industries, where operating conditions are often harsh, a multi-principal element coating with complex microstructural characteristics will be created using a simple, bottom up approach. The new toughening concept proposed in this project provides fresh insights into combining hierarchical structuring with wide-ranging gradients in order to push forward the durability limit of coatings. The process proposed here is amenable to large-scale industrial production, at low cost, and opens up new avenues for the development of engineering coatings with the correct combination of mechanical, electrochemical and thermal properties for a variety of extreme environments.							
DP200103207 Hu, Prof Jiankun	Password based authentication systems cannot verify genuine users. Biometric authentication can address this issue. However, the booming IoT applications and cloud computing require that the biometric authentication must be conducted in the privacy-protected setting in order to comply with privacy protection legal regulations. Latest reports show that current biometric authentication systems, under protected setting, exhibit poor authentication performance, which is not commercially applicable. This project aims to investigate innovative solutions to this issue. The intended deliverables will include deep learning based biometric feature extractor, cancellable biometrics and cloud oriented biometrics security protocols.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement							
	Password based authentication systems cannot verify genuine users. Biometric authentication can address this issue. However, the booming IoT applications and cloud computing require that the biometric authentication must be conducted in the privacy-protected setting in order to comply with privacy protection legal regulations. Latest reports show that current biometric authentication systems, under protected setting, exhibit poor authentication performance, which is not commercially applicable. In addition to the big impact to the huge IoT market, the project will contribute to Australia's national interest for countering cyber-crimes. In Australia, identity crime costs Australia upwards of $1.6 billion per year. The most recent hacking attack on the Australian Parliament Servers is closely related to the vulnerable password based authentication where all users' passwords are forced to be reset by the national security agencies. The deliverables of this project can contribute to resolving these issues.							
DP200103288 Whitford, A/Prof Thomas J	Inner speech refers to the silent production of words in one's mind. While inner speech has long been assumed to be unquantifiable, we have recently demonstrated an ability to decipher the content a person's inner speech using an objective electrophysiological marker. In this project, we will extend upon this work and use our marker to establish the physical and temporal properties of a person's inner speech, such as its loudness, pitch, accent and temporal properties. Our hope is that our modified marker will be capable of determining what a person is saying in inner speech, when they are engaged in inner speech, and also how their inner voice sounds. This work has major implications with regards to technology, health, and basic science.	50,864.00	105,552.50	114,527.00	59,838.50	0.00	0.00	330,782.00
	National Interest Test Statement							
	Developing an objective brain marker of a person's inner speech would provide the following benefits to Australia's national interest: Commercial and economic benefits: this research will allow us to estimate a person's inner voice, which could then be replicated by means of a vocal synthesizer. This could improve both the utility and tolerability of vocal synthesizers in people who have lost the power of overt speech (e.g., people in the advanced stages of motor-neurone disease), and provide a platform for the development of brain-computer-interface technologies capable of deciphering and transmitting an accurate representation of a person's inner speech. Social benefits: irregularities in inner speech have been hypothesized to underlie numerous social and health-related conditions, ranging from educational disorders such as dyslexia, to motor disorders such as stuttering, to psychological disorders such as auditory-verbal hallucinations. This research will provide the first objective marker capable of testing these hypothesis, which could provide a basis for the development of novel treatments.							

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DP200103401 Balleine, Prof Bernard W	The aim of this project is to understand the brain circuits controlling voluntary or goal-directed actions and particularly the memory processes that contribute to such actions. Goal-directed action is a fundamental capacity necessary for normal decision-making that is significantly attenuated by normal aging. This project aims to establish the neural circuits engaged in encoding new goal-directed actions, how this encoding is accomplished without interfering with pre-existing memories and how these memories are later retrieved to guide planning and performance. Understanding the determinants of such actions will enable the development of novel ways to treat ageing-related deficits in decision-making with significant economic benefits.	115,000.00	240,000.00	255,000.00	265,000.00	270,000.00	135,000.00	1,280,000.00
	National Interest Test Statement The overarching aim of this project is to understand the brain circuits controlling goal-directed actions. Such actions are fundamental to decision-making and are heavily dependent on the interaction of the neural processes that mediate cognitive and emotional functions. This is a core capacity at the heart of all of our everyday activities, the smooth operation of which is crucial to maintaining normal health and wellbeing. The marked deterioration in decision-making capacity associated with normal aging is well recognized and one of the most debilitating problems facing our aging population. In Australia, the number of older individuals (over 65) will double from 2017 to 2050 making research into this issue of the highest national significance. Any delay in or amelioration of ageing-related deficits in decision-making as a consequence of this research will, therefore, have a significant economic benefit as well as improving the quality of life of affected individuals and their families.							
DP200103420 Ho-Baillie, A/Prof Anita W	This project aims to develop a novel, low cost and high performance monolithic photovoltaic-electrochemical (PV-EC) device for clean hydrogen production. This device tailors and integrates low cost and high performance thin film and tandem photovoltaics for water splitting with the aim of achieving high solar to hydrogen conversion efficiency towards 20%. Earth abundant and stable catalysts will be developed in this project to replace noble based catalysts, as well as novel architectures for electrical contacting, feed-through and catalyst integration in PV-EC devices. These innovations offer high performance and the potential for device costs 2 to 3 orders of magnitude lower than recent world record photoelectrochemical devices.	71,500.00	143,000.00	147,000.00	75,500.00	0.00	0.00	437,000.00
	National Interest Test Statement The concept of using H2 as an energy carrier has generated immense research and development activities as well as investment opportunities driven by Asia's recent desire to promote the use of and the import of zero-emission hydrogen. The energy stored as H2 from harnessed solar energy is made more mobile diversifying energy sources and so improving energy security. Australia is well placed to develop such technology, harnessing the sun's abundant energy for clean carbon-free production of H2. The expected outcomes of this research will contribute to major progress in water splitting applications, producing innovative device designs with higher solar to hydrogen conversion efficiency, and improved knowledge of the essential properties of earth-abundant electrochemical catalysts for efficient water splitting. These insights will lead to advances in the field of H2 production research, generating significant reputational benefits and intellectual property for Australia, as well as enabling technologies for clean H2 production and an export industry economically beneficial to Australia.							
DP200103515 Dzurak, Prof Andrew S	The field of metrological science strives for continuous improvement in precision and reproducibility, a goal only achievable by exploiting the fundamental constants of nature. In electrical metrology, both voltage (V) and resistance (R) standards have reached this milestone, but not current (I). We aim to develop novel self-referenced nanoelectronic charge-pump devices that can generate a highly accurate, error-detectable output current utilising Australian-developed silicon-based single-electron transistor technology. We will undertake high-precision measurements in collaboration with leading European standards institutes and researchers, establishing the technological basis for a new world current standard that is reproducible worldwide.	92,500.00	185,000.00	182,500.00	90,000.00	0.00	0.00	550,000.00

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	National Interest Test Statement							
	Precision measurement standards for electrical current and voltage are necessary to ensure the safe and accurate operation of much of the electronics equipment that underpin modern society, both in Australia and worldwide. This project will develop a new ultra-high-precision eletrical current standard, providing a missing link in today's world standards for electrical measurement. It will employ Australian-developed silicon nanoelectronics technology within an international consortium to help establish a new international system of measurement units based only on the fundamental constants of nature. The project will help position Australia as a leader in the field of precision measurement and silicon nanoelectronics, enhancing our international reputation as a generator of advanced new technologies.							
DP200103535 Hawkes, Prof Evatt R	We aim to improve fundamental understanding of flame stabilisation and structure in conditions relevant to axially staged combustion employed in gas turbines, in which an initial ultra-lean premixed stage is followed by a short residence time stage at higher equivalence ratios. This concept enables high turbine entry temperatures and thus high efficiency while limiting emissions of nitrogen oxides, and, importantly, enables improved operational flexibility in turndown and in burning fuels with different reactivities, such as hydrogen. This project will apply large-scale direct numerical simulations to advance fundamental understanding of this unusual combustion mode, and develop practical models able to predict its behaviour.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
	National Interest Test Statement							
	The drive for improved fuel economy and for greater operational flexibility to accommodate increasing penetration of intermittent renewables has led gas-turbine manufacturers to develop staged combustors where a lean premixed stage is followed by a second, high temperature and short residence time stage. These systems improve efficiencies without increasing emissions, and enable larger load changes. This project will provide fundamental understanding of axially staged combustion, which is currently almost non-existent, and develop practical models capable of predicting it. These outcomes will lead to improvements in the axially staged combustion concept, in particular to further improve efficiencies, reduce pollutant emissions, and to burn fuels with large reactivity differences compared with natural gas, such as renewably produced hydrogen. Such fuels have major future commercial potential to be produced in Australia, but require efficient, robust means of end use in countries such as Japan which cannot meet their energy needs from domestically produced renewable electricity alone.							
DP200103548 Arns, Prof Christoph H	This project aims to develop an efficient multi-scale laboratory-based modelling framework for colloidal suspensions flow in porous media by utilizing recent advances in 3D/4D image-based geometrical/topological analysis. Regional partitioning techniques based on local structural measures are used to observe the penetration/retention of colloids into identified zones. Zone-dependent colloid interaction probabilities for computational modelling are derived from fundamental relationships. Expected outcomes of this project include a full-scale modelling capability for heterogeneous samples validated by experiment and the extraction of robust model coefficients for newly developed theory for colloid-suspension transport through porous media.	80,000.00	152,000.00	144,000.00	72,000.00	0.00	0.00	448,000.00
	National Interest Test Statement							
	The key project benefit is the significant advance in statistical physics and fluid mechanics due to development of unified stochastic theory of suspension and colloidal flows in rocks, soils, porous materials and resultant fundamental understanding of fluid filtering and rock clogging, crucial in key areas of environmental, chemical, civil and petroleum engineering. The theory, supported by a detailed integrated modelling framework, will burst various technologies in above industries, determining economic, commercial, and environmental benefits to the Australian community. The social benefits stem from the multidisciplinary and multi-industrial nature of the project, yielding novel training and new employment opportunities. The project outcomes will directly impact Australian high-priority areas of water supply quality, potable and technical water production using artesian wells, fresh water storage, industrial filtering, gas production for coal seam reservoirs, geothermal energy and water resources contamination. It has the potential to place Australia in the forefront of the cutting-edge technologies.							

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DP200103577 Song, Prof Chongmin	This project aims to develop a computer simulation technique to address the safety of engineering structures. A novel numerical framework based on the scaled boundary finite element method will be developed to model the fracture process critical to assessing structural integrity. The expected outcomes of this project include an innovative technology for numerical simulation and improved capabilities to generate high-fidelity predictions of structural safety at minimum human efforts. The fully automatic and robust numerical tool developed in this project will help engineers and government authorities to perform safe and cost-effective design and management of engineering structures that are vital to modern economies. **National Interest Test Statement** The safety and management of national infrastructure assets are critical to the Australian economy. A very large part of Australia's vital dam, bridge and building infrastructure is ageing and experiencing cracking. This project aims to develop a computer simulation technique for the safety assessment of structures susceptible to fracture by undertaking original research. This novel technique will enable engineers to obtain, in a timely manner with minimum human efforts, high-fidelity simulations vital to cost-effective design of new and management of ageing engineering infrastructure. This fundamental research is equally applicable to computer simulations in the development of new resilient materials. It is expected that this project will contribute to increasing productivity and help Australian industries stay competitive. It is also envisaged that the outcome of this project will lead to scientific and technological advances and the creation of new skills for modern economies that are increasingly reliant on digital technology.	75,000.00	145,000.00	137,500.00	67,500.00	0.00	0.00	425,000.00
DP200103587 Dai, Prof Liming	Gecko footpads have unique structures with amazing features; imitating these fine bio-structures will lead to a multitude of innovations. This project aims to study fundamental principles governing adhesion phenomena for creating entirely new biomimetic nanomaterials with tunable adhesion, self-cleaning and controlled release capabilities. The gecko-mimicking materials and the associated dynamic effects will be characterized quantitatively at multiscales and the nanoscale phenomena will be linked to macroscopic performance. The results of this research should provide a fundamental understanding of tunable adhesion mechanisms for the design and development of optimized materials with superb performance of practical significance. **National Interest Test Statement** The anticipated goal of the Project is to generate new knowledge and a generalized methodology to achieve unprecedented performance of biomimetic materials with tunable adhesion, self-cleaning, and controlled release capabilities. The dry adhesives to be developed could enable a wide variety of exciting applications, including drug delivery, sensors, actuators, switchable adhesives, MEMS, NEMS, to name a few. This will place Australia at the forefront globally of dry adhesive science and technology, and strengthen the leading role of Australia in smart materials. The intended outcome of this Project is to provide an opportunity for the domestic adhesive industry to create new jobs and will strengthen the Australian economy. In addition, this project involves a postdoctor and graduate student on leading-edge research topics in a high quality research environment. Training students to do what interdisciplinary scientists and engineers do on a day-to-day basis is a critical element for effective education and should enhance their prospects for future employment as well as service of the national interest.	71,500.00	145,500.00	148,000.00	74,000.00	0.00	0.00	439,000.00
DP200103764 Foster, Prof Stephen J	In 2017 and 2018 the Australian Standards for the design of concrete bridges and structures were released; these are some of the first in the world, to include design procedures for steel fibre reinforced concrete (SFRC) in a comprehensive way. While rules have been introduced for shear and bending of SFRC girders, the rules exclude the use fibres to carry torsional moments. This study investigates the torsion-bending-shear interaction performance of SFRC members. The study will provide vital data needed for for adoption by engineers and Standards bodies.	60,000.00	125,000.00	130,000.00	65,000.00	0.00	0.00	380,000.00

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	National Interest Test Statement							
	Total construction works in Australia exceeds $200 billion a year, 14% of its GDP, with a significant proportion of this infrastructure on concrete construction in bridges, buildings, parking and wharf structures and the like. Conventional structural concrete can significantly deteriorate with time requiring regular and often costly maintenance. With improved understanding of fibre reinforcement mechanisms in concrete and SFRC behaviour at material and structural level, improved models can be developed to predict the behaviour of concrete structures in extreme events. This becomes increasingly important in a carbon constrained world where more efficient use of materials is demanded from the community. In this respect, the development of high-tech fibre reinforced concrete is needed if Australia is to maintain its competitive advantages in a global economy. The outcomes from this project will provide engineers with the tools needed for efficient design of SFRC structures and the project outcomes will aid in the development of Australian Building Code recommendations for the use of fibre reinforced concrete.							
	The University of New South Wales	4,960,624.50	9,975,282.50	9,955,819.00	5,299,161.00	493,000.00	135,000.00	30,818,887.00
The University of Newcastle								
DP200100375	This project looks at female domestic care workers from India and China who travelled to Australia and elsewhere during the period of British colonialism.	52,500.00	80,699.00	43,218.50	15,019.50	0.00	0.00	191,437.00
Haskins, Prof Victoria K	Accompanying colonial families along circuits of empire between Australia, Asia, and the UK over two centuries, these were extraordinarily mobile women. By exploring the historical experiences and cultural memories of these earliest global domestic workers, the project aims to illuminate a broader transcolonial history of domestic work. Expected outcomes include a number of publications and a website; and the project offers the social and cultural benefits to be gained by advancing our historical understanding of the forgotten cross-cultural relationships that have shaped our world today.							
	National Interest Test Statement							
	This research project on transcolonial Indian and Chinese care workers in Australian and British history will contribute to Australia's national interest in three ways. Firstly, it will bring social and cultural benefits for Australians in advancing our understanding of the nation's diverse past, by highlighting the historical experiences and memories of family travel from Asia to Australia, and by exploring our historical connections with other British colonial societies. Secondly, in contributing to our knowledge of our historical connections with Britain and our Asian neighbours, the project will encourage a better understanding of our longstanding relations with these nations, and facilitate international engagements in our region. Thirdly, it will bring economic and political benefits to Australia by strengthening Australia's international reputation for scholarly excellence in historical studies, as the project will position our university education and research prominently on the world stage.							
DP200100746	This project aims to help Australian and international industry better predict the severity of localised corrosion at structural steel details, over years and decades.	80,000.00	180,000.00	150,000.00	75,000.00	45,000.00	20,000.00	550,000.00
Melchers, Prof Robert E	This is significant for the safety, reliability and economics of critical steel infrastructure, such as offshore structures and pipelines and defence facilities operating in and near marine environments. To reduce first cost, these often are not provided with coatings (paints) or other protection. The expected outcomes include improved scientific understanding and world-leading corrosion prediction models. Benefits can be expected for Australian industry, infrastructure and economics, and keeping Australian engineering consultants internationally competitive.							
	National Interest Test Statement							
	By better predicting the severity of localised corrosion at critical locations of steel infrastructure this project has the potential for significant commercial, economic and environmental benefits for Australia. It will contribute to optimal management of the safety, reliability and life-time economics of offshore structures and pipelines and defence facilities benefiting both industry and government end users. The project outcomes can also be expected to further enhance Australia's research expertise in marine corrosion. This will enhance the competitiveness of high-level Australian engineering consultants and their potential export earnings.							

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DP200101079 Palmer, A/Prof Bill	This project aims to determine how culture and social diversity interact with landscape in representing physical space in the minds and grammars of speakers of Australian Indigenous languages. The project will conduct the first Australia-wide survey of Indigenous spatial description correlated with landscape, and the first large-scale investigation of diversity in spatial behaviour among individuals within communities. The findings are expected to inform crucial debates on the formative role of landscape in language, and advance our knowledge of human spatial cognition. It will collect completely new experimental and natural data in six endangered languages, with significant benefits for the maintenance of Indigenous languages and cultures. **National Interest Test Statement** This project will benefit Australian Indigenous communities and Australian society as a whole in several ways. By collaborating with Indigenous communities to document and understand Indigenous concepts of landscape and relationships with environment, it will provide traditional knowledge holders with the opportunity to make their expertise in managing the Australian environment available to the wider community. By focusing on Indigenous cultural and cognitive diversity, it will strengthen mutual understanding and respect between Indigenous and non-Indigenous Australians. By recognizing the contribution Indigenous cultural concepts can make to understanding ourselves and the way we interact with our environments, it will acknowledge the significance of Indigenous culture. Finally, by documenting endangered Indigenous Australian languages and cultural concepts, the project will contribute significantly to the maintenance and vitality of Indigenous culture. This will benefit Indigenous communities, as knowledge of traditional languages has been shown to correlate with enhanced social and physical wellbeing.	102,500.00	183,000.00	120,000.00	39,500.00	0.00	0.00	445,000.00
DP200101471 Karayanidis, Prof Frini	This project aims to demonstrate that engaging the brain's prefrontal cortex, an area that is highly sensitive to ageing, can improve the function of arteries that supply blood to this brain region. Using an innovative optical imaging methodology that maps the brain's regional arterial health, it aims to generate new knowledge about the link between this arterial system and the progressive decline in cognitive control ability and in prefrontal cortex structure and function in healthy older adults. This interdisciplinary, international collaboration aims to put Australia at the forefront of brain optical imaging methods that may have significant benefits by informing approaches to promote and maintain healthy brain and cognition in old age. **National Interest Test Statement** This interdisciplinary project brings together a strong team of early-mid career and senior Australian researchers as well as outstanding international colleagues with complementary expertise in brain and optical imaging, psychology, and neurology. In the short-term, this work will have social and economic benefits associated with establishing unique expertise among early-mid career researchers and creating opportunities to retain these internationally-competitive scientists in Australia. In the long term, the fundamental knowledge arising from this work will inform future development of approaches to detect and prevent brain vascular changes in healthy middle-aged adults, and protect their brain and cognitive ability from the effects of ageing. The fact that the average age of the Australian population is increasing has significant implications for healthcare and welfare needs. Successful completion of this project may bring important economic, social and cultural benefits by maintaining healthy cognition, prolonging economic participation among older adults, and reducing reliance on the healthcare purse.	87,958.50	179,967.00	181,569.50	89,561.00	0.00	0.00	539,056.00
DP200101969 Murch, Prof Graeme E	Aims: The project aims to comprehensively study heat and mass coupling in liquid alloys by describing it mathematically, measuring it experimentally and calculating it by simulation. Significance: When a liquid alloy exists at different temperatures, the coupling of heat and mass flows causes rapid segregation of its components. This is a major complication in controlling solidification from liquid alloys in manufacturing and in the design of liquid alloy coolants for efficient heat transfer. It has never been addressed. Expected outcomes: This research is expected to be the pioneering foundation of the area. Benefits: It is anticipated that the research would provide the means to properly control the engineering use of liquid alloys.	80,000.00	162,500.00	165,000.00	82,500.00	0.00	0.00	490,000.00

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	National Interest Test Statement							
	The research aims to provide the pioneering advance in the inter-coupling of heat and mass flows in liquid multi-component alloys and also to enhance Australian computational engineering by building significant research capability and capacity. The research expects to provide new guidelines associated with the design of next-generation heat transfer liquid alloys in concentrated solar power systems thereby improving their efficiency and reducing the cost of solar power. It aims to improve the use of room temperature liquid alloys for the highly efficient cooling of computer chips and to improve the design of new miscibility gap alloys for energy storage. It also aims to improve the control of the additive manufacturing of multi-component alloys used in biomedical devices, aerospace, marine and offshore components made by laser melting. In order to do this, in conjunction with industry and CSIRO contacts, the Chief Investigators expect to build on the project outcomes by making use of the Integrated Network Innovation program at the University of Newcastle partnered with the CSIRO accelerator program.							
DP200102122 Galvin, Prof Kevin P	Aims: -to achieve a significant advance in the hydrodynamic fractionation of particles on the basis of density, and develop an algorithm to deconvolve the fractionation data to produce the underlying density distribution of the particles. Significance: This density distribution, which is used in resource assessment, plant design, and process evaluation in mineral processing, is currently produced using toxic, and environmentally damaging heavy liquids, despite the emergence of alternative mineral analysers. Expected Outcomes: -a safe, cost effective basis for generating the density distribution. Benefits: -increasing mineral resource recovery through improved access to critical data, while eliminating the need for the toxic heavy liquids.	100,000.00	180,000.00	160,000.00	80,000.00	0.00	0.00	520,000.00
	National Interest Test Statement							
	In minerals processing, the recovery and concentration of the particles of high metallurgical value requires new strategies to capitalise on an unprecedented growth in demand for metals, while also addressing falling grades. One strategy involves removal of waste ore at coarser sizes. Information on the density distribution of the coarser particles is therefore increasingly important for achieving accurate resource assessment, innovative plant design, and process evaluation. This project is expected to establish a new laboratory method that is cost effective, safe, and environmentally acceptable by eliminating the need for toxic heavy liquids. The project aims to generate this information by developing a novel method for fractionating the particles, and a new algorithm to deconvolve the data to generate the actual density distribution. This method will benefit the health of workers and the environment. The project will also deliver major economic benefits through increased access to data on the density distribution of the particles, in turn maximising the recovery of Australia's mineral resources.							
DP200102346 Todd, Prof Juanita	Moving from assumptions to new learning. The project aims to investigate the processes that drive new learning by using automatically evoked brain responses to examine when new information triggers the brain to update beliefs about the world. The project will generate new knowledge on the maturity of this process at birth, how it declines with older age and the brain areas critical to the process. The outcomes will provide insight into how attentional resources are automatically marshalled when beliefs are challenged, and it will help identify the consequences for learning when a system is immature, or the process breaks down with increasing age.	50,598.00	85,598.00	35,000.00	0.00	0.00	0.00	171,196.00
	National Interest Test Statement							
	Learning effectively in the world, for any organism, requires the ability to update beliefs when new experiences contradict expectations. However, not all sources of experience are equally reliable so the determination of when to update a belief versus disregard contradictory experience becomes critical to efficient and effective decision making. In this study we will advance a methodology that can be used to assess these fundamental principles of learning across the lifespan. We will explore the maturity of these learning principles at birth and their alteration as we enter advanced age. A deeper understanding of the factors that govern our ability to reshape beliefs is of central importance to the science of learning with implications relevant to addressing many problems impacting the human condition. Examples include failures to learn effectively during development, intervening in delusional or unhelpful beliefs, and preventing the acquisition of problems with new learning as we age.							

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DP200102364 Moscato, Prof Pablo A	This project aims at developing the new generation of symbolic regression methods using a yet unexplored way to represent mathematical functions. We will use memetic algorithms to create mathematical models for symbolic regression. Our memetic computing approach will be data-driven and will use multi-objective optimization and multi-task evolutionary computation for symbolic regression, addressing a core need of many areas of science and technology. A large number of datasets will be investigated to benchmark the new methods. The expected outcomes will help support our national priorities with new data analytic capabilities. With a strong and interdisciplinary team in three continents, the project will attract international collaboration.	89,000.00	174,000.00	170,000.00	85,000.00	0.00	0.00	518,000.00
	National Interest Test Statement We are approaching an era in which an increasingly large number of decisions will be automatically taken by algorithms after being trained with existing large datasets. It is then essential to create mathematical models that support these algorithms to predict future outcomes based on the observations from the past. Of particular interest is a class of methods called "symbolic regression" in which one particular outcome of interest is modeled, by the computer, as a mathematical expression that depends on a large number of variables. Symbolic regression methods are interesting because they produce a mathematical model without human biases, thus provide a unique perspective. They can support the discussion and complement humans at the time of decision marking, thus having a great economic, commercial and environmental importance in many areas of national scientific and technological interest. We will create new state-of-the-art techniques for symbolic regression based on the generation of models via a new mathematical approach for their representation and innovative search techniques.							
DP200102605 Doroodchi, A/Prof Elham	The principal vision in this project is to gain a deeper understanding of the formation, growth and collapse of bubbles within micron-size droplets and, in doing so, provide the technical underpinning necessary to advance the development of a range of emerging technologies in the light alloys manufacturing, atomisation, non-invasive medical therapy, drug delivery, and nucleation / solidification in thermal energy storage systems. Expected outcomes include new experimental evidence and validated mathematical models for the analysis of bubbles encapsulated by fine droplets. The outcomes should significantly enhance Australia’s research and innovation capacity in the field of confined space bubble dynamics and related industrial applications.	50,000.00	100,000.00	90,000.00	40,000.00	0.00	0.00	280,000.00
	National Interest Test Statement This project will significantly enhance Australia’s research and innovation capacity in the field of confined space bubble dynamics (e.g. bubbles encapsulated by droplets); laying a strong foundation for the development of a range novel and exciting technologies beyond the project time-frame in industrial applications as diverse as light alloys manufacturing, fuel atomisation in engines, non-invasive medical therapy, drug delivery, and thermal energy storage. The ability to optimise the performance of these emerging technologies simply by controlling the bubble dynamics will lower their complexity and cost; de-risking their scale-up and commercial roll-out. This should lead to the creation of new Australian products or added value to existing ones, ultimately, contributing to the Australian Government's effort under the Research Priority “Advanced Manufacturing”. The socio-economic benefits will be significant and include: research and development of innovative technologies; Intellectual Property (IP) revenue and licensing, market creation and export potential.							
DP200102940 Zhang, A/Prof Hongyu	This project aims to develop a data-driven approach to improving the resilience of online service systems. Many software systems are now provided as online services via the Internet on a 24/7 basis. Although a lot of effort has been devoted to service quality assurance, in reality, online service systems still encounter many incidents and fail to satisfy user requests. This project expects to develop innovative data-driven methods for effective fault identification, fault localization, and failure prediction. Expected outcomes of this project include novel techniques and tools for maintaining online service systems. This project will provide significant benefits, such as improving the resilience and reliability of our cyber infrastructure.	15,000.00	70,000.00	110,000.00	55,000.00	0.00	0.00	250,000.00

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	National Interest Test Statement							
	A large number of Australian business and government organizations provide their services online via the Internet on a 24/7 basis. Many of these systems are so critical and have become key parts of our cyber infrastructure. Failures of these systems could cause huge financial loss and may even affect the normal operation of our society. Therefore, high resiliency is essential as the systems should be able to quickly recover from incidents and keep the service disruption time to a minimum. In delivering more resilient and reliable cyber infrastructure this project will bring economic benefits to Australia and will also improve cybersecurity.							
DP200103287 Stockenhuber, Prof Michael	While natural gas (of which methane is the primary component) is an abundant source of energy, it is normally found in remote areas and for its successful exploitation it needs to be processed. The processing usually requires significant energy and resources input. In this project we will develop a fundamental understanding to a single step catalytic process that can utilise natural gas and nitrous oxide (both potent greenhouse gases) and oxygen to produce selectively methanol and hydrocarbons from a natural gas feedstream in a controlled manner. A single step process for natural gas conversion utilising waste green-house gases is expected to be of great benefit to the Australian economy, environment and energy security	108,500.00	185,000.00	155,500.00	79,000.00	0.00	0.00	528,000.00
	National Interest Test Statement							
	Australia is fortunate enough to have abundant resources of natural gas. The demonstrated conventional reserves are 186,000 PJ, with significant additional quantities available in non-conventional reserves. Expertise to produce natural gas is well developed, but an impediment for the exploitation of this abundant reserve is the remote location of the gas fields. Furthermore, the value of products such as methanol is significantly higher due to the easy transport and distribution and thus beneficial to the Australian economy. Natural gas also has the lowest carbon footprint of all hydrocarbons and thus replacement of existing sources will help Australia meet its emission targets. While indirect, multistep processes exist for the conversion of natural gas to high value products, energy and emission levels remain high in these processing steps. In this proposal, routes to directly convert natural gas into high value products are developed through expansion of the fundamental knowledge for single step oxidation of natural gas using a variety of oxidants.							
DP200103390 Sloan, Prof Scott W	AIMS: To develop new computational methods and software for predicting the failure of civil infrastructure such as tunnels, roads, ports and foundations. SIGNIFICANCE: Australia will spend over $200 billion over the next five years on transport and other built infrastructure. This project will formulate new methods and computer programs to underpin the geotechnical design of this infrastructure. Emphasis will be placed on efficient computational schemes for three-dimensional problems and complex ground conditions, where current procedures are inadequate. EXPECTED OUTCOMES AND BENEFITS: International leadership in computational methods for designing cheaper and safer infrastructure, supported by scientific publications and software.	70,000.00	135,000.00	127,500.00	62,500.00	0.00	0.00	395,000.00
	National Interest Test Statement							
	To accommodate Australia's rapidly growing population, massive investment is now underway to upgrade its ageing transport and other built infrastructure. Safe and economic design of this infrastructure is thus central to Australia's future prosperity. Due to the scale of the costs involved in constructing roads, railways, tunnels, ports and pipelines, even small percentage savings resulting from scientific research give large returns in absolute dollar terms (noting that the geotechnical fraction of these costs is typically in the range 15-50%, depending on the project). This research will deliver fast and memory-efficient methods for predicting the static load capacity of large-scale three-dimensional geostructures embedded in materials with complex properties, noting that existing approaches are often slow, rooted in empiricism and of uncertain accuracy. The resulting innovative engineering software will be able to be used by practising engineers to design complicated infrastructure in a safer and more cost-effective manner.							

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DP200103507 Fu, Prof Minyue	This project aims to study large scale networked systems in major infrastructures including power networks, transportation networks, internet of things, and other cyber-physical systems. This project is expected to develop new methodology and algorithms for distributed estimation, control and optimisation of these systems. Distributed solutions are essential because traditional techniques which were designed for small systems are not suitable for efficient operations of large scale systems. Application examples include distributed state estimation for power networks, control of multi-agent systems and optimal scheduling of transportation networks. The outcomes of this project are vital to the understanding and management of these systems. **National Interest Test Statement** The distributed solutions offered by this project should bring significant benefits to efficient, reliable and robust operations of large scale networked systems. In particular, our results are expected to find applications in transportation, automation, manufacturing, mining, environment and other cyber-physical applications. The knowledge developed through this project should provide new understanding of large automated networks. The work is also expected to provide training of cross-disciplinary expertise in control systems and network operations, and promote applications of these systems to the Australian industry.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
	The University of Newcastle	961,056.50	1,865,764.00	1,657,788.00	778,080.50	45,000.00	20,000.00	5,327,689.00
The University of Sydney								
DP200100006 Newson, A/Prof Ainsley J	This project aims to provide a better way to help people to think and reflect about new genetic tests in pregnancy. These tests are on the rise. Yet they are occurring in a setting that is overly individualistic and underplays problems that can come from increased information and choice. This project will involve an interdisciplinary team to generate new theoretical and practical knowledge to re-frame the concept of 'reproductive autonomy'. Expected outcomes include new bioethics knowledge, innovations in research methodologies, new data and recommendations for practice. The project will provide benefits by generating the first analysis of how reproductive autonomy needs to change to ensure new tests in pregnancy are offered and used well. **National Interest Test Statement** This project will generate benefits for the Australian community, in particular through the facilitation of better health, social and cultural outcomes for anyone having (or supporting someone having) a baby. Many new genetic tests are now available in pregnancy. These tests offer more and finger-grained information about a baby's future health. This information is often offered in such a way that refusing it can be difficult. Responsibility for the choice to test is placed on individual women and couples, neglecting wider social and cultural contexts. The allure of technology and information mean it can be hard to tell which tests may be useful, and which may not. This project will develop a way of thinking about these tests that ensures they are offered and used well. Results of the project will inform recommendations for policy and practice to ensure that test offers and decisions to use them will allow a full consideration of social and individual values and preferences. This will lead to social and economic benefits by ensuring the line between over- and under-use of technology is appropriately drawn.	33,302.00	86,844.00	106,379.50	52,837.50	0.00	0.00	279,363.00
DP200100112 Uy, Prof Brian	This project aims to develop an innovative coupled composite steel-concrete shear wall and frame system that revolutionises and improves the economical design and construction of multi-storey buildings. The proposed system uses novel cost-effective composite structural components that can be prefabricated and easily assembled on-site using innovative blind bolting techniques to speed up construction. The project will offer a promising opportunity to promote prefabricated and modular construction which is believed will have a major benefit in shaping the future construction industry. This will provide significant benefits to Australian structural engineers and the construction industry in advancing their knowledge in composite construction.	90,000.00	180,000.00	175,000.00	85,000.00	0.00	0.00	530,000.00

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	National Interest Test Statement Australia's current population is expected to reach 25 million by 2020 and future forecasts place estimates of 40 million by 2050 and a doubling of the population to 50 million by 2065. This significant population increase which is most likely to occur in the major capital cities will see an increased densification of living and working spaces. Central to this shift will see an increased reliance on multi-storey buildings. This project will provide innovative solutions for the design and construction of multi-storey buildings which will promote prefabrication methods. The innovations provided in the coupling of composite steel-concrete frames with innovative composite shear wall systems will be world leading and will ensure Australian construction practices are at the forefront of international trends. The research outcomes will ultimately lead to reduced construction costs of multi-storey buildings which have the potential to provide significant economic, commercial, environmental, social and cultural benefits to the Australian community.							
DP200100210 Joshi, Prof Nalini	Modern science derives its power from mathematics. The project aims to capture, identify and describe pivotal, transcendental solutions of nonlinear systems that are universal in science, in the sense that they always arise as mathematical models under certain physical limits. The project expects to produce new mathematical methods to describe such functions by using a newly discovered geometric framework. Expected outcomes include the description of elusive solutions of discrete and higher-dimensional nonlinear systems. This should provide significant benefits, such as new mathematical knowledge, innovative techniques, enhanced scientific capacity in Australia.	71,000.00	142,000.00	142,000.00	71,000.00	0.00	0.00	426,000.00
	National Interest Test Statement Mathematics is essential to our society. It provides a logical, quantitative and analytical basis that underpins advances in science, engineering, medicine and technology. The benefits of the project to Australia lie in three directions. First, it will add to Australia's achievements in excellent, internationally-competitive research. Second, it will increase research training and career opportunities for our future society. Third, it will enhance Australia's standing internationally through collaboration. The specific outcomes of the project will increase future tools available to model electricity supply and predict epidemics. Such improvements in decision will also contribute to Australia's economic growth by ensuring stable energy supply and improve health outcomes.							
DP200100305 Kepert, Prof Cameron J	This project aims to develop new molecular materials in which the incorporation of electronic switching leads to the emergence of fundamentally new chemical and physical phenomena. Through an innovative interdisciplinary approach that targets interesting new forms of interplay at the nanoscale this project expects to generate step-change advances in the understanding of spin-switching materials. Significant anticipated outcomes and benefits include identification and development of several new classes of materials function, each of major fundamental interest, and to the generation of advanced new materials worthy of commercial development in electronic device, actuator, sensor and gas separations technologies.	75,000.00	210,000.00	255,000.00	120,000.00	0.00	0.00	660,000.00
	National Interest Test Statement Following recent scientific and technological advancements the rapid expansion of molecular framework materials into hi-tech industries is underway. Immense opportunities now exist for the development of materials that will underpin these new technologies. Spin crossover is a core component of many proposed electronic molecular devices, spanning data storage, quantum computing and spintronics. The first objective of this Project, targeting the achievement of fundamental new physical phenomena in these materials, promises to unlock long-term economic benefits when the materials prove useful as nanoscale switches, memory devices and actuators. Our second objective is to combine spin crossver with porosity to generate entirely new molecular host-guest properties, leading in turn to our development of new technological approaches for industry-scale gas separations, sensing and storage processes. The Project will provide essential training of early career researchers in state-of-the-art multidisciplinary science and technology, fostering leadership and promoting a long-term creative research culture in Australia.							

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DP200100376 Markauskaite, A/Prof Lina	This project aims to create a strong integrative research foundation to explain how university researchers and students develop the expertise needed to work in interdisciplinary teams and how this development can be enhanced. It combines three perspectives investigating: how research and innovation communities create interdisciplinary knowledge, how interdisciplinary teams learn to function effectively and the personal resourcefulness that enables individuals to participate in interdisciplinary work. The outcomes will provide a much better understanding of the qualities that help individuals and groups to work productively across disciplinary boundaries. They will be used to create better strategies for supporting interdisciplinary learning	68,381.00	156,435.50	177,937.50	139,902.00	50,019.00	0.00	592,675.00
	National Interest Test Statement The future success of Australian research and innovation depends upon the ability of organisations and individuals to work fluently across disciplinary boundaries. However, the foundational knowledge needed to help develop interdisciplinary expertise is currently very weak. The research carried out by this project will provide a much firmer understanding of how interdisciplinary research organisations and teams actually function and how researchers learn to work with others across traditional boundaries. This will improve the guidance available to those involved in research leadership, team facilitation, and the teaching of interdisciplinary courses. The project's initial benefits will flow to interdisciplinary R&D teams and interdisciplinary university courses in health and advanced manufacturing— two large sectors of national priority. By enhancing our general understanding of the capabilities of interdisciplinary teams, the project will also help achieve greater innovation productivity in other fields, and better translation of research outcomes into new systems, services and products.							
DP200100447 Probyn, Prof Elspeth C	This project aims to conduct the first comparative interdisciplinary ethnographic study about how urban fish markets act as vital infrastructures connecting the oceans and cities, fishers, buyers, tourists and consumers. Through three case studies of the fish markets in Sydney, Dakar, and Manila, it expects to generate new knowledge about the local impacts of the global issues of overfishing, ocean warming, and geo-political disputes about fishing regulations. The expected outcomes include new cross-cultural knowledge about the roles of fish markets, and enhanced international interdisciplinary collaborations. The rich theoretical and empirical results should provide significant benefits to academia, industry, and government policy-makers	38,500.00	79,500.00	109,500.00	68,500.00	0.00	0.00	296,000.00
	National Interest Test Statement The benefits to the Australian community of this project will be seen in a better understanding of the cultural role of urban fish markets as connectors between cities and the oceans, and fishers, suppliers, tourists and consumers. The Sydney Fish Market is the biggest in the Southern Hemisphere and third largest in the world, and attracts an estimated 3 million tourists per year. It is slated for relocation and redevelopment beginning in 2020. The project's multi-sited comparative research will generate new research about the cultural, social and economic benefits of fish markets, including the benefits of tourism, to Australia and to Sydney. Fish markets are also at the forefront of marine ecological change, and the project seeks to provide better cultural and environmental understanding of how Australia can best to respond to local and global issues of overfishing and ocean warming.							
DP200100453 Gale, Prof Philip A	The project aims to develop switchable anion transporters and new assays to monitor the switchability of these compounds. Anion transport into cells has been shown to trigger cell death and so could be used as a method of killing cancer cells. However in order to do this the transporter compounds must target cancer cells specifically and not affect normal cells. Should this project be funded it will provide new fundamental knowledge on transporter design (switching transport on in cancer cells) which will be applicable to the future development of transporter-based therapeutics. It will also also provide interdisciplinary training opportunities for a PDRA, PhD and Honours students in a successful Australia-Spain collaboration.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00

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	National Interest Test Statement This project will develop new switchable anion transporters designed to function in the environment found in cancer cells but not in that present in healthy cells. There are currently 138,00 new cases of cancer diagnosed in Australia each year and it is the leading cause of death in this country. The project will develop fundamental new knowledge on the design of switchable anion transporters which could be applied in the future to develop transporter-based therapeutics for cancer. This project is providing the foundations for what would constitute a completely new way of treating cancer. Should the project be funded it will also result in training for a post-doctoral research associate, PhD student and honours students in an important multidisciplinary area of science. The students will gain experience of synthetic chemistry, membrane biophysics and supramolecular chemistry. Supramolecular chemistry is an area in which this country is world-leading and this project will reinforce the strength of this important area in Australia.							
DP200100712 Parkinson, Dr James W	To goal of this project is to make fundamental advances in representation theory, a powerful branch of mathematics focused on taking abstract mathematical structures and ``representing'' them in a concrete and useful way. In particular we aim to prove a series of long standing and influential conjectures by George Lusztig concerning the representation theory of Hecke algebras, objects which are ubiquitous in modern algebra. Our work will lead to new discoveries, a fundamentally deeper understanding of Kazhdan-Lusztig theory, and will drive future research. Benefits include enhanced international collaboration and increasing capacity in pure mathematics, especially in the cutting-edge area of representation theory.	75,500.00	151,000.00	151,000.00	75,500.00	0.00	0.00	453,000.00
	National Interest Test Statement The impact of basic research in mathematics beyond academia, such as the role of number theory in cyber-security via cryptographic systems, is commonplace but difficult to predict. This project supports first class international research, expands Australia's knowledge base, and fosters Australian international competitiveness. The inclusion of students and early career researchers expands mathematical capability and capacity in a technologically driven world. There is a high demand in society for individuals with a strong mathematical training. Those who continue in academia contribute to Australia's international reputation, those who go to work in government agencies enhance Australia's ability to develop policies based on evidence and data, and those who go into industry help to keep Australia's economy strong. Finally, this project's outcomes will have a significant and lasting impact in shaping future research directions in mathematics. We develop fundamentally new and innovative techniques, and produce computational software that will be of considerable utility to the broader research community.							
DP200100773 Ranzi, Prof Gianluca	This project aims at the development of a scalable daytime radiative cooling technology suitable for large deployments in the built environment that will help mitigating the urban heat island effect, and reduce future cooling energy needs in buildings. The main outcomes of the project will consist of the development of radiative coolers that will be able to operate in the built environment under Australian climatic conditions, and of clear guidelines for their large deployment. The technology is based on a passive cooling strategy requiring no energy for its operations. The outcomes of the project will also have a beneficial impact on the Australian building and construction industry.	80,000.00	155,000.00	155,000.00	80,000.00	0.00	0.00	470,000.00
	National Interest Test Statement The development of a scalable daytime radiative cooling technology will have a significant impact on the Australian building and construction industry, and will aim at reducing the energy demands of buildings and at mitigating periods of peak urban ambient temperatures under Australian climatic conditions. In particular, the proposed technology is expected: to decrease ambient temperatures in the built environment by about 3.5-4°C; to decrease cooling loads in buildings up to 45-50%; to decrease outdoor discomfort by 65%; and to decrease heat related mortality by 40%. The outcomes of the project will lead to a new building cooling technology that will find wide application in buildings and the urban built environment.							

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DP200100848 Jolliffe, Prof Katrina A	The goal of this project is to develop a toolkit of molecular probes that are able to selectively bind to the phospholipids that constitute a large part of biological membranes. Membranes are composed of over one thousand structurally different lipid molecules but we do not have a clear understanding of how these structural differences impact on cell function. This project will provide new tools that can be applied to expand our knowledge of the impact of lipid diversity on biological function. This will underpin advances throughout cell biology. It will provide new opportunities for interdisciplinary collaboration between synthetic chemists and cell biologists.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
	National Interest Test Statement Selective molecular probes are crucial tools for use in molecular imaging and used widely in Australia's world-leading biomedical research efforts. This project will provide innovative technologies for the selective detection of lipids in biological systems. The tools developed will have potential to be commercialised and will have impact across the biomedical and agricultural industries. Both of these industries are important for the Australian economy. The project will provide training for undergraduate, postgraduate and postdoctoral STEM researchers for future careers in both academia and industry, thereby building national research capacity in chemistry, applicable to the biotechnology industry in Australia.							
DP200100940 Ceguerra, Dr Anna V	Observing atomic-scale structure (AS) is key to unlocking advanced materials science and engineering (MSE). Aims: We aim to (1) develop software that will enable the accurate observation of atoms in a material, and (2) apply this new software to additive manufactured alloys and quantum computing materials. Significance: We expect to complete aberration-corrected atom probe tomography capability for the first time internationally. We intend to gain better insights into some longstanding questions in MSE that can only be answered by accurately observing AS. Benefits: By making the outcomes commercially available, we aspire to improve consistency in the quality of products, and increased yield, that result from manufacturing processes.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement Australia’s maturity as a technologically advanced nation is demonstrated by advanced scientific instrumentation as essential infrastructure for societal and economic benefits, similar to roads, transport and telecommunications. Microscopy supports 50% of the fields of research. In 11 years, Microscopy Australia (MA), our government-funded national network of microscopy laboratories, enabled 16k users and hundreds of companies, leading to 18k papers and hundreds of patents, with a return-on-investment of 10x for just 12 of the start-ups supported. Atom probe microscopy (APM) is a flagship of MA, and we have existing international leadership in developing the software analysis capability of this microscope. APM’s unique combination of information lets materials engineers (1) observe the atomic-scale structure of solid-state materials; (2) infer structure-property relationships; and (3) design sustainable, high performance materials. Enabling accurate observations at the atomic scale will enhance our material design capability and contribute to Australia's cybersecurity and advanced manufacturing strategies.							
DP200100959 Ling, Prof Chris D	The aim of the project is an economically viable design for “all-solid-state” rechargeable batteries. Eliminating organic liquid electrolytes from lithium-ion batteries will dramatically increase safety, range of operating conditions, lifetimes, and energy density. The key technical challenge is keeping solid-solid interfaces intact over thousands of charge/discharge cycles. We will address this by inserting inorganic interfacial layers that change smoothly from hard ceramic to flexible glass and back again, through rigorous chemical design and synthetic control. This will reduce the stress that causes mechanical failure, while increasing chemical stability so that the latest generation of high-power electrodes can be brought into service.	80,000.00	170,000.00	175,000.00	85,000.00	0.00	0.00	510,000.00

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	National Interest Test Statement The “all-solid-state” rechargeable battery is a Holy Grail of energy materials research. The safety and performance benefits of eliminating the flammable organic liquid electrolytes used in conventional lithium-ion batteries have long been recognised, but a practical implementation remains elusive. In this project, we will insert protective inorganic layers at the interfaces between battery components, which is where all-solid-state batteries break down. The design is compatible with efficient and scalable solid-state fabrication methods already used in the electronics industry, smoothing the path from laboratory-scale to prototype to bulk production and, ultimately, commercial devices. Australia’s diverse and geographically dispersed sources of renewable energy mean that it stands to gain more from better and cheaper batteries than any other nation. Coupled with forecasts that Australia will become the world’s largest producer and exporter of lithium within two years, the value-added economic benefits of moving to the forefront of solid-state battery research, development and technology are enormous.							
DP200100966 Seton, Dr Maria	Massive volcanic eruptions are a fundamental part of the Earth System, responsible for globally disruptive events, from airspace disturbance, to extinction of the dinosaurs. This project will reveal relationships between hot, deep sources of volcanic material, and the tectonic processes at the Earth's surface. Expected outcomes of this project include assembling an unprecedented set of new observations from underwater volcanoes offshore Eastern Australia, and the development of innovative geodynamic models of how the deep Earth interacts with the surface to form these volcanoes. This will provide significant benefits by advancing our understanding of the deep Earth, and its impact on Earth’s surface, natural hazards, and mineral systems.	143,500.00	244,500.00	131,000.00	30,000.00	0.00	0.00	549,000.00
	National Interest Test Statement Volcanic eruptions sourced from deep within the Earth have exerted a major control on how our planet has evolved over geological time, and continue to pose challenges to society today. Understanding the history of volcanism hidden in the seas around Australia will provide significant new knowledge to inform policies related to natural hazards, resources and habitats both within Australian waters and throughout the SW Pacific. The project aims to leverage significant investment by Australia in state-of-the-art computational resources and marine science enabling infrastructure, and will directly lead to benefits for Australia and our Pacific Island neighbours, an area of renewed foreign policy focus. These benefits include an understanding of the volcanogenic tsunami hazard in the region, informing Australian disaster management policy and practice; an assessment of marine mineral resources, potentially contributing to Australia’s economic growth; and training the next-generation of marine scientists and educators and inspiring STEM activities in schools.							
DP200100979 Cobb-Clark, Prof Deborah A	This project aims to use new Australian data to study the way that people’s self-control affects their economic behaviour. This project expects to advance science by testing two new ways of identifying whether people understand their own self-control issues and conducting an innovative program of research that links people’s self-control to their life chances. Expected outcomes include an understanding of i) the factors driving the capacity for self-control; ii) the role of self-control in promoting wellbeing; and iii) policy options for improving outcomes through better self-control. This should provide significant benefits in supporting policy agendas such as the Government’s Priority Investment Approach and behavioural economics teams.	43,039.00	115,921.00	153,548.00	80,666.00	0.00	0.00	393,174.00
	National Interest Test Statement Social and economic policy is far more likely to succeed if it nurtures (rather than hinders) people’s ability to make good decisions for themselves. This research advances Australia’s national interests by using new data to identify those Australians who are likely to struggle with future planning, avoiding impulsive decisions and making long-term investments. This allows vulnerable groups to be identified and novel policy options for supporting them to be developed, contributing to the success of the Government’s Priority Investment Approach (announced in the 2015-16 National Budget). This research advances Australia’s national interests by giving us a better understanding of the ways that limited self-control and disadvantage may reinforce each other, helping Australia meet one of its key UN 2030 Sustainable Development Goals; ending poverty. Finally, this research advances Australia’s national interests by establishing Australia as the world leader in the scientific effort to study people’s awareness of their self-control issues and the role of self-control in mental, physical and economic wellbeing.							

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DP200101059 Grace, Dr Kazjon S	The project aims to demonstrate how interactive systems can enhance creative productivity, through the development and evaluation of a model for how humans and AI can interact while creating. This is expected to generate new strategies for effective, intelligent, and domain-general creativity support. These new strategies will be validated in the domains of drawing and music composition by rigorous human-centred prototyping techniques. The principal anticipated outcome of the project is a model for how to enhance creative work through interacting with AI, an opportunity that is currently largely unexplored. Benefits will include an increase in the rate of creative outputs, both within the creative industries and throughout the economy. **National Interest Test Statement** The economy is being fundamentally transformed by automation, which is expected to further accelerate over the next decade. Creativity's centrality to this transformation has been argued for by policymakers at the highest levels, including the NSW Department of Education and the World Economic Forum. Creative work is resistant to automation, and the number of jobs requiring creativity is expected to sharply rise as more-mundane work is automated away. We will develop AI-powered interactive systems that, we hypothesise, will enhance creative productivity in targeted domains. Augmenting creative work will help to position Australia as a leader in the knowledge economy. The new technology could play a role in democratising the ability to produce creative output, assisting people to develop creativity as a specific skillset. Beyond the economic benefits, creativity has a demonstrated effect on quality of life, empathy, and the building of robust communities. The project will help train the next generation of Australian experts in how technology can facilitate creativity.	50,000.00	110,000.00	125,000.00	65,000.00	0.00	0.00	350,000.00
DP200101120 Marks, Prof Peter R	This project aims to reorient our understanding of George Orwell via case studies of different zones demarcated in Nineteen Eighty-Four: Oceania, Eurasia and Eastasia. Its significance derives from uncovering and assessing for the first time Orwell's diverse, evolving international importance. The project will produce innovative area studies that integrate literary criticism, international political history, and studies in publishing, translation and adaptation. These studies will fashion the new figure of an International Orwell. The expected outcome will be a radical re-evaluation Orwell's literary, cultural and political impact. The benefit will be a fuller understanding of the most important political writer of the last century. **National Interest Test Statement** George Orwell is an established figure in Australia's cultural conversation: taught in schools, invoked in discussions of language, power, surveillance by politicians the media and the public. He is a contested figure, championed by the political left and right. This project generates cultural benefits by presenting a detailed, historically-informed account of Orwell's multifaceted contribution to Australian public life. It aims to substantially enhance that account by comparing the influence of Orwell in Australia to that in other nations, determining key points of overlap and distinctiveness. It situates aspects of Australia's social and cultural life in an international context. Orwell has been lauded and lambasted by some of Australia's finest intellectuals from across the political divide. This first multidimensional and multinational account of Orwell adds to our established knowledge base, aiming to stimulate new debates on this provocative figure. Orwell addresses key public concerns, and this research presents the first account of his multiform public impact on Australia's social and cultural life.	15,000.00	37,191.50	49,691.50	27,500.00	0.00	0.00	129,383.00
DP200101550 Rutkowski, Prof Marek	Australians have more than $2.7 trillion in superannuation assets, meaning that Australia is the fourth largest holder of pension fund assets worldwide. Hence the impact of market fluctuations on financial well-being of retirees can be detrimental, especially during market downturns associated with economic crises. The finance industry addresses this issue by complementing variable annuities with riders designed to protect the income stream of retirees. This project aims to develop a novel approach to fair pricing and optimal withdrawals and surrender policies for superannuation guaranteed benefit products through a comprehensive analysis of complex optimisation problems in stochastic models of financial markets with downturn risk.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00

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	National Interest Test Statement Superannuation funds offer a large variety of income stream products to retirees but, typically, the balance of the annuity account is invested in risky assets to ensure the desired performance. Consequently, the wealth of retirees is exposed to market volatility, most crucially, to substantial losses during periods of market downturns or financial shocks. The aim of this project is to develop novel modelling and pricing approaches for complex financial products and to reduce the harmful effects of confusion in financial decisions of retirees. Due to the complexity of superannuation guaranteed benefit products, they are likely to further enhance the profitability of insurance providers at the expense of policy holders, unless the latter can make informed decisions based on well-established and publicly available tools, which will allow them to independently assess each option from a wide range of products. Decreased confusion will raise financial well-being of retirees and made them more resilient to financial shocks. This project will also help regulators to efficiently supervise financial institutions.							
DP200101748 Colagiuri, A/Prof Ben	The nocebo effect – when negative expectancies trigger adverse outcomes – causes enormous personal and societal harm. Although there have been advances in understanding some of the psychological processes underlying these effects, much less is known about how to inhibit them or the role that social learning plays in producing them. This project uses a new experimental model involving Galvanic Vestibular Stimulation to address these important gaps in our knowledge. The project will significantly advance our fundamental understanding of the nocebo effect and pave the way for translational research to reduce the substantial harm it causes.	82,893.50	168,733.50	180,770.50	94,930.50	0.00	0.00	527,328.00
	National Interest Test Statement Nocebo effects - when negative expectancies trigger adverse outcomes - are an enormous social and economic burden to individual Australians and the Government. For example, nocebo effects are estimated to cause more than 40% of all medication side effects, which has substantial flow on effects in terms of treatment discontinuation and increased healthcare costs. Although significant progress has been made in understanding some of the basic psychological processes underlying nocebo effects, there are currently no effective strategies for preventing them and we know little about the social transmission of these effects. The current project involves important new fundamental research that will uncover how learning and communication strategies can be used to counteract nocebo effects and what role social learning plays in inducing them. This will provide enormous benefit to the Australian community, by paving the way for translational research that will allow us to reduce the huge individual and societal cost of nocebo effects.							
DP200101787 Carlson, A/Prof Thomas A	The choices we make define our lives. Despite exciting progress in neuroscience, we still don't know how the inner workings of the brain give rise to simple decisions. This project brings together experts from diverse domains of computational neuroscience to investigate how our brains turn perceptual information into action. Together, we will develop new methods to track information flow through the brain during the decision making process. By doing so, we will develop a world-leading model of how the brain makes decisions, and also provide the broader scientific community with a set of exciting new tools for studying information processing in the brain.	68,515.50	140,275.00	169,583.50	97,824.00	0.00	0.00	476,198.00
	National Interest Test Statement This project will advance our understanding of the human brain by developing new cutting-edge analysis tools to study information processing in the brain. The project will increase Australia's stature as a leader in the field by developing research tools that can be used by the cognitive neuroscience community, forging international collaborations with Germany and the USA, and providing world-class training for Australian early career researchers.							
DP200101866 Goldys, Prof Beniamin	The aim of this project is to develop a mathematical theory and numerical models of stochastic partial differential equations for magnetic nano-structures. Such materials will yield next-generation magnetic memories with up to three orders of magnitude faster switching speeds and dramatically increased data storage density. New mathematical theories will help understand their sensitivity to small random fluctuations that can destroy stored information. This project aims to revolutionise mathematical modelling of magnetic memories and put Australia at the forefront of international research. Technological advances to create much smaller and faster memory devices are expected to enable groundbreaking ways of managing and mining big data.	87,500.00	175,000.00	175,000.00	87,500.00	0.00	0.00	525,000.00

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	National Interest Test Statement Magnetic memories are principal devices for storing information. Their next generation will require greatly increased access speed and data-storage capacity. This project will develop the mathematical theory of new magnetic memory materials, a crucial first step in their understanding and being able to finetune their properties. Numerical simulations of realistic systems will help to identify optimal designs, towards practical implementation. Ultrafast, high capacity memories will underpin technological advances for the entire society and the economy, from new business solutions, better e-health, improved security for the Australian and global community, and faster internet. The project will foster the international competitiveness of Australian research and it will expand the Australian knowledge base and research capability in mathematics. We will also initiate long term collaborations with leading centres of research in Hong Kong and Europe. Advanced training of students will provide them with expertise highly sought in the telecommunication industry, military institutions and in weather prediction.							
DP200101893 Eggleton, Prof Benjamin J	The project aims to develop practical on-chip photonic isolators – one-way optical circuits – by harnessing light–sound interactions in a nanoscale platform novel in its materials, design and mechanism. The project should develop new nanofabrication techniques and transform understanding of the physics of one-way photonic processes. Expected outcomes include enhanced design and fabrication capabilities for photonic circuits, ultra-compact, high-performance optical isolators and circulators that shield sensitive optical components, and a suite of theoretical tools for describing propagation and noise in these devices. These new high performance photonic circuits should benefit telecommunications, radar, defence, and sensing applications.	80,000.00	230,000.00	230,000.00	80,000.00	0.00	0.00	620,000.00
	National Interest Test Statement The basic science of the project will enhance our existing strong reputation in optical science, by targeting one of the main outstanding challenges in the miniaturisation of optical devices. The benefits of the Project will be seen in better outcomes for Australian radar and communications technology which require advances in processing of high data rate radio frequency signals, by delivering new photonic components having markedly improved performance and greatly extended capabilities. These components will be especially useful for deployment on mobile platforms including drones, or for short-range navigation. Direct benefits to the economy will accrue through technology transfer to Australian companies. The outcomes of this project are expected to transform the capabilities of photonic circuits and the processes used to design and fabricate them. These outcomes will position Australia as a leader in this field, attracting scientists and engineers from other countries and creating a high quality workforce for local industry in our sophisticated photonics sector.							
DP200101905 McKenzie, Prof David R	Neuromorphic electronics emulates cognitive processes of the brain and like the brain, is capable of extracting features and recognising patterns within data with extremely low energy requirements. Carbon materials are naturally adapted to neuromorphic electronics and uniquely form a compatible interface for sensing molecules in liquid and gaseous media. This project aims to develop a carbon-based neuromorphic electronic sensing device and couple it with carbon based neuromorphic pattern recognition technology to build an ‘artificial nose’ for improved health and environmental monitoring. Intended outcomes will include a technology for low-cost and rapid diagnostic services.	85,000.00	170,000.00	165,000.00	80,000.00	0.00	0.00	500,000.00
	National Interest Test Statement Improvements in the health, environmental, safety and security sectors are enabling Australians to live longer and with a better quality of life. Our well-being depends on maintaining and building on these gains by more efficient monitoring at the molecular level and more efficient and compatible processing of the information to enable early and preventative decision making. In this project, we aim to design and implement a sensor and pattern recognition technology based on the concept of an artificial nose to bring to the community the benefits of improved health outcomes, lower health costs, improved environmental quality, safety and security.							

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DP200101919 Shen, A/Prof Luming	As conventional oil and gas become depleted in most of the producing basins, extraction of unconventional gas trapped in shale formations needs to become more viable. Since Australian shales have different characteristics from North American ones, the existing knowledge cannot be directly applied. We aim to develop a novel multiscale framework for deep understanding of the complex multiphase interactions in shale gas reservoirs. The outcomes will not only enable us to effectively assess the viability of gas extraction from Australian shale reservoirs with accurate long-term production forecasting, but help to develop strategies to effectively extract this relatively low carbon-emitting fossil fuel in the transition to a renewable economy.	82,500.00	160,000.00	145,000.00	67,500.00	0.00	0.00	455,000.00
	National Interest Test Statement Australia has huge shale gas resources, exceeding its estimated recoverable reserves of coal seam gas, which currently account for more than 40% of Eastern Australian domestic gas production. But since Australia's prospective shale gas reservoirs have different characteristics from those in North America, the viability of extraction and use of shale gas in Australia needs to be effectively evaluated. In the project, we will develop a novel experimentally validated multiscale framework to gain a deep understanding of complex multiphase interactions in the process of shale gas extraction. The new knowledge will enable us to more accurately predict the long-term gas production, to more effectively evaluate the viability of the shale gas extraction of a given site, and to develop strategies to more economically harness shale gas. The project will promote the use of shale gas in Australia, which will make significant contributions to the nation's economic wellbeing and 2030 climate change target since gas emits much less carbon dioxide than coal and oil.							
DP200101927 Rognon, Dr Pierre	This project will investigate the mechanisms controlling the mechanical wear that is incurred while handling geomaterials such as sand, ore, coal and fragmented rock. The overarching aim is to help forecast and mitigate extreme wear conditions by analysing the microscopic forces that granular materials produce when in contact with moving metallic surfaces. The intended outcomes include a thorough understanding of these interfacial interactions and an experimentally validated theory predicting wear rates for a range of materials and handling processes. The expected benefit of this project is to enhance the productivity and reliability of the mining and construction sectors by reducing wear-related machinery failures.	52,500.00	105,000.00	105,000.00	52,500.00	0.00	0.00	315,000.00
	National Interest Test Statement This project will improve the productivity of two industrial sectors that are essential to Australia's economy: mining and construction. These sectors yield approximately 15% of Australia's GDP and directly employ 10% of the national labour force. The project will help to reduce the large losses resulting from machinery wear, which currently consume up to 40% of operational costs. This will lead to a reduction in the cost of developing Australia's public infrastructure including roads, airports and tunnels. This is particularly important in the current national context of unprecedented infrastructure development, financed by $75b in taxpayer money over the next decade. Furthermore, the project will provide a competitive edge to national mining companies, which suffer from $30 billion in wear-related losses every year. These companies represent 20% of the ASX market and contribute to 35% of Australia's exports. The project will thus help to secure and enhance Australia's leading position in the global economy.							
DP200101970 Ju, Dr Lining	Understanding how cells can sense and respond to mechanical environment such as dynamic blood flow represents a fundamental question in the emerging field of mechanobiology. This project develops new biomechanical engineering approaches to determine the critical interrelationships among fluid flow disturbance, platelet clotting and the mechano-sensitive signal transduction mechanisms of integrin receptor – the most important mechano-sensor implicated in cell adhesion, migration, growth and survival. Specifically, it integrates nationally unique cutting-edge techniques including single-molecule force probe, microparticle image velocimetry, microfluidics and molecular dynamics simulation, super resolution and 3D volumetric imaging modalities.	81,500.00	158,000.00	153,000.00	76,500.00	0.00	0.00	469,000.00

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	National Interest Test Statement When the blood flow is disturbed, platelets mount their natural response and induce clotting. The most common form of flow disturbance is introduced by implantable devices intended to save lives. Despite growing community understandings about lifestyle risk factors, the numbers of Australians who need such devices continue to grow. Clearly, improvement of designs and manufacturing is critically in need for these devices that can overcome this clotting response without endangering the person's life. As our population ages there will be an acknowledged and exponentially increasing cost-burden on the national economy. This Project is part of Australia's world-leading research that contributes to lowering this cost by generating a return on investment far in excess of the cost of research – in the order of more than 100:1. Further, in contributing to a healthier future Australia, this project provides pathways to bettering our broad societal well-being by enabling senior Australians to participate more fully in society for longer – enriching all our lives.							
DP200101998 Horst, Prof Heather A	Governments, NGOs and other entities have turned their attention to the creative industries as an alternative space for national economic development. This project focuses upon the development and growth of the Fijian fashion industry across national (Suva), regional (Sydney and Auckland) and global (London) sites. It explores this growth in relation to three key factors: the integration of technology in the processes of design and production; the use of digital and social media to build and expand markets; and capacity building for fashion entrepreneurs. Using digital ethnography and anthropological approaches, this study analyses how creative industries can be supported and sustained in developing contexts.	41,500.00	89,750.00	105,750.00	57,500.00	0.00	0.00	294,500.00
	National Interest Test Statement Fiji is an important Pacific neighbour with a garment manufacturing sector that rapidly expanded following the 1987 coups. Tax incentive schemes has led to a number of highly successful Australian companies such as Kookai and Rip Curl manufacturing in Fiji. More recently, the Fijian Textile, Clothing and Footwear (TCF) industry has focused on establishing Fiji as the Pacific hub for fashion design with fashion weeks and festivals acting as platforms for emerging fashion entrepreneurs seeking to capture local, tourist and diasporic market segments. Australia has responded showcasing Fijian and other Pacific designer collections in high-profile fashion events such as Pacific Runway at Carriageworks in Sydney. Another important role is contributing to the development of fashion design courses through the Australia-Pacific Technical College and links between emerging Fijian designers and the Fashion Design Studio in Sydney with the aim of providing specialised technical skills and knowledge vital to sustainable economic growth in this sector.							
DP200102051 Scott, Dr Karen M	This project aims to understand adolescents' digital health literacy: their capacity to find, understand, appraise the trustworthiness of, and act appropriately on, digital health information. Technological development is racing ahead of insight into how adolescents use technology for health information and subsequent self-care. We must harness the benefits of these technological advances while protecting adolescent health. In co-designing a flexible suite of education resources, this project aims to generate critical new knowledge about the digital health literacy of a diverse range of adolescents. It is anticipated that the education resources will provide significant benefits to adolescents through enhanced capacity for self-care.	34,729.50	94,288.50	101,498.50	41,939.50	0.00	0.00	272,456.00
	National Interest Test Statement Adolescents increasingly integrate technology into their daily lives. The internet is an ideal source of health information that can engage adolescents and enable them to manage their health and establish healthy behavior – but what is trustworthy? Though proficient with technology, most adolescents find the amount of online information overwhelming, and struggle to identify what is trustworthy and use it to decide whether to see a physician. Adolescents need strong digital health literacy to appropriately find, understand, appraise and act on online health information. Adolescents with poor digital health literacy risk adopting unhealthy, dangerous beliefs and behaviours, and inaccurate self-diagnosis and treatment. This project generates critical new knowledge about the digital health literacy of a broad range of adolescents. Building on Australia's leadership in public health awareness-raising, we will work with adolescents and other stakeholders to develop a flexible suite of education resources that help a diverse range of adolescents improve their digital health literacy and capacity for self-care.							

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DP200102071 Myerscough, Prof Mary R	The project aims to create new mathematical theory for immune cell behaviour which leads to heart attacks and strokes. This includes formulation and analysis of new types of mathematical models for atherosclerotic plaque development, leading to the creation of new mathematical tools to investigate cell fate in plaques and to generate new hypotheses for experimental research. Expected outcomes of this project include powerful and reliable mathematical models ready for application, and national and international collaborations with scientists and mathematicians. This should provide significant benefits including increased capacity to use mathematical models in vascular biology and training young researchers in interdisciplinary methods. **National Interest Test Statement** This project will contribute to Australia through the knowledge that it produces and the training in cross-disciplinary mathematical modelling that it provides. Heart attacks and strokes have a profound economic and societal impact in the Australian community. This research will provide foundational mathematical models, formulated as differential equations, for the cellular mechanisms and processes that lead to heart attacks and strokes. Although it is beyond the immediate scope of this project, these models will contribute to Australia's capacity to develop personalised medical treatment for vascular disease. This project will also train graduate students and an early career researcher in interdisciplinary research at the boundary of mathematics and the life sciences. Australia needs workers with this deep level of skills and cross-disciplinary experience to work, for example, in epidemiological modelling and disease control, designing medical technology, and agricultural and water supply planning.	80,000.00	165,000.00	170,000.00	85,000.00	0.00	0.00	500,000.00
DP200102130 Wechselberger, Prof Martin	Reaction-nonlinear diffusion models play a vital role in the study of cell migration and population dynamics. However, the presence of aggregation, or backward diffusion, leads to the formation of shock waves - distinct, sharp interfaces between different populations of densities of cells - and the breakdown of the model. This project will develop new geometric methods to explain the formation and temporal evolution of these shock waves, while simultaneously unifying existing regularisation techniques under a single, geometric banner. It will devise innovative tools in singular perturbation theory and stability analysis that will identify key parameters in the creation of shock waves, as well as their dynamic behaviour. **National Interest Test Statement** We will provide a novel mathematical formalism for the description and subsequent analysis of the complex and cryptic processes involved in biological interface evolution. Our geometric approach will permit the representation of many heretofore disparate physical models under a single unifying banner. The mathematical insights thus gained will greatly support the cross-disciplinary flow of ideas and theory leading to significant and novel insights into a wide variety of biological phenomena including tissue growth, wound healing, and the impact of environmental change on biological systems.	80,000.00	160,000.00	160,000.00	80,000.00	0.00	0.00	480,000.00
DP200102139 Mathas, Prof Andrew	Recent advances in representation theory have revealed beautiful new structures in the classical representation theory of the symmetric groups and Hecke algebras. These discoveries have provided us with new algebras, the cyclotomic KLR algebras, that encode deep properties of fundamental objects in algebraic combinatorics and geometric representation theory. The cyclotomic quiver Hecke algebras are central to several open problems in mathematics but they are still poorly understood, with even basic properties like their dimensions being unknown. This project will establish a new framework for studying these algebras that will remove the current obstacles in this field and alllow us to prove substantial new results that advance the theory.	79,000.00	158,000.00	158,000.00	79,000.00	0.00	0.00	474,000.00

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	National Interest Test Statement							
	Mathematics is essential to our society. It is the language that underpins science, engineering and all of our technological advances. The benefits that mathematics bring to society range from forming the basis of the knowledge economy, to enabling the information technology, to underpinning pivotal advances in engineering, and being a vital component of the world's financial markets. This project will contribute to Australia's research environment and further advance Australia's strong reputation in algebraic combinatorics and representation theory. The project will strengthen our international collaborative links by bringing high profile international mathematicians to Australia to work on this project and to give seminars. By training postgraduate students and post-doctoral researchers we will add to Australia's research expertise and capabilities. The skills and expertise that are required for this project are readily transferable and highly sought after by industry, including the financial, IT and education sectors.							
DP200102164 Dehghani, Prof Fariba	The project aims to design a new class of tough hydrogels to address issues in engineering complex soft and robust structures. These hydrogels have superior properties compared with current materials as they are biologically active, processable by various manufacturing techniques, elastic and have a capacity for rapid self-recovery that are ideal for soft tissues. Their physical property is tunable by modification of their compositions that enable construction of complex seamless structure such as valved conduit with anistropic property. Expected outcomes of this project include new insights into material design, multi-physics modelling, and multi-material additive manufacturing for broad applications in soft robotics and medical implants.	77,500.00	155,000.00	155,000.00	77,500.00	0.00	0.00	465,000.00
	National Interest Test Statement							
	Current hydrogels are ill-suited for soft implants and medical devices. They are generally passive, unable to interact with biological entities, mechanically weak and lack processability. The development of biologically active and mechanically tough hydrogels, which are processable by modern fabrication methods such as additive manufacturing is highly desirable. This project will contribute in developing the next generation of tailored hydrogels by generating critical knowledge in polymer synthesis, numerical modelling, and advanced additive manufacturing. Such task specific hydrogel will be ideal for the design and construction of soft robotics and fabrication of seamless artificial cardiac valved conduit that will resemble the functionality and complexity of the innate tissues. The research outcomes will bring Australia to the forefront of advanced manufacturing and science for material and technology that can be used for personalised medicine. It will empower innovation in robust and elastic materials with high potential for designing complex implants and advanced surgical devices that help many people.							
DP200102248 Warr, Prof Gregory G	This project aims to produce a new class of green, economical, non-toxic, low volatility, designer solvents from mixtures of one or more molecular components, and ionic liquid-inspired salts. By manipulating the intermolecular forces between components of these nanostructured ionic molecular "hybrid liquids" (HLs), we will develop new understanding of how liquid structure arises from the nano- to the colloidal and even micro-scale. HLs will enable the development novel complex fluids, which are liquids containing interacting particles, polymers, and/or surfactants. Lubricants developed from HL based complex fluids will act as a "test-bed" application for the new understanding this project will engender, towards use of HLs in diverse areas.	150,000.00	290,000.00	280,000.00	140,000.00	0.00	0.00	860,000.00
	National Interest Test Statement							
	By lowering volatile emissions and using low-cost, environmentally-friendly and water-compatible components, the new solvents developed in this project will be of broad benefit for chemical synthesis, extraction, and processing with potential for wide impact and uptake in both large scale operations and specialist industries. Technology transfer will be facilitated through existing local and international industry and research partnerships, and the project will train early career researchers and graduate students in cutting edge experimental chemistry techniques.							

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DP200102351 Holmes, Prof Edward C	Viral diseases pose an ongoing threat to Australian aquaculture. The devastating impact of emerging viruses makes it imperative to understand the factors that allow them to evolve and infect new hosts. We will address these key issues by revealing the diversity, abundance and evolution of viruses in fish sampled along the Australian east coast. The data generated will reveal the untapped biodiversity of fish viruses, the frequency which they jump species boundaries and the determinants of this process, and how they are impacted by host ecology, including whether fish viruses follow a latitudinal gradient in diversity. The data generated will transform our understanding of fish viruses and identify those most likely to impact aquaculture.	91,347.50	186,002.00	187,887.50	93,233.00	0.00	0.00	558,470.00
	National Interest Test Statement Aquaculture is fastest growing primary industry in Australia, with commercial fishery and aquaculture production generating $3.06 billion to the economy in 2017. Yet aquaculture faces ongoing and potentially devastating threats from emerging viral infections. The research proposed here will directly benefit Australian aquaculture, and is strongly in the national interest, by: (i) revealing which viruses reside in fish in Australian waters and factors that shape their diversity and evolution, (ii) determining why some viruses are better able to jump species boundaries and cause disease than others, and hence pose the biggest risk as agents of emerging disease, and (iii) identifying those factors in the biology of the fish hosts that enable them to carry more viruses that can invade more hosts. The project will also determine the extent to which genes for antimicrobial resistance have entered Australian fish and so could re-enter the human food chain. In sum, the proposed research will provide a new understanding of viral disease emergence, guide response to outbreaks, and help protect Australian aquaculture.							
DP200102371 Moul, Dr Caroline	Psychopathic personality traits engender risk for socio-emotional problems and antisocial behaviour; this project should shed light on the mechanisms responsible. It aims to advance our understanding of the origin of psychopathic personality by applying novel theory and methods to investigate the cognitive mechanics of these traits. It is expected that this will lead to new insights into the roles of associative learning and attention, and the underlying neural mechanisms, in social learning and empathy development. Expected outcomes of this project include; significant advances in this field of research, ongoing interdisciplinary collaborations, and highly desirable postgraduate opportunities.	83,280.50	145,574.00	123,431.00	61,137.50	0.00	0.00	413,423.00
	National Interest Test Statement This research has the potential to have social and economic benefits to the Australian community. A better understanding of how empathy and prosocial behaviour can be fostered via simple cognitive mechanisms allows for the future development of wide-scale, community or classroom-based programs that improve social relationships. Empathy protects against antisocial behaviour which has a significant burden on the nation's economy through the services of schools, the police force, and medical and social services. Improvements in our understanding of empathy and our ability to positively manipulate its development will reduce these financial burdens through a reduction in antisocial behaviour.							
DP200102378 Proctor, A/Prof Helen L	This project aims to investigate the activities, networks, ambitions, and rationales of community groups advocating for education policy reform across Australia in the 1970s and 1980s. The project expects to generate new knowledge about the relationship between education policy change and civic participation in Australia's recent history. Expected outcomes include a detailed understanding of how community-based education reformers shaped education policy, from across the political spectrum. This should provide significant benefits including an innovative, publicly available database, insight into how and why people organised to bring about education reform, and the role of community action in policy formation.	48,796.50	97,320.50	92,379.00	43,855.00	0.00	0.00	282,351.00

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	National Interest Test Statement This project will benefit Australia's social and cultural life by advancing knowledge about a significant period in Australian history, the 1970s and 1980s, beyond nostalgia. The project is a historical study that has relevance to present day concerns about citizen engagement in the public sphere. It will generate significant new knowledge about community organising for education reform, and advance conceptual understanding of how and why people become involved in working together to effect change, from a variety of perspectives and political allegiances. The project will also produce new collaborations with international researchers studying similar movements as well as new knowledge about how groups within Australia were inspired by and use the strategies and ideas of international organisations. The development of a publicly accessible interactive historical data base will be central to the project's outreach agenda.							
DP200102463 Sunde, A/Prof Margaret	This project will determine how a protective protein coating forms on the surface of fungal spores and infectious structures. This coating is comprised of amyloid protein fibrils and is used by fungi to improve efficiency of infection and to avoid detection by the host plant or animal. We have discovered novel small molecules that prevent the fibrils from forming. This project will use these molecules to reveal the details of the fibril assembly mechanism and find the best way to undermine this fungal defence system. This knowledge will enable the development of potent small molecule inhibitors to treat fungal infections that blight crops and harm animals, and the production of new layered biomaterials for nanotechnology applications.	80,000.00	165,000.00	165,000.00	80,000.00	0.00	0.00	490,000.00
	National Interest Test Statement Effective, affordable treatments are not currently available for fungal infections of many crops, birds, animals and humans. Fungal infections of major crops such as rice and maize reduce yields by up to a third annually. These are crops that provide the majority of the calories in many peoples' diets, so hard-to-treat fungal infections risk food security. Likewise, fungal infections of poultry cannot be cost-effectively treated using current remedies, so infected birds are culled, at considerable cost. Fungal pathogens in hospitals are responsible for some of the most difficult to treat hospital-acquired infections; clearance of these infections necessitates the shutdown of facilities, with huge associated expenses. This project aims to produce novel anti-fungal agents that are effective against major air-borne fungal pathogens of crop plants and animals. Such agents would deliver social and economic benefit for Australians. In addition to the direct outcomes, new understanding of the fungal structures will be used to inspire the production of useful biomaterials with nanotechnology applications.							
DP200102467 Barbour, Prof Margaret M	This project aims to develop leaf anatomical ideotypes with improved photosynthesis and water-use efficiency for wheat, rice, chickpea and cotton using novel three dimensional imaging and modelling techniques. This project expects to generate new understanding of the role of leaf anatomy on leaf function. Expected outcomes of this project include the world's first 3D spatially-explicit, anatomically accurate model of leaves of crop plants to allow virtual experiments identifying optimized anatomy for improved photosynthetic performance. Benefits to the agricultural industry include increased crop productivity and water-use efficiency to meet future global food demand and to make the most of Australia's limited water resources	55,000.00	125,000.00	135,000.00	125,000.00	60,000.00	0.00	500,000.00
	National Interest Test Statement Dryland production dominates Australian agriculture and improving the amount of crop per drop of water would provide significant economic benefits. This project will enable the discovery of leaf ideotypes that enhance photosynthesis and water-use efficiency for wheat, rice, chickpea and cotton. The leaf anatomical ideotypes will provide guidance to crop breeding companies as objectives in their breeding programs. Increased crop yield and improved water-use efficiency will benefit the agricultural industry through increased profitability and environmental sustainability. The current conflict around water allocation between agriculture and the environment highlights the need to maximise crop production per unit of water.							

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DP200102497 Ye, Prof Lin	Disintegration of the external façade (with tiles, plates, etc.) of high-rise buildings presents a great challenge and a threat to community. This project develops fundamental knowledge and algorithms that underpin the deployment of a new technique for fast and automated quantitative integrity assessment of façade units of high-rise buildings, integrating mechanisms of directional acoustic waves, vibro-acoustics of façade tiles or panels, laser sensing technology, deep learning algorithms and drone technology. Outcomes of this project are critical for implementing the new technology for enhanced safety to community and the development of new procedures for driving down maintenance costs of the external façade of high-rise buildings.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement There have been many incidents of disintegration and falling of external façade with bonded or attached tiles and glass panels of high-rise buildings. These incidents present a great challenge and a threat to community. Direct inspection and assessment of the façades of high-rise buildings or some modern architectural masterpieces are challenging tasks which sometimes cannot be completed without potentially inducing new or additional damage to the façade. This project develops fundamental knowledge and algorithms that underpin the deployment of a novel technique for fast and automated quantitative integrity assessment of façade units of high-rise buildings. It is based on new design and mechanisms for activating directional acoustic-induced vibration of façade tiles or panels, implementation of laser sensing and deep learning technology integrated with drone technology. The outcomes of the project are critical for implementing the new technology for enhanced safety to community and the development of procedures for driving down maintenance costs and extending the life-span of façades of high-rise buildings.							
DP200102542 Minasny, Prof Budiman	Not knowing where and how soil responds to climate change and human intervention compromises food, water, climate and energy security. Currently there is a lack of soil process knowledge and data infrastructure collectively causing significant uncertainty and risk in the assessments of key threats to soil. The project devises a transformational digital soil model to forecast where and how soil pH and carbon will change in New South Wales. Tested on sites within Australia, the model will give insight on the drivers of change and will provide a unique analysis of the effect of climate change and land management on the dynamics of soil.	67,500.00	147,500.00	160,000.00	80,000.00	0.00	0.00	455,000.00
	National Interest Test Statement Soil is a key component of functional ecosystems and is crucial for food, water and energy security, maintaining above- and below- ground biodiversity, mitigating climate chang, and has strong links to human health. The project will devise a suite of methods to forecast how soil function changes across space and time to facilitate tactical and strategic ecosystem management.							
DP200102565 Warren, A/Prof Charles R	This project aims to determine how soil microbial communities adapt to phosphorus availability, and how the breakdown of microbial biomass sustains phosphorus demand. Using some of the most globally P-impoverished soils, the project expects to uncover how cellular composition of microbial populations is shaped by phosphorus availability, and feedbacks between cellular composition of microbes and phosphorus availability. Expected outcomes include better understanding of factors determining phosphorus availability, and a new analytical toolkit for tracing pools and fluxes of organic P in soils. Overall, these should provide significant benefit to the global effort in understanding how phosphorus shapes soil function.	73,968.00	152,593.00	157,980.00	79,355.00	0.00	0.00	463,896.00
	National Interest Test Statement The outcomes of the project have the potential to contribute to better management of phosphorus in agricultural systems. Productivity of much of Australia's landscape is sustained by fertiliser additions, yet there are strong economic and environmental incentives to reduce reliance on P fertiliser inputs. One avenue for reducing fertiliser inputs is to reduce losses of phosphorus from soils by increasing the internal cycling of phosphorus. Our project will deliver the comprehensive understanding of how phosphorus is cycled within soil that is required to better manage phosphorus in agricultural ecosystems, thereby delivering economic and environmental benefits to the Australian community.							

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DP200102585 Lenzen, Prof Manfred	This project aims at exploring future pathways for the Australian food system to remain secure under future disruptive changes, environmentally and socially sustainable, and able to offer healthy food choices. It will reveal the connections among food supply chains, diets and human health, and portray a food system that achieves public health and sustainability goals while positioning Australia securely into the global supply chain network. These goals will be achieved by creating the Australian Food Lab, which will provide a collaborative research platform for environmental scientists, economists, public health experts, and food industry representatives for investigating issues pertaining to the future of our food system.	60,000.00	125,000.00	130,000.00	65,000.00	0.00	0.00	380,000.00
	National Interest Test Statement The project responds to the call for research on food security and human health by the National Strategy on Climate, Health and Well-Being for Australia. Using new Australian eResearch technology, it will create a collaborative research platform–the Australian Food Lab-that will position Australia as a research leader important to an industry worth many billion dollars in most countries. The Lab will directly benefit the Australian community as it will assist in safeguarding Australia's food system under future population growth, possible economic shocks, and climate change, and in maintaining Australia's food security, sustainability and health. Outcomes will benefit government and policymaking and rural research & development bodies, because these explicitly identify adaptation to climate change and natural hazards as a research priority. The project directly relates to Australian Government Science and Research Priorities: food (supply-chain security, sustainability and healthy choices), soil and water (impacts on land and water resources), and environmental change (climate change and population growth).							
DP200102599 Schlosberg, Prof David	This project aims to improve two key areas of environmental policy by investigating the meaning of environmental justice and how it is best implemented. It will generate a significant new framework of the idea of environmental justice and offer innovative research that demonstrates what hinders and enables just policies in practice. Expected outcomes of this project include an updated and enhanced theory of environmental justice, a new understanding of the enablers and barriers to its implementation in practice, and recommendations to make policies on urban food security and energy transition more just. Overall, the project should provide the benefit of the development of more just policies on two key environmental issues facing Australia.	46,063.50	109,650.00	124,042.50	60,456.00	0.00	0.00	340,212.00
	National Interest Test Statement More just, equitable, and inclusive policymaking is clearly in the national interest of all Australians. With its focus on bringing important demands for justice into the development of two key areas of policy – food security and energy transition – this project aims to improve the legitimacy of government decisions and the quality of everyday life for all Australians. The project aims to bring economic and environmental benefits through the design of food and energy systems that are equitable and support more healthy and sustainable lifestyles. Social and cultural benefits will come from more authentic inclusion of community concerns and desires in the development and implementation of public policies. Economic benefits will come from advising governments on healthier and economically sustainable food and energy policy. And the work will bring academic benefits as Australia is increasingly seen as a home for cutting edge environmental justice research for real impact.							
DP200102604 Tomitsch, A/Prof Martin	This project aims to understand the link between trust, safety, and the public acceptance of driverless cars. The uptake of autonomous mobility systems relies upon public trust. Recent injuries, and even a fatality, have highlighted the risks they pose to pedestrians in particular. The project investigates new interfaces for improving public trust and pedestrial safety by allowing vehicles to communicate with the people around them. Along the way, it develops a validated approach for simulating real interactions with autonomous vehicles in a virtual-reality environment. Benefits include strategies for making driverless cars safer for pedestrians and a new approach for testing solutions to this emerging problem in a low-cost, low-risk way.	70,000.00	145,000.00	150,000.00	75,000.00	0.00	0.00	440,000.00

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	National Interest Test Statement							
	Australia is seen as a leader in the development and adoption of driverless cars. Australia's Smart Cities Plan, highlights that their transformational impact will "fundamentally change how we live and work". Driverless cars and other autonomous vehicles (AVs) have the potential to contribute to the strategic goals of Australian cities, addressing sustainability and liveability through shared ownership models and reduced congestion. This project contributes to the foundation for AVs by focusing on a mostly overlooked aspect: how to make AVs sympathetic to the social life of the urban spaces they inhibit. It tackles this challenge by developing new understanding about the way AVs interact with people around them, and how this is linked to perceived trust and safety. This in turn has the potential to reduce the risk of accidents from pedestrians misinterpreting the intention of the vehicle and to improve their public perception. Economic benefits include reduced costs of development and trials, as well as indirect cost benefits associated with road accidents and trauma by making AVs safer for pedestrians.							
DP200102645 McArthur, A/Prof Clare	This project aims to apply principles of community ecology to the gut microbiome of an urban exploiter – the common brushtail possum - to reveal how animal traits influence individual variation in the load of gut parasites that cause disease in both humans and wildlife. By combining assays defining the behavioural and physiological states of individuals with sophisticated analyses of their gut microbiome, our project will provide a new, yet crucial, perspective on how and why diseases spread. Our discoveries will help understand and manage the burden of infectious diseases from parasites in and beyond our cities and across the human-wildlife interface; essential for improving human and wildlife health in an increasingly urbanised Australia.	88,500.00	182,000.00	163,500.00	70,000.00	0.00	0.00	504,000.00
	National Interest Test Statement							
	The individual trait-based model, developed by this project, will have a demonstrable impact on Australia's capacity to effectively predict and manage disease spread by parasites shared between humans and wildlife, and between cities and our bush; thus responding to an accelerating need as Australia becomes increasingly urbanised. Specifically, it will vastly improve our capacity to manage the spread of Cryptosporidium and Giardia by possums. But our research will also provide crucial principles, baseline information and improved understanding to help manage emerging diseases, for example buruli ulcer, the flesh-eating disease on the rise in coastal Victoria that has been linked to bacteria in possum faeces. Tangible benefits of our research will therefore be (1) environmental — improved wildlife conservation by better managing reverse zoonoses; (2) social — capability to better manage and enjoy interactions with urban wildlife; and (3) improved human health — by helping pioneer novel, targeted and hence more economic ways to help reduce disease spread from wildlife to humans.							
DP200102904 Ashe, Dr Alyson K	This project aims to determine the mechanisms responsible for the inheritance of acquired traits. Sometimes the environment can have effects on the phenotype of not only the exposed individual, but also their children and grandchildren. While it is clear that this can occur, what is not clear is the mechanism by which this happens and the frequency at which it happens. This project will combine use of the model organism Caenorhabditis elegans with biochemistry and structural biology to determine what the molecular mechanism is by which this "transgenerational epigenetic inheritance" occurs.	87,945.00	181,483.50	192,301.00	142,979.00	44,216.50	0.00	648,925.00
	National Interest Test Statement							
	This application investigates one of the most fundamental and long-standing questions in biology – what is the nature of the information that is passed between generations? The answer to this question and delineation of the mechanisms by which that information is transmitted has the potential to have significant implications across medicine, agriculture and biotechnology. As well as providing a deeper understanding of the world around us, determination of these mechanisms will potentially allow more efficient and higher-quality agricultural production and pathways to treatment for a range of human disorders.							
DP200102935 Akhtar, A/Prof M. Shumi S	Multinationals (MNCs) tax avoidance has become a national blight and a global problem impacting tax fairness, transparency and economic efficiency. This project aims to find the optimal solution for the tax avoidance problem for both MNCs and governments via effective cost-benefit analysis through the design of a cutting-edge interdisciplinary machine-learning technique. Expected outcomes will include profound breakthroughs for enhancing economic growth via tax policy reform in Australia but also globally through cross-country tax avoidance comparison. The benefits will be instrumental in reforming fiscal and investment policies that are highly critical for improving economic welfare and capital inflows in Australia.	64,216.00	118,663.00	102,861.00	48,414.00	0.00	0.00	334,154.00

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	National Interest Test Statement The tax treatment of MNCs is a double-edged sword. Losses in national tax income through favorable tax treatment for MNCs must be balanced against the significant economic and social benefits they bring. MNCs bring many economic advantages, yet many continue to conceal their wealth in tax haven countries. This project will benefit both governments and MNCs via effective cost-benefit analysis to develop an optimal economic environment for both parties. It will quantify, for the first time, the pros and cons of Australia's tax policy versus MNC tax avoidance strategies, and enable the promotion of specific government initiatives to enhance Australia's economic growth, enrich fiscal flows and improve overall competitiveness. The project will influence policy development in a global context, creating fair, transparent and efficient tax policies optimising the tax treatment of MNCs. The outcomes will provide fresh data-driven evidence which is in critical need to create a fairer and more transparent tax policy in Australia and globally. These reforms will have a demonstrable benefit for all Australian businesses.							
DP200103005 Prokopenko, Prof Mikhail	The project aims to greatly improve the accuracy and scope of computational epidemiological models predicting emergence and evolution of foodborne diseases in Australia. It expects to reveal key pathways for both biological evolution of microorganisms, and their spread though food supply chains and human interactions. The intended outcomes include discovering how the most dominant strains of foodborne infection emerge and self-organise in complex networks, how to predict and contain the epidemics closer to their source, and which are the most vulnerable groups and communities. This should make a significant economic and social impact, improving health of the population, while also safeguarding national and international supply chains.	83,500.00	173,500.00	180,000.00	90,000.00	0.00	0.00	527,000.00
	National Interest Test Statement The benefits of the Project will be seen in improved Australian responses to both local and regional health threats, including a radically new platform for public health surveillance, faster identifications of infection origins, more timely and precise allocations of public health resources, as well as efficient risk-based interventions during outbreaks of foodborne diseases. These responses and interventions will focus on fresh produce, mass catering and hospital and aged care facilities, enabling timely containments of the outbreaks closer to their source. This will make a significant economic, commercial and social impact, by improving health of the Australian society, especially its most vulnerable parts, significantly reducing the number of disruptions to national and international supply chains, and mitigating food- and biosecurity risks. Expected benefits also include developing a leading position for the Australian research in the field of large-scale computational modelling of foodborne epidemics.							
DP200103015 Tran, Dr Minh-Ngoc	This project pursues breakthroughs in time series modelling and develops novel statistical models and inference techniques, with a focus on modelling of financial time series data. The advances will be achieved through interdisciplinary research, combining recent advances in machine learning, Bayesian computation, financial econometrics and the increasing availability of Big Data. The outcomes will provide a new range of proven and powerful approaches for analysing time series and understanding time effects. The methodologies developed will lead to a greater accuracy in financial forecasting and risk management, and open up new horizons for the wider scientific community to analyse time series data.	65,000.00	125,000.00	75,000.00	15,000.00	0.00	0.00	280,000.00
	National Interest Test Statement In the Fourth Industrial Revolution era, the data held by Australian government agencies and other institutions are recognised as one of the nation's most invaluable assets. The amount of data is quickly increasing and this calls for new data analysis techniques that are capable of transforming these big data into useful information. Being at the forefront of data-centric technologies has become Australia's national strategy and interest. This project will advance data analytics with a focus on financial time series analysis with big data. This project will develop a range of novel models and estimation methods for analysing time series, providing a vital tool for both government and industry sectors for making informed decisions in national economic security and financial risk management. This project will reduce the risk in that decision making process by capturing better the uncertainty associated with financial forecasting.							

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DP200103148 Banks, Prof Peter	This project aims to develop new approaches to improve wildlife management by showing how deceit and misinformation can alter decision-making in pest animals. Using wild house mice as a model, it will test new theory on how animals decide whether or not to interact with wildlife control devices, like traps and baits, which is critical to all pest control efforts. The expected outcomes include new pest control tools that make strategic use of misinformation to alter decision making, to reduce a pest's ability to damage important agricultural crops such as wheat, boost the attraction of lures to traps, and improve bait uptake. These outcomes should provide significant new options for vertebrate pest control in Australia and globally.	54,675.00	119,015.00	116,385.00	52,045.00	0.00	0.00	342,120.00
	National Interest Test Statement The benefits of this project are in generating new options for monitoring and managing the impact of vertebrate pest animals in Australia and globally. Vertebrate pests such as house mice impose significant costs to Australian agriculture and to conservation values. This project will identify new tactics to overcome the significant limitations to effective pest management that occur when pests fail to interact with wildlife management devices such as baits, traps and surveillance devices. It will also develop a simple technique to protect wheat from mouse damage. These new approaches using deception to alter animal decision making, will help improve the efficiency of pest control and monitoring and have the potential to improve wheat yield, keeping Australia at the forefront of vertebrate pest management research.							
DP200103202 Gurran, Prof Nicole	Affordability pressures are increasingly forcing low income renters into substandard or ‘informal’ housing arrangements ranging from share accommodation through to backyard ‘granny flats’ and unauthorised dwelling units. This project aims to uncover how this ‘hidden’ housing is produced within formal systems of urban regulation, and risks or benefits for residents. By exposing the significant but often ignored role of informality within housing systems, the project expects to advance the fields of housing and urban studies; lead international scholarly collaboration; and build research capacity. Project outcomes are intended to enhance local planning practice and improve housing standards and choice, particularly for low income renters.	76,716.00	162,993.50	176,180.00	89,902.50	0.00	0.00	505,792.00
	National Interest Test Statement The benefits of the project will be seen in better outcomes for Australian urban planning and housing development, with flow on benefits for the wider community. By exposing how informal practices emerge under particular regulatory regimes, and the risks or benefits associated with these practices, the project will improve efficiency and standards in the housing market, a critical sector of the economy. Further, by informing policy and regulatory frameworks surrounding the supply of private rental accommodation, and in reviewing and developing models for diverse and affordable housing production, the project will increase housing choices for low income earners, supporting community well-being and social inclusion.							
DP200103223 Zhou, Dr Luping	AI-assisted image segmentation & synthesis are very challenging and usually require pixel-level labelling (per-pixel prediction) that is costly to obtain. The small amount of labels makes it difficult to train an “optimal” unified model for varied data as conventional methods did. This project aims to develop a new paradigm “personalised learning” to tackle this problem, where each image could be dealt with a model tailored to individual characteristics. The success of this project could significantly advance the fundamental research in image analysis. Expected outcomes include new knowledge and algorithms for image analysis, which could benefit fields like biology and archaeology, where labeled images are hard to attain and scarce.	62,500.00	128,500.00	135,500.00	69,500.00	0.00	0.00	396,000.00

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	National Interest Test Statement							
	Automatic image analysis is a central issue in AI, computer vision and pattern recognition. As an important sub-problem, per-pixel prediction, including the classic tasks such as image segmentation & synthesis, is often an indispensible core module in AI-assisted systems in a wide spectrum of fields. Therefore, developing new techniques for per-pixel prediction has great potential to contribute to Australian's national interest. Economically, these techniques could significantly help save time and labour for processing and analysing images in professional fields such as medicine, archaeology and botany. The improvement of efficiency in these fields could further bring social benefits, for example, improving the quality of healthcare and enhancing the patients' experience. They could also be used in applications that bring environmental benefits (for example, plant image segmentation for weed control and sonar image segmentation for analysing seafloor type), and culture benefits (for example, archaeological sites segmentation for measurement and image synthesis in culture heritage applications).							
DP200103334 Benjamin, Prof Roger H	The project aims to give a first-time analysis of visual culture at the Strait of Gibraltar. It asks how painting, photography, film, and maps relate to colonial expansion, with a focus on Australian, French and Spanish involvement in the Western Mediterranean. The British fortress-colony of Gibraltar and the international Moroccan port of Tangier have never before been subject to comparative analysis. Key outcomes include two major exhibitions, one on Australian Orientalism at the National Gallery and the second on historical art in the region. By shedding historical light on people smuggling, contraband and post-Brexit identity at the Strait, the project aims to generate cultural knowledge pertinent to international co-operation.	41,000.00	81,500.00	69,000.00	28,500.00	0.00	0.00	220,000.00
	National Interest Test Statement							
	In the 50 years following the 1869 opening of the Suez Canal, every passenger ship sailing from Australia to Britain stopped at the Rock of Gibraltar, a key symbol of the British Empire and a zone of intense cross-cultural contact between Europe and Africa. Moving from Europe to Africa, and from Christian to Muslim worlds, many Australian painters and photographers who crossed the Strait of Gibraltar were deeply influenced by the visual traditions they encountered on the journey. In exploring this neglected aspect of Australian engagement with Gibraltar, the project will contribute to Australia's national interest through its enrichment of our understanding of the art history of this period and its contribution to Australia's cultural development. It will also result in major national exhibitions that will bring together, for the first time, work from leading Australian artists in scholarly conversation with Orientalist traditions in the region.							
DP200103494 Zomaya, Prof Albert Y	Edge Computing (EC) is an emerging paradigm with a great promise for advancing Information and Communications Technologies. This project aims to investigate and provide solutions for the realization of a seemingly integrated Edge Data Centres (EDCs) with cloud environments. Using theoretical and system development approaches, the project expects to generate new knowledge for managing the resources of an EDC ecosystem. Outcome of this project includes practical solutions through building novel mathematical frameworks and resource management objectives accompanied by system implementations. These outcomes will benefit both scientific and industrial communities, and mark Australian scientists as pioneers in this emerging area of research.	85,000.00	170,000.00	170,000.00	85,000.00	0.00	0.00	510,000.00
	National Interest Test Statement							
	The ultimate goal of the project is to contribute to the provision of technological solutions and wealth creation that will help building a smarter and more sustainable planet. This project expects to build mathematically verified industrial platforms through which useful pieces of information that surrounds us can be sampled, collected and analyzed. Because this project provides efficient environments for monitoring and control of intelligent spaces, management of urban and rural environments, its outcomes will directly contribute to mitigation of many modern problems such as manufacturing, energy, transport, public health, to name a few. Overall, Edge and Cloud Computing are very important technologies to Australia's technological success. Developing fundamental principles and engineering techniques for these areas is essential if Australia is to maintain its momentum in developing and enhancing 21st century technology. The proposal will lead to the creation of new hardware and software platforms that could be of commercial value.							

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DP200103530 Richardson, Prof Des R	Basic biochemistry and the metabolic regulation of proliferation remain as the fundamental building blocks of knowledge in cell biology that have enabled breakthrough advances in biology and medicine. Polyamines are unique and ubiquitous low-Mr amines that play vital roles in many biological processes, including proliferation, DNA/RNA synthesis, etc. This proposal will mechanistically dissect the "new" biochemistry of polyamines, as we have discovered that polyamines are regulated by iron at 2-major levels, involving >10-key polyamine pathway proteins. This proposal represents first-in-field studies specifically designed to dissect mechanisms involved in this relationship. Our Central Hypothesis is that iron regulates polyamine metabolism. **National Interest Test Statement** This is basic science proposal that will mechanistically dissect the intricate biochemistry of polyamines and how they interact with other pathways vital for a plethora of processes. This is critical, and represents a "treasure trove" of biochemistry with vital implications for understanding the basic mechanisms of life eg., growth. Such knowledge is vital to dissect, as altered polyamine levels are involved in disease development and will enable innovative breakthroughs & commercial exploitation for designing new technologies. Indeed, CI Richardson strongly commercialises novel technologies into translatable products after dissecting mechanism (17 patents/3 patent suites). This proposal provides the training/mentoring of outstanding early-mid researchers for the Australian scientific workforce ie, PI Lane (49 Publs. with CI Richardson), PhD & Honours student. It also stimulates collaboration with outstanding international & national investigators, to fortify the strength of Australian science. Our proposal will contribute to the Australian National Science and Research Priority of "Health" (Section B1)	68,093.50	136,887.00	150,616.50	81,823.00	0.00	0.00	437,420.00
DP200103549 Prokhorov, Prof Artem	The project aims to develop new statistical tools, applicable when the conventional paradigm that diversification reduces risk fails and when textbook approaches to risk quantification severely under-report risk. The new tools enhance our capacity to build and manage natural, social and human-made systems in uncertain environments. Our effective response to many threats including financial crises and natural events, depends on this capacity. Thus, the expected benefits in the form of more reliable and robust risk analytics will accrue when they are most needed. **National Interest Test Statement** Accurate risk measures and confidence in benefits of risk aggregation are key to effective decision making under uncertainty. Extreme events such as financial crises and natural disasters have profound detrimental effects on Australia's economy and require innovative risk analytics to enhance the country's resilience to such shocks. By better evaluating the uncertainty surrounding such events, the project will provide the means to minimise their impact, ensuring smooth economic development, crucial for long term prosperity of Australia. Thus, the project is expected to have a direct impact on important areas of national interest such as stability of the financial sector and effective response to natural disasters, with profound implication for engineering, economics, finance and risk management.	50,200.00	97,700.00	102,500.00	55,000.00	0.00	0.00	305,400.00
DP200103609 Masri, Prof Assaad R	This project aims to transform our understanding of the dynamics of fires and smoke in enclosures and their interaction with water sprays and mists carrying chemical suppressants. Fires in buildings remain very difficult to contain and continue to cause extensive loss of lives and property. The proposed research will exploit advances in laser diagnostics and computer power to determine and quantify the complex interactions between droplets, turbulent flames, smoke formation and chemical suppression processes. Outcomes include novel experimental databases for turbulent buoyant flames and chemical suppression effectiveness, thus laying the foundation for enhancing our predictive capabilities and improving fire control methodologies.	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00

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	National Interest Test Statement Building fires in Australia are responsible for many fatalities, thousands of injuries and extensive property losses every year. The social, emotional, material and financial costs are immense. This project provides the fundamental knowledge and quantitative measurements that will lead to improved control methodologies for compartment fires and more effective techniques for flame suppression. Improved predictive capabilities for flame behavior and enhanced chemical suppression effectiveness of mists and sprays will lead to a step change in the decision-making processes and management of building fires. This will enable Australia to maintain its research lead in the science of fire safety and equip Australian industry as global leaders in providing fire-fighting know-how. The advances delivered by this project will have considerable economic benefit and the potential to influence policy-makers through informed changes to fire-fighting practices.							
DP200103718 Zhou, A/Prof Bing B	Implementing deep learning (DL) applications usually requires a large amount of collected data and powerful computing resources in the cloud. However, this centralised approach has issues of high latency, large bandwidth usage, and possible privacy violation for many practical applications. Without properly addressing these issues, the wider application of DL in practice will seriously be hindered. This project aims to solve several key challenging problems in effective deployment and efficient execution of DL applications in a distributed edge-computing environment. Several innovative edge-computing methods will be developed for DL training, inference and implementation to achieve high performance with low latency and enhanced privacy.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement The project develops novel methods that will open up new research directions in the promising areas of edge computing and deep learning. The proposed solutions will contribute to fundamental understanding of edge computing system design and allow deep learning technology to easily integrate with existing mobile and wireless infrastructure to enable a new generation of smart mobile applications. The outcomes of the project will lead to patents and licensing opportunities and could also be of commercial value. Edge computing and deep learning are two of the most promising technologies. Thus developing fundamental principles and engineering techniques for edge-accelerated deep learning is essential for Australia to set the international agenda in these research areas and maintain its momentum in developing and enhancing 21st century technology.							
DP200103748 Kim, A/Prof Jinman	The project aim is to derive a technology platform comprising new image processing and machine learning algorithms to integrate imaging and biological data across multiple body sites. The relationships between image features and biological data across multiple sites has not been discovered before. We propose the use of biological information from one sampled site to investigate other unsampled sites based on imaging-omics correspondences. We will use a data-driven, searchable graph model approach for knowledge discovery within the population data. The project will provide new insights into systems biology and bioinformatics that will then inform and promote benefits in life sciences, with potential future benefits in healthcare.	80,000.00	160,000.00	160,000.00	80,000.00	0.00	0.00	480,000.00
	National Interest Test Statement The benefits of the Project will be seen in better outcomes for biological data analysis through allowing Australian scientists to better understand how the human body functions. In the long term, our outcomes will allow for the creation of new digital tools with high commercial potential; the future application of these tools will enable more efficient health decision making for doctors, leading to a healthier population, which will in turn increase economic participation in the workforce and greater social inclusion.							
	The University of Sydney	4,079,662.00	8,433,320.50	8,519,222.50	4,319,799.50	154,235.50	0.00	25,506,240.00

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University of Technology Sydney								
DP200100091 Suggett, A/Prof David J	This Project aims to uncover volatile gas "fingerprints" of coral reef taxa and how they are diagnostic of healthy reef functioning over space and time. All organisms emit distinct volatile gases via physiological fine-tuning and signalling as their environments change. Whilst coral reef taxa and coral reefs are hotspots for volatile gas emissions, which gases are produced, when and why, is entirely unexplored. This project unites a multidisciplinary team of experts to, for the first time, couple volatile gas assessment, metabolic physiology and functional genomics techniques to transform understanding of how key volatile gases underpin coral resilience to stress and disease, which is essential to improve coral reef ecosystem management.	79,496.00	167,809.00	176,011.00	87,698.00	0.00	0.00	511,014.00
	National Interest Test Statement Our Project will deliver new knowledge of how volatile gas emissions by coral reef taxa signify healthy reef functioning, further advancing Australia as a global leader in innovative coral reef science. Our outcomes will identify volatile gas “fingerprints” that diagnose susceptibility of reef taxa to key stressors (climate change, disease), and so directly address national Science and Research Priorities, as well as Strategic Plans (e.g. Reef 2050) for transforming management of Australia’s reef estate. In doing so, the Project carries direct benefit to stakeholders and industries reliant on healthy coral reefs, which in Australia alone underpins a >$6B per year economy and iconic cultural identity (including World Heritage Status of the Great Barrier Reef and Ningaloo). Identifying volatile gas fingerprints of reef health unlocks new potential for application of electronic-nose sensor technology to reef management – sensors that are now transforming the human health and sustainable agriculture sectors through non-invasive early-warning health diagnostics, and central to growth of new bio-sensor industries.							
DP200100358 Oberst, Dr Sebastian M	Our recent research revealed termites use vibrations to avoid predators/competitors for survival. However, the enabling mechanisms of this amazing ability remain unknown. The project aims at unlocking the secrets of these mechanisms by relating the mechanical properties of termite, legs, antennae and sensing organs (measured with advanced micro measurement techniques) to vibration signatures of ants and termites (extracted using innovative signal processing techniques and nonlinear dynamics). We will develop novel bio-dynamics models that incorporate machine learning. We will test the models’ ability to manipulate termites foraging behaviour, with the ultimate objective of developing chemical-free, vibration-based pest control devices.	66,132.00	150,829.00	164,465.00	79,768.00	0.00	0.00	461,194.00
	National Interest Test Statement This project aims to significantly advance fundamental knowledge of the evolution of vibrational communication in termites and their interrelations with competitors, parasites and predators. We will demonstrate the potential to develop innovative, environmentally friendly, vibration-based termite control technologies using bioassays on live termites. The results will put Australia at the forefront of science and technology in this field with national and international health benefits by reducing or eliminating chemical means of termite control. Further, Australia will benefit economically through reducing termite-damage related costs, currently estimated at well over A$1 billion per year, as well as generating jobs and export income.							
DP200100700 Lu, Prof Jie	Current machine learning and optimisation methods cannot well support sequential prediction and decision-making due to the dynamic nature and pervasive presence of big data. This project aims to create a foundation and technology for sequence and uncertainty learning, sequential and dynamic optimisation, and their integration. It is expected to improve robustness and mitigate the vulnerabilities of machine learning algorithms, to increase prediction accuracy and reliability in dynamic sequences, and to support decision-making in complex situations to achieve robust and adaptive results. Anticipated outcomes can help data scientists with state-of-the-art skills to manage sequential data and benefit data-enabled innovation in Australia.	80,000.00	160,000.00	160,000.00	80,000.00	0.00	0.00	480,000.00

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	National Interest Test Statement Data-driven prediction and decision-making in dynamic, uncertain and sequence environments are critical for governments, businesses and individuals. The intended outcomes of this project are fundamental, translation-ready methodologies for sequential prediction and decision-making in complex environments by sequentially, robustly, and adaptively integrating sequence learning for prediction and sequential optimisation for decision-making. The proposed techniques and prototype systems will benefit innovation and the quality of decisions when the complexity of the data environment challenges humans. Examples of potential impact include dynamically scheduled cloud computing, dynamically decision-making in autonomous vehicles and real-time anomaly detection in cybersecurity. The outputs of this project can be commercialised, promoting our ICT economy, data science, artificial intelligence, and other sectors. By opening a new research direction, the project should also increase Australia's capacity to effectively exploit data.							
DP200100919 Seymour, Prof Justin R	This project aims to resolve the foundations of healthy ocean function by employing innovative approaches to uncover the links between marine chemistry and microbiology. While the importance of microbes in governing ocean health is unquestionable, they are often studied over inappropriately large-scales, leading to inaccurate interpretation of the oceanic processes that ultimately influence fishery production and climate control. We will develop new oceanographic tools and analytical techniques to provide a unique "microbes-eye-view" of the sea. The project's outcomes are anticipated to deliver transformative new knowledge on the controls of ocean productivity and sustainability, helping to safeguard Australia's valuable marine estate.	105,000.00	220,000.00	195,000.00	80,000.00	0.00	0.00	600,000.00
	National Interest Test Statement Invisible and often ignored, marine microbes are in fact the most abundant organisms in the ocean and play profoundly important roles in maintaining the health of marine ecosystems. By governing the productivity of marine food-webs and associated fisheries, while mediating the chemical cycles that control climate, these tiny microbes have big impacts, and are key to sustaining the marine industries and ecosystem services worth $50 billion/yr to Australia's economy. However, despite their fundamental importance, marine microbes have traditionally been studied at inappropriately large-scales, and as a result our understanding of the ecological factors controlling their impacts often remains very poor. This research will apply innovative oceanographic, genomic and analytical chemistry approaches to more precisely unlock the influence of the microbiological stewards of our extremely valuable marine ecosystems, while also providing excellent training for the next generation of Australian marine scientists, helping to manage and protect our nation's important ocean territory.							
DP200100933 Wang, Dr Qilin	Sewage treatment is producing large amounts of sewage sludge, which represents a substantial, but largely untapped, energy source. This project aims to develop and demonstrate an innovative, economically attractive and environmentally friendly technology, and the underpinning science, to maximize bioenergy recovery from sewage sludge. The technology is based on the treatment of sludge using free ammonia, a by-product of sewage treatment. This project is expected to benefit Australia by substantially reducing the reliance on fossil fuels and accelerating a shift to affordable renewable energy. The outcomes of the project would provide significant energy, economic, environmental and social benefits for Australians.	41,500.00	90,000.00	89,769.00	41,269.00	0.00	0.00	262,538.00
	National Interest Test Statement The water utilities have set the aspirational targets of maximizing bioenergy recovery from sewage sludge and providing greenhouse gas neutral water services. Through removing the key technological and knowledge barriers for maximizing bioenergy recovery by delivering an innovative technology and its fundamental mechanisms, this project will provide critical support to both the Australian and global water industry in achieving their aspirational targets. The outcomes of this project would bring significant energy, economic, environmental and social benefits for Australia. It would conservatively bring Australia an additional energy production of 120,000 MWh per year, which would be adequate for supporting the sewage services in Sydney and for supporting the energy requirement of up to 40,000 households in Australia. The net economic benefit would be around $20~30 million per annum, accompanied by a substantial reduction in CO2 emission by 80~130 kilotonnes per year in Australia. The project would also create significant business opportunities for Australia through technology commercialization and licensing.							

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DP200100938 Yang, Prof Yi	This project aims to propose new algorithms and technologies for constructing an efficient video analysis system, which will be aligned with Australia's science and research priorities. Specifically, during this project, a novel network structure search method based on auto machine learning will be proposed, an unsupervised domain adaptation algorithm will be developed, and a generative data augmentation method will be constructed. All of these will construct a stable and efficient deep neural network, which is able to process large size videos captured from real scenarios in high efficiencies. Various fields, such as health care service and cybersecurity, will benefit hugely from this project. **National Interest Test Statement** The proposed research is closely related to a number of Australian Government's strategic research priority areas, such as "Effective technologies for individuals to manage their own health care" and "Discovery and understanding of vulnerabilities, threats and their impacts, enabling improved risk-based decision making". The expected research outcomes from this project will significantly improve the ability of individuals, businesses, governments, and social groups to make more efficient use of large video data in a wide range of application areas, such as in aged-care facilities, video surveillance, intelligent transportation, urban environment monitoring, emergency responses, and other daily-life activities. The fundamental research conducted in this project, together with the technologies developed by highly trained people, will advance Australia's international standing in advanced database systems, Big Data analytics, computer vision and multimedia technology, to "lift productivity and economic growth for Australia" in all areas related to video production and consumption.	81,000.00	162,000.00	162,000.00	81,000.00	0.00	0.00	486,000.00
DP200100946 Zhu, Dr Tianqing	The project aims to develop a theoretical model and practical mechanisms to address the critical challenge – 'right to be forgotten' - raised from the General Data Protection Regulation (GDPR) with minimal compromising of the utility of the data. To achieve the aim, we will design a 'right to be forgotten' framework and associated erasure mechanisms that are effective even information is derived from multiple related social networks. The framework will be created by identifying heterogeneous information, modelling individual behaviour patterns and designing erasure policies. The outcomes of the project can be used by the government to provide privacy guarantees to Australian cyberspace and by industry to protect their clients' privacy. **National Interest Test Statement** The project aims to address a critical challenge in the General Data Protection Regulation (GDPR): the right to be forgotten, which directly impacts customers, companies, citizens and governments. People may not trust data curators because of serious concerns about privacy leakage, yet data curators still have very few technologies to prevent this. Achieving this goal will restore trust between all parties, to the benefit of society as a whole. The project will provide business and government with new tools to enhance their privacy-preserving capabilities. Concerns can be addressed and trust re-built between relevant parties. When user privacy can be safely preserved in all network sources, people will be more willing to participate in projects or services in which they share their data, such as the Australian initiative My Health Record.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
DP200100950 Ji, Prof Zhengfeng	This project aims to advance our knowledge of quantum computation through the lens of algorithm and complexity theory. Three core areas of the theory will be examined: interactive computing models, query complexity, and circuit lower bounds. The expected outcomes include: revealing the quantum advantages of interactive computing models; techniques for verifying quantum devices in the cloud and quantum cloud computing in general; sharpening the separation between algorithm performance in quantum and classical query models; establishing both unconditional and conditional hardness results for quantum circuits. This comprehensive understanding will enhance Australia's research portfolio in the theory of quantum computing.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00

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	National Interest Test Statement							
	Quantum computing has increasing importance to both academics and industry. A better understanding of the power of quantum computation and its impact on industry, government, and society is of great scientific and economic value. Addressing fundamental problems in the theory of quantum computing from the algorithm and complexity theory perspective will significantly progress research in this field. The outcomes will greatly improve our knowledge about the power, the structures, and the limits of various quantum computation models. More specifically, the research in this project will provide deep insights into distributed quantum computing in the cloud, clarify the nature of quantum speedups in query and circuit models, and help us understand the impact of quantum computing on the national economy and security. The computer science emphasis of the project complements Australia's strength in quantum computing research in the physics community and will help secure Australia's place in a changing world and our global position in cutting-edge quantum computation.							
DP200100982 Huang, A/Prof Shoudong	This project aims to investigate the problem of building a three-dimensional map of a deformable environment in real-time using images and at the same time localising the camera within the map. This project expects to generate new knowledge in the area of simultaneous localisation and mapping in deformable environments using visual sensors. Expected outcomes include in-depth understanding of the fundamental sensing requirements for the problem to be solvable, the achievable accuracy, and efficient algorithms for achieving accurate three-dimensional reconstruction of deformable environments. The research outcomes from this project offer significant benefits to diverse areas such as minimally invasive robotic surgery.	57,500.00	117,500.00	122,500.00	62,500.00	0.00	0.00	360,000.00
	National Interest Test Statement							
	Using surgical robots to perform minimally invasive surgery can significantly improve the efficiency and accuracy of the surgery operations. The new techniques for visual simultaneous localisation and mapping in deformable environments to be generated in this project will significantly speed up the development of surgical robots through enhancing the robot's navigation and environment awareness ability. The potential future applications of the developed techniques in surgery and diagnostics could hold down the rising healthcare costs, which benefits the Australian community significantly. The project will further strengthen Australian contributions to robotics research by propelling the next generation of robotic applications in multiple areas.							
DP200101046 Alexander, Dr Isabella J	This project aims to leverage historical insights to investigate the tensions underlying the legal treatment of visual works of art. It will generate software and scholarship that trace the relationship between technology and visual copyright from the first statutory protections of visual artworks in the 18th century through to contemporary regulation of the dissemination of digital image data via digital publishing platforms. Its significance lies in its interdisciplinary and innovative investigation of long-standing problems of contemporary copyright law at the intersection of the visual and digtal domains. It will have impact on law reform and policy development, with benefits for visual artists, collecting institutions and the public.	35,000.00	98,750.00	123,250.00	59,500.00	0.00	0.00	316,500.00
	National Interest Test Statement							
	Arts and culture are of intrinsic value to Australian society, nourishing our inner lives, and offering measurable impacts on well-being, the economy and education. Creativity and creative skills are essential for innovation and equipping Australians for future jobs. Law-makers around the world seek to encourage the production and dissemination of creative works of visual art through copyright laws. Yet the relationship between legal regulation, technology and creativity remains poorly understood. Creation of, and access to, visual art works in the digital age is of significant commercial and cultural interest. The project will advance knowledge by combining the disciplines of legal history and art history with techniques from computer vision and data science in an innovative, international collaboration. By offering a comprehensive historical overview of the relationship between artists, technology, and visual copyright, this project will contribute to debates over the role and reform of copyright law, as well as informing the development of policies regulating the circulation of image collections online.							

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DP200101058 Hansbro, Prof Phil M	We aim to completely define the cellular and molecular biology of gut and lung M cells for the first time. We will elucidate how they develop, are regulated and function at a molecular level, and how M cells maintain normal gut and lung tissues and induce immune responses to protect against microbial challenges. In the future, the new insights will be essential pre-requisites for the development of mucosal-based interventions and vaccines that protect the gut and lung from infectious and inflammatory issues. The harnessing of effective immune responses to control such challenges, are of enormous fundamental and long-standing biological interest, and are amongst the most important areas of current scientific research. **National Interest Test Statement** Our proposal will produce significant new knowledge by elucidating the fundamental biology of M cells and their role in mucosal homeostasis and immunity in the gut and lung. This will address the national and global challenge of inducing protective immune responses and controlling microbes and will place Australian researchers at the forefront of investigating these processes. 75,000 Australians have gut disease costing $2.7 billion per year and >$840 million for livestock. In the lung, influenza alone causes 3,000 deaths, costs $115 million and regular culling of poultry and pigs. In the future, we will use the new knowledge to progress research into maintaining mucosal protection, mucosal vaccination and disease prevention and treatment. The new insights into M cell biology are essential pre-requisites that will enable the harnessing of immunity to protect against mucosal infections. The deleterious effects of infections and harnessing of effective immunity to control them, are of enormous long-standing biological interest and are amongst the most important areas of current research.	80,000.00	163,000.00	170,000.00	87,000.00	0.00	0.00	500,000.00
DP200101249 Wang, Prof Guoxiu	This project aims to develop lithium-rich cathode materials for a new generation of high-energy lithium-ion batteries. These innovative materials could double the capacity of commercial cathodes, thereby doubling the energy density of lithium-ion batteries. A further increase is anticipated from fundamental insights into anionic redox. Expected outcomes include materials with optimised architecture and chemistry, stabilisation of lithium-rich cathodes, identification of redox mechanism of lithium-rich cathode materials, technologies for producing lithium-rich cathode materials on a large scale and fabrication of new generation high-energy lithium-ion batteries. This project will have benefits especially in the transport and energy sectors. **National Interest Test Statement** Lithium-ion batteries have conquered portable electronics and are enabling the widespread adoption of electric vehicles and the use of renewable energies. This project aims to create new cathode materials for lithium-ion batteries that will enable these batteries to work much longer. The development of high-energy lithium-ion batteries will also help Australian utilities to implement smart electricity grids that can better integrate renewable energy and improve the reliability of electricity supply to Australian consumers and industry. The project's outcomes will support a secure, reliable low-emission energy future for Australia, and open new industry and job opportunities in battery materials and manufacturing. They will help the Australian government to achieve goals in climate change and energy policy and strengthen investment in renewables. The novel materials and new-generation of lithium-ion batteries have strong prospects for commercialisation, given evident industry demand from automotive and renewable energy sectors.	65,000.00	132,500.00	135,000.00	67,500.00	0.00	0.00	400,000.00
DP200101328 Tsang, Prof Ivor W	This project aims to design and implement a foundational deep representation learning framework for early detection, classification and defense of emerging malware by capturing their underlying behaviours via structured and unstructured heterogeneous information through hybrid representation learning, behaviour graph mining, and symbolic adversarial learning to discover and defend unknown malware families, thereby significantly boosting the accuracy and robustness of existing classifiers and detectors. The resulting representation learning framework will enhance the national security to protect user privacy, reducing the multi-million-dollar loss caused by fraudulent transactions, and defending against cyber attacks.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00

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	National Interest Test Statement							
	This project will conduct seminal research for building a foundational framework that supports reliable and robust malware detection and understanding through adversarial learning of hybrid representation for emerging malware. Tackling the challenges in complicated malware representation and discovery of zero-day malware, this project will deliver both theoretical foundations and frontier technical solutions to the machine learning community to further enhance the competitiveness Australia's research in this important area. By supporting research training for PhDs, this project will also provide a fertile environment to attract national and international talents, contributing to Australia's skill base. The success of this project will provide a new infrastructure for detecting and classifying emerging malware, thereby providing a trustworthy mobile environment that benefit a large part of Australia's ICT industry, where smart devices are the essential parts of almost every software ecosystem, e.g., defence, social network, finance, banking, retail, and communication.							
DP200101374 Yu, Prof Shui	This project aims to create a novel and effective method for privacy protection at individual level, which is now a great concern of persons, businesses, and government agencies in this big data age. The project expects to build an automatic smart practical personalized privacy preserving system through removing the fundamental obstacles. The project will significantly advance human knowledge of privacy, and push Australia to the front line of the research field, and protect Australia better.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement							
	The success of the project will benefit all Australians in two aspects: protect our privacy at individual level and prevent or reduce the possible loss due to privacy attacks; at the same time, encourage people and businesses to share sensitive data in a worry-free way, which will enable the governments and businesses to have a better understanding of the different parts of the society, and then serve each sector of the country better.							
DP200101438 Anufriev, Prof Mikhail	This project aims to improve our understanding of individual decision making in financial markets and its implications for macro-economic stability. Using laboratory and internet experiments, models of adaptive choice behaviour will be developed and validated. The project will help to gain insight into how past information, and the way it is presented, affects investment decisions, which individual characteristics matter for decisions, and how this behaviour translates into the evolution of aggregate macro-economic variables. The expected outcomes of the project will have the potential to improve the design of tools for better individual financial decision making, to stabilize volatile markets and to enhance economic welfare.	55,543.50	154,230.50	186,654.50	87,967.50	0.00	0.00	484,396.00
	National Interest Test Statement							
	This project will have a positive impact on Australia in several aspects. First, the investment experiments will help us to determine how the interplay between presentation of relevant information and individual characteristics affects individual well-being. This will enable policy-makers to design better policies including financial education and guidelines on presentation of information (e.g., for the superannuation funds). In light of recent findings of the Royal Commission, there is a need for improving current financial advice to customers. Second, the project will develop a better model of dynamic economic systems with feedback. Performing policy analysis using such a model will deliver better advice for macroeconomic stability. Finally, by collaborating with high profile academics from the Netherlands and the US, combining expertise in nonlinear dynamics, experiments, macroeconomics, and finance, training 2 PhD and 4 Honours students, and producing high quality publications in top international journals, this project will contribute to enhancing research environment of Australia.							
DP200101445 Putnins, Prof Talis J	Financial markets are failing to serve society. The recent Royal Commission into Misconduct in Financial Services has highlighted many examples, as have major litigation cases against Australia's banks for market manipulation at enormous scale. Markets are becoming increasingly fragile with the automation of trading and are failing in funding companies, with fewer companies listing on stock markets. This project will investigate how and why financial markets are failing, what are the real effects of these failings, and what should be done about them. The project will develop policy solutions to mitigate the failings, thereby enhancing Australia's economic prosperity, benefitting retirement savings, and improving regulatory efficiency.	30,392.00	65,284.00	65,284.00	30,392.00	0.00	0.00	191,352.00

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	National Interest Test Statement							
	Financial markets serve a crucial role in our economy, providing capital for investment by companies (e.g., the 2,283 listed Australian companies worth $1.86 trillion), thereby driving economic growth, and providing investment returns on retirement savings (e.g., the 1.1 million Australians with $755 billion in Self-Managed Super Funds). Well-functioning financial markets therefore benefit the economy and society enormously. However, markets cannot function without trust and confidence. Markets are also ineffective when plagued by concerns about fragility and instability. Collectively, the research agenda in this project tackles the issue of how can we restore confidence in financial markets and have them work for the benefit of society. How can we make them more robust and thereby promote economic prosperity. The economic benefits of even modest improvements to the integrity and robustness of Australia's financial markets are many multiples of the proposed investment in this research project.							
DP200101462 Hemsley, Prof Bronwyn	This project aims to identify ways that 3D food printing (additive manufacturing using real food in a device like a ink-jet printer) could be used to improve the visual appeal of puree meals for people with swallowing difficulty, who make up ~8% of the world's population. This study will be the first to include people with swallowing disability (e.g., related to cerebral palsy, stroke, older age) and their supporters in examining the views and experiences of stakeholders on the impact of 3D food printing on quality of life, enjoyment, participation, and safety. Outcomes include new knowledge on factors affecting the implementation of 3D food printing in disability and aged care services, to inform policy, practice, and future research.	64,423.50	127,593.00	121,388.00	58,218.50	0.00	0.00	371,623.00
	National Interest Test Statement							
	This 3-year project will advance the design and implementation of inclusive 3D food printing technologies in the homes of people with swallowing difficulties, an estimated 8% of the population. The provision of thickened fluids and pureed foods is routine in the management of swallowing difficulties. However, puree foods are often unattractive, by being indistinguishable, and unsafe in residential care, reducing mealtime-related quality of life for people who need these foods to survive. 3D food printing potentially offers a solution to this problem but research on its development and implementation to date has excluded engagement with key target groups: people with swallowing difficulties, their supporters and key stakeholders in food services industry and residential care. The new knowledge created in this inclusive research will bring meaningful social benefits through enhancing the quality, appeal, and safety of 3D printed puree meals provided to people with swallowing disability, and enhancing their participation and autonomy in the food creation process.							
DP200101532 Huang, Prof Xiaojing	This project aims to develop the theory and enabling techniques to achieve high-speed millimeter wave (mm-wave) backbones for integrated space and terrestrial networks. New scientific breakthroughs will be in fundamental transmission theory, efficient self-interference cancellation and spatial multiplexing techniques using hybrid antenna arrays. These will enable Terabits per second wireless transmission that is 10 times faster than current technologies. A proof-of-concept prototype will be developed to demonstrate the feasibility and performance of the new system architecture and algorithms, thus paving the way for commercialisation. The developed technology will enhance Australia's information infrastructure as well as defence capacity.	78,500.00	163,000.00	163,000.00	78,500.00	0.00	0.00	483,000.00
	National Interest Test Statement							
	Integrated space and terrestrial network (ISTN) will serve as arguably the most important national and global information infrastructure for the 21st century. A critical component of the network is the high-speed aerial backbone that interconnects the spaceborne, airborne and ground based transmission systems to form a seamless global communication network. The project will enhance Australia's leadership in wireless communication technology. The innovations developed in this project will enable Terabit mm-wave backbones to be used the ISTN which is one of the main targets of the 6th generation mobile systems. Such systems will truly connect everyone and everything at any time and from anywhere, supporting industries such as logistics, fishery, mining, agriculture and defence. The benefits of improved communication capability will impact all aspects of people's lives and industries, bringing economic and social benefits to Australian society. The project also targets technology transfer and commercialisation and hence will stimulate growth of the local industry and attract overseas investment to Australia.							

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DP200101860 Stewart, Dr Martin P	Cells transmit information through molecules. By delivering foreign molecules into cells, such as DNA and proteins, it is possible to engineer and reprogram cells just like a computer. This proposal aims to develop a novel microfluidic device for intracellular delivery. The device will work by exposing cells to rapid thermal shock to generate transient disruptions in cell membranes and thereby enable influx of foreign molecules into cells. To understand how the method can be optimized, the thermodynamic pathway of membrane disruption will be investigated at a single cell level. The methods and insights arising from this project could eventually lead to novel, patentable and lower-cost health technologies.	92,500.00	172,500.00	160,000.00	80,000.00	0.00	0.00	505,000.00
	National Interest Test Statement The proposed approach for performing intracellular delivery via thermal shock on mammalian cells is innovative and not published previously. New intellectual property arising from this work could provide a foundation for a local start-up company, such benefiting the Australian Biotech scene. Moreover, one of the Australian Government's research priority areas is 'Advanced Manufacturing'. This project could provide a new means for 'Biomanufacture', which is the production of biomaterials and biomolecules by the harnessing of biological systems. This project may provide breakthrough methods for transfecting and reprogramming cells to produce biomaterials and biomolecules for various industries with higher yield and scalability than competing techniques. In future, it could become a platform technology in medical applications. For example, to conduct gene therapy on blood cells to cure genetic diseases or reprogram immune cells for cancer immunotherapy. This proposal aims to decode the basic mechanisms underpinning thermal shock-driven intracellular delivery technologies for the long-term benefit of humankind.							
DP200102445 Bradfield, Dr Laura A	The hippocampus is a part of the brain that is central to learning and memory yet little is known about its role in decision-making. It is the aim of this application to provide the first detailed, causal evidence of hippocampal regulation of decision-making. This is significant because many mental health disorders and dementias that involve decision-making deficits are characterised by hippocampal dysfunction, but any direct link between these factors is unknown. The outcomes of the current grant will provide the first evidence of that link, thus providing deeper understanding of the neurophysiological mechanisms of these disorders, which could eventuate in the creation of more beneficial treatments.	83,403.00	169,217.50	167,061.50	81,247.00	0.00	0.00	500,929.00
	National Interest Test Statement Decision-making impairments are broadly observed across most mental health disorders as well as many different types of dementia. However, the neural causes of these impairments are unclear. One finding that is relatively common to most of these disorders is of massive dysfunction in the hippocampus, a region of the brain that is central to learning and memory. Further, in almost all of these disorders, neuroinflammation in the hippocampus (and elsewhere) is particularly known to cause dysfunction. It is surprising, therefore, that so little is known about hippocampal regulation of decision-making at a basic level. The current proposal aims to address this question. This information will be helpful for professionals treating disorders and dementia, as well as the individuals with these diseases (e.g. drug addicts or individuals with binge eating disorder), who are trying to understand the inflexibility of their actions or the reasons underlying their poor decisions. Increasing knowledge in this way might eventually bring about economic benefit, reducing the enormous costs associated with such diseases.							
	University of Technology Sydney	1,365,390.00	2,854,213.00	2,901,383.00	1,412,560.00	0.00	0.00	8,533,546.00
University of Wollongong								
DP200100065 Trevitt, A/Prof Adam J	Mass spectrometry is a major tool for the detection of molecules for understanding disease, pollution control and chemical synthesis. However, intricate differences in molecular structure - vital to chemical function - can confuse detection methods leading to false negatives. This is especially problematic for complex biological samples. Recent breakthroughs in laser-based mass spectrometry methods, combined with ion mobility, now allow detection of subtle yet important structural features. This project aims to exploit these advances by developing new instrumentation and protocols with these enhanced capabilities thus accelerating advances in automated mass spectrometry, improved antibiotic detection and complex biomolecule screening.	50,000.00	130,000.00	160,000.00	80,000.00	0.00	0.00	420,000.00

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	National Interest Test Statement							
	New fundamental science and technical methods will be developed for more accurate and sensitive molecular detection for disease diagnosis, pollution control and chemical synthesis. Highly-skilled students will be trained in instrumentation development, mass spectrometry, high-powered lasers and chemical detection. These developments will accelerate discoveries that exploit laser activation in chemistry, biology and advanced materials and furthermore create new technology for a deeper understanding of the underlying structure of molecular ions.							
DP200100101 Quilter, A/Prof Julia A	There is strong evidence that intoxication by alcohol and other drugs is frequently associated with sexual violence. Criminal law reforms in Australia have attempted to break the 'rape myth' nexus between intoxication and assumed consent. This project will subject the operation of relevant rules to systematic analysis. Focusing on intoxication evidence in rape trials, this project will undertake qualitative analysis of appellate judgments, court transcripts and interviews with prosecutors and defence lawyers, in three Australian jurisdictions. It should produce significant new knowledge about whether existing laws and court room practices are optimally adapted to achieving the important objective of justice for sexual violence victims.	73,073.00	97,888.00	46,588.00	21,773.00	0.00	0.00	239,322.00
	National Interest Test Statement							
	Despite 40 years of rape law reform, justice for victims remains elusive. This project will generate new knowledge about how intoxication evidence affects rape trials, and how existing laws, practices and attitudes may continue to impede justice for rape complainants. Findings will be shared with advocates for sexual violence victims, legal professional bodies, judges, and relevant government departments. Where weaknesses are identified, the project will make targeted recommendations for statutory amendments and changes to court room trial practices to improve the delivery of justice in rape trials. These outcomes will produce social benefits for victims of sexual violence, improve the quality of public policy and law reform, and enhance the integrity of the criminal justice system. The Australian legal system rightly aspires to be a world leader in confronting gender-based violence, including by ensuring justice is provided to victims of sexual violence. By adding to the evidence-base and facilitating continuous improvement, this project can be expected to contribute to Australia's national interest.							
DP200100144 Susilo, Prof Willy	Public cloud storage offers low-cost solutions for small and medium-sized enterprises. However, cloud data leakage is a major concern. Encrypting data with a security policy before storing in the cloud does not solve the problem due to the presence of malicious senders who deliberately make encrypted data accessible beyond the described policy. This project aims to enable secure public cloud storage by developing new practical cryptographic solutions that provide protection against malicious senders, in contrast to the existing knowledge that can only cope with malicious receivers. The expected outcomes are innovative technologies, which will lower infrastructure costs and provide cybersecurity for cloud storage.	53,135.00	110,179.50	117,902.00	60,857.50	0.00	0.00	342,074.00
	National Interest Test Statement							
	In the context of secure cloud storage, the involvement of malicious senders has not been studied. It directly hinders the adoption of public cloud storage as it diminishes cloud users' confidence in using the cloud solution. Providing secure cloud solutions, and hence secure cloud technologies, in the presence of malicious senders will directly enable frontier technologies with the aim of improving cybersecurity for all Australians. The outcomes of this project will bring direct benefit to Australian industries by lowering costs and increasing productivity. The project impacts include significant changes in Australian cybersecurity standards, which will be influenced through the Australian Signals Directorate. It will enable research training for the best available Australian and international researchers through research collaboration. This project will deliver research outcomes directly to Australia and will enhance Australia's research capability, and secure data storage by enabling secure and environmentally friendly cloud storage.							
DP200100149 Du, Prof Haiping	This project aims to develop an innovative, electromagnetically interconnected suspension system to enhance vehicle ride comfort, stability and handling dynamics, and thus safety of electrified vehicles. Specifically, the project integrates a set of novel electromagnetic shock absorbers to form an effective electrical network so as to realise an electromagnetically interconnected suspension system. Advanced integrated control techniques can then be applied to improve vehicle performance and dynamics in three planes. The project will assist the rapid development of transportation electrification. The outcomes from this project will lead to tangible improvements in vehicle comfort and safety.	50,000.00	105,000.00	110,000.00	55,000.00	0.00	0.00	320,000.00

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	National Interest Test Statement Through exploring innovative electromagnetically interconnected suspension and integration of advanced control techniques, this project aims to improve electrified vehicle ride comfort, stability and handling dynamics with the intention of isolating vibration and preventing accidents. As stated in the Australian Government's 2015 report on the future of Australia's Automotive Industry, 'Australia is a country that relies heavily on the automotive industry...'; and 'Australia has a long history of excellence in automotive manufacturing, industrial engineering and design.' The expected outcomes will enable Australian automobile original equipment manufacturers to increase their capability and capacity in leading edge technologies and products in the automotive industry, leading to growth of the Australian economy. With improved vehicle safety from the new suspension, the prevalence of injuries and accidents can also be reduced, thereby realising a safer society. This project is expected to contribute to Australia's international leadership in automobile engineering, enhancing Australian innovation culture.							
DP200100155 Sims, Prof Aidan D	The aim of this project is to develop mathematics that enables us to transfer information back and forth between dynamical systems and algebras, including operator algebras. Dynamical systems - systems that change over time - are ubiquitous, and central to modern mathematics and its applications. In mathematics, dualities allow us to translate questions from one context to another in which they are easier to solve and then translate the answer back again. Expected outcomes include increased understanding of the relationship between operator algebras and the dynamical systems that they represent. Benefits include enhanced international collaboration, and increased Australian capacity in pure mathematics, particularly operator algebras.	73,500.00	152,000.00	157,000.00	78,500.00	0.00	0.00	461,000.00
	National Interest Test Statement Long-term commercial impact of fundamental research in mathematics is common, but hard to predict. It typically arises through the development of new technologies based on the use of mathematical concepts in other disciplines. The operator algebras central to this project underpin quantum mechanics, which in turn enabled the development of the transistors and LEDs from which your electronic devices are built. Impact also arises via mathematically skilled individuals who transition to industry. At least five recent doctoral graduates in operator algebras are currently working in Australian government agencies and driving policy. This project supports world-leading research in operator algebras, expands Australia's knowledge base in mathematics, and fosters Australian international competitiveness. Its capacity-building aspects will train individuals who will enhance Australia's international reputation, our ability to make decisions informed by evidence and data, and our broader economy.							
DP200100176 McGuirk, Prof Pauline	Across the world, innovations in urban governance are emerging as cities seek to address complex urban challenges. This project poses much needed critical questions of these innovations: who do they involve; how do they work; how do they intersect with longstanding practices of governing the city. It aims to build new understandings of urban governance by delineating the scope, mechanisms, limits and potentials of these innovations. Through integrating insights from Australian and international cases, project outcomes include new knowledge to inform urban governance innovation for the Australian context and enhanced capacity to facilitate the future prosperity, wellbeing and democratic inclusiveness of Australian cities.	48,465.00	112,635.50	111,813.00	47,642.50	0.00	0.00	320,556.00
	National Interest Test Statement As cities become more complex, more is expected of urban governance. One significant response to these new expectations is innovation in how and by whom cities are governed. New roles for the government, business, civic and university sectors are emerging, as are innovations in financing and collaborative partnerships (such as CityDeals). Little is known about the governance capacities produced by these new ways of governing, their effectiveness, inclusiveness and legitimacy, or their ultimate benefit to future cities. This project will produce an Australian and international evidence-base to reveal and disseminate new knowledge on the actors, practices and processes involved in advancing urban governance innovations, their possibilities and limits. This new knowledge will benefit Australian cities as a support framework to help them recalibrate governance capacities and by informing national policies to help them fulfil their roles. The project will also benefit Australia by extending and deepening its international research linkages and nurturing the next generation of promising young urban scholars.							

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DP200100206 McGregor, A/Prof Helen V	This project aims to investigate the interconnected processes that led to past reef growth and demise. The iconic Great Barrier Reef and reefs globally are under threat. Yet reefs appear to have undergone cycles of death and recovery, though the causes are poorly understood. This project will reconstruct past climate, rainfall, water quality, coral bleaching and reef ecology feedbacks across Great Barrier Reef death events to establish which environmental stressors and paleoclimate variations are most critical for reef health. The outcomes will better constrain long term coral reef dynamics and provide significant benefits to those who manage reefs globally, since the Great Barrier Reef covers the full range of reef environments.	70,500.00	147,500.00	138,500.00	61,500.00	0.00	0.00	418,000.00
	National Interest Test Statement The project will revolutionise understanding of climate-ecology feedback experienced by Australia's Great Barrier Reef – a unique World Heritage site. The project will capture the reef's natural range of variability and will give a clearer understanding of the timing rates and spatial variability of reef loss and recovery. An additional benefit is a more comprehensive understanding of climate, rainfall and drought variability in north Queensland and the tropical western Pacific, important for water managers and for improved climate modelling. This project will give environmental decision makers new quantitative information needed to maintain reef health and to ensure correct assessments of the state of the reef are made. Better reef management will benefit the ~$6.4 billion fisheries and tourism industries dependant on the Reef.							
DP200100223 Robinson, Prof Sharon A	Declines in terrestrial ecosystem health as a result of a drying climate have been observed in some areas of East Antarctica. This project aims to determine if such changes are widespread. Since mosses, the dominant plants of Antarctica, preserve a record of past climate down their shoots they can be used as surrogates to study how both ecosystems and climate are changing at remote polar sites. Outcomes will include improved climate data for Antarctica, enabling more robust analysis of regional climate change, and development of ultrahigh-resolution techniques capable of non-destructively monitoring Antarctic ecosystem health. This research will advance ecosystem science and inform best practice in management of Antarctic biodiversity.	92,500.00	172,500.00	160,000.00	80,000.00	0.00	0.00	505,000.00
	National Interest Test Statement Australia claims 42% of the Antarctic continent including some of the best developed, most extensive vegetation on the continent but recent expeditions and research suggest that the health of this vegetation is declining. Australia has key international obligations under the Antarctic Treaty to protect these terrestrial ecosystems within its Antarctic territories. Polar mosses will be used as sentinels to determine the extent to which climate change and ozone depletion have impacted Antarctic terrestrial ecosystems. These plants are also important indicators for the future resilience of Antarctic terrestrial communities. We will develop novel remote sensing methods capable of non-destructively monitoring Antarctic ecosystem health, and identify biodiversity most at risk. This will provide Antarctic Environmental Managers, from Australia and other nations, with new tools and information to assess the health of plant communities enabling appropriate protection and management of biodiversity and satisfying Australian State of the Environment and International Antarctic Treaty obligations.							
DP200100365 Dou, Prof Shi Xue	This project aims to develop a promising electrocatalyst technology platform, based on novel 2D material architectures that have applications ranging from hydrogen generation via water splitting through to carbon dioxide reduction. The project is expected to generate advanced knowledge for the rational design of electrocatalysts and to promote the development of renewable energy technologies. Expected outcomes include a clear understanding of the relevant fundamental science and mechanisms, a framework for designing and optimising for specific applications, and a demonstration of prototype devices. This project is of great benefit for addressing Australia's energy and environmental concerns and boosting national economic growth as well.	80,000.00	160,000.00	160,000.00	80,000.00	0.00	0.00	480,000.00

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	National Interest Test Statement This project has been designed to provide clear and strategic benefit to Australia through ensuring we retain scientific leadership and a strong capability for developing transformative electrocatalyst technologies that will play a major role in our transition to a more renewable and sustainable energy future. While the initial focus of this project is on demonstrating this platform technology for hydrogen generation via water splitting, we have also identified carbon dioxide reduction applications, where both could be of significant economic, environmental, and social impacts. Australia has the capacity to be a leader in the hydrogen market, and it is imperative Australia maintains scientific and IP leadership to capture as much of the value chain as possible. This research has great potential to impact millions of Australians – through the development of a cutting-edge electrocatalyst technology platform; the substantial benefits of the application of this platform to establish a sustainable energy future; and through the cultivation of next-generation materials scientists through high-quality training.							
DP200100633 Gibson, Prof Christopher R	This project aims to investigate the past, present and future significance of Australian industrial landscapes. It focuses on a crucial trading zone and one of the nation's most significant industrial precincts, Port Kembla, New South Wales. Amidst growing debate over the future of port infrastructures and urban industrial land, a novel interdisciplinary, place-based approach aims to understand how industrial ports and surrounding communities endure and evolve over time. Expected outcomes include timely archiving of recent industrial, worker and migrant histories, new knowledge that will contribute to resilient industrial port regions and economies, and an evidence base for future strategic thinking around industrial port infrastructure.	65,449.00	154,057.50	122,988.00	34,379.50	0.00	0.00	376,874.00
	National Interest Test Statement Urban and regional industrial ports are key sites connecting Australia with international trade and infrastructure networks. Yet the future of urban industrial space is increasingly under threat, amidst competing land use pressures and macroeconomic transformations. Meanwhile, following privatisations and regulatory complications, the future of port infrastructure is also unclear. Amplifying the policy problem is that substantial changes are unfurling within an evidence vacuum. This historical-geographical project seeks to respond by comprehensively documenting temporal change, existing capacities and future aspirations for port industrial space, at a point in time marked by technological and economic upheaval. The research will enable industrial enterprises, strategic planners and researchers to make better-informed decisions that leverage existing strengths of legacy industrial localities. Australia will benefit from a rigorous analysis of existing industrial precincts, infrastructures and workforces, supporting better understanding of the nation's future industrial capacities.							
DP200100750 Orchard, A/Prof Phil C	This project aims to investigate how the United Nations and individual states can respond to forced displacement crimes through seven emerging accountability mechanisms at the domestic, regional, and international levels. The growth of conflict-induced forced migration is at unprecedented levels, driven in part by states that deliberately displace their own populations in contravention of international law. This project will use a comparative and focused approach to examine the effectiveness of the range of current efforts to hold state and individual perpetrators accountable. In so doing, it will directly inform the Australian and international policy-making response to such crimes with the goal of averting future forced migrant movements.	27,730.00	59,343.50	63,147.50	31,534.00	0.00	0.00	181,755.00
	National Interest Test Statement A systematic examination of emerging accountability mechanisms to respond to forced displacement crimes is crucial for informing Australian responses to this important challenge. The Australian government has made a number of core commitments at the domestic and international levels in order to improve the response to refugees and internally displaced persons and to protect people affected by conflict, including in the 2017 Foreign Policy White Paper. The research proposed in this project will systematically examine the effectiveness of seven different mechanisms at the international, regional, and domestic levels which can hold state and individual perpetrators of forced displacement crimes to account through law, sanctions, and other measures. This project's findings will be directly communicated to practitioners and tailored to the needs of Australia's foreign policy establishment, as well as to international policy makers. It will address one of the core drivers of forced migrants globally, and help Australia respond effectively to the current global crisis.							

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DP200101123 Dosseto, A/Prof Anthony	Fire shapes Australia's landscape, biodiversity and resources. This project aims to quantify the recent history of fire intensity and severity using several novel proxies in the fire-prone landscapes of south-eastern Australia. Calibration of these new proxies to recent wildfires will be used for a better characterisation of fire regimes. This research will be applied to sedimentary archives to investigate how fire regimes have evolved over the past 100 years. The outcomes will inform debates about the relationship between climatic variability and fire severity, and this will contribute to increase the preparedness of natural resource management to potential future climate and land-use scenarios.	63,500.00	138,500.00	126,000.00	51,000.00	0.00	0.00	379,000.00
	National Interest Test Statement Bushfires are Australia's worst natural hazard in terms of loss of life. It is critical to understand how fire regimes will respond to future climate change in south-eastern Australia, where most of the Australian population is concentrated. To achieve this, models need data of past relationship between fire and climate. So far, data available only go back 20-40 years, which limits the robustness of forecasting models. This project will develop novel tools to identify the intensity and severity of past fire events, and produce a 100-year record of fire history in south-eastern Australia. By extending up to five-fold our knowledge of past fire regimes, outcomes from this project will improve our ability to forecast how they will change in the future.							
DP200101289 Wang, A/Prof Lei	Image retrieval plays a key role in many practical applications. The recent increase of real-world applications calls for higher retrieval accuracy. This project aims to address this issue by exploring advanced visual representation that models the high-order information of image content. This project expects to generate new knowledge in the area of computer vision by developing a novel image retrieval framework. Expected outcomes include theory development on visual representation and more effective retrieval techniques. This should provide significant benefits, such as improving public information access services, facilitating environmental monitoring, and enhancing smart traffic management.	72,500.00	147,500.00	150,000.00	75,000.00	0.00	0.00	445,000.00
	National Interest Test Statement Image retrieval aims to find the images from a large database that meet the requirements submitted by a user. It is a fundamental task in practical applications involving visual information. Developing advanced retrieval techniques has great potential to contribute to Australia's national interest. For the economic benefit, this technique can significantly automate visual information access, increasing the efficiency and precision of information extraction. This not only lowers labour costs but also improves productive efficiency. For the commercial benefit, image retrieval is an efficient means to connect customers with suppliers. Given a photo of a product, image retrieval can find the best supplier online. For the environmental benefit, this technique can be applied to vegetation monitoring or inferring the sea-level change of the Great Barrier Reef. For social and cultural benefits, image retrieval improves public access to the visual information in archives, libraries, and museums.							
DP200101363 Ville, Prof Simon P	We aim to deliver the first history of foreign multinational firms in twentieth-century Australia, connecting to, and enhancing, a rich overseas literature on global business. Foreign corporations have played a critical but poorly understood role here with public and policy opinions polarised between approval for new investment, job creation and innovation against concern for their impact on tax revenue, competition, and economic policy. Through a closer, long term understanding of multinationals – their magnitude, motives to settle here, corporate structures, and adaptation to local conditions – our findings will inform public debate and policy about the roles of foreign investment and foreign enterprises in the Australian economy today.	40,596.50	80,663.50	60,339.50	20,272.50	0.00	0.00	201,872.00

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	National Interest Test Statement							
	Overseas multinational enterprises have occupied an important place in Australian business for over a century. Their contributions to our economic, commercial, environmental, social and cultural life have been the subject of strenuous debate over decades. Their right to settle in Australia and under what terms is the subject of ongoing policy development. This project will provide a long run account of the nature and impact of multinational enterprises in Australia and, as such, will offer an important voice in better understanding these major institutions. It will explain where these firms have come from, what motivated their decisions to invest in Australia, and in which industries they have been predominantly located. Their impact in Australia will be assessed from multiple perspectives including their contributions to capital formation, export earnings, employment, and improvements in production, product and managerial technologies. In brief, the project will inform public debate and policy, in Australia today, about the roles of foreign investment and foreign enterprises in the Australian economy.							
DP200101591 Murray-Wallace, Prof Colin V	This project aims to reconstruct environmental changes that occurred in southern Australia during a geologically recent time interval termed the Early-Middle Pleistocene Transition (1.2 million to 700 thousand years ago) and an interglacial period some 400,000 years ago. Using innovative geochronological, geochemical and modelling techniques, the environmental changes that shaped modern Australian coastal landscapes, including the intensification of aridity and their timing will be examined. The project will yield new knowledge about the sensitivity of landscapes to current and ongoing environmental changes and derive explanatory models of the rates and characteristics of landscape response to assist future coastal environmental management.	60,000.00	139,000.00	135,500.00	56,500.00	0.00	0.00	391,000.00
	National Interest Test Statement							
	Focusing on a period of profound environmental and climatic change that occurred in the geologically recent history of Australia, this project will derive information about the sensitivity of Australian landscapes to future climate and environmental changes. The research findings will assist in the management of landscapes in the Lower Murray-Darling drainage system, a critical issue for the Australian nation. In economic terms, the research will assist in reducing the costs of land management by identifying the key drivers of landscape change and their impact on human land use. The derived geological information will also refine the understanding of coastal environmental processes, sea-level changes and global climate-changes as they relate to fisheries, construction and engineering industries and potential geohazards. In a cultural and social heritage context, the research will enhance the understanding of the inherent nature of Australian landscapes and their perceived influence on a national identity, as well as providing important geological information of commercial significance in geotourism.							
DP200101862 Guo, Prof Zaiping	This project aims to advance energy storage technology by developing high energy aqueous rechargeable zinc batteries, which are the most promising choice for large-scale electrical energy storage, in particular for smart electric grids, owing to their low cost, high safety, and eco-friendly features. The success of this project will advance our fundamental understanding of aqueous rechargeable batteries, provide techniques for the development of a low-cost, high energy, and long life system for renewable energy storage, and benefit Australia's environment, economy, and sustainability.	85,000.00	170,000.00	170,000.00	85,000.00	0.00	0.00	510,000.00
	National Interest Test Statement							
	This project will develop safe, low-cost, high-energy, and long-life aqueous rechargeable zinc batteries to achieve energy storage for smart grids, especially for storing intermittent solar and wind energy in Australia. The proposed zinc battery system will advance energy storage technology and implement clean energy into a smart grid in an efficient, safe, and sustainable way. This project will generate new fundamental knowledge on designing high performance electrode materials and enhance our understanding of the charge storage and kinetics in zinc batteries, which will provide guidance for developing sustainable energy storage device. The project will train students and young scientists in this emerging area, support Australia's access to new high-technology markets, and enhance the international competitiveness of Australia in the energy storage field. It will also create intellectual property with potential commercialized products for storing renewable energy, bring business opportunities for industries, reduce our dependence on fossil fuels, and facilitate a cleaner and more sustainable Australia.							

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DP200102008 Cliff, Dr Dylan P	This project aims to discover how much physical activity, sedentary behaviour and sleep young children need each day to best support their development. Through the creation of an international database and the application of innovative analytics, the project seeks to determine the optimal daily balance of these behaviours that results in the best developmental outcomes for young children. The project is expected to inform national movement behaviour guidelines. The expected benefit for parents and professionals is improved confidence in supporting children's physical activity, sedentary behaviour and sleep. The expected benefit for children is positive development, given the broad impacts of these behaviours on health and well-being.	84,323.00	168,832.00	109,843.50	25,334.50	0.00	0.00	388,333.00
	National Interest Test Statement This project is expected to have important social benefits for the Australian community through identifying how much physical activity, sedentary behaviour and sleep young children need each day to best support their development. The discovered knowledge on the optimal daily levels of each movement behaviour to best support children's development is expected to be beneficial for: i) parents aiming to support their children's development; ii) professionals, aiming to enhance developmental outcomes in young children, and; iii) government health departments seeking to develop evidence-based guidelines for the public. Specifically, the new evidence is expected to inform updates of the Australian 24-Hour Movement Guidelines for the Early Years (0-5 years), which provide recommendations on daily levels of physical activity, sedentary behaviour and sleep for young children. The new knowledge will allow the creation of more effective strategies and public health messages designed to promote optimal development in children, and contribute to the promotion of their physical, mental and cognitive development.							
DP200103405 Muttaqi, Prof Kashem M	The research aims to design, develop and implement a next generation, compact and light-weight, smart solid-state transformer with a newly developed high-frequency magnetic link and power converters that will provide a better and faster voltage transformation and regulation and support the power grids. The proposed research will revolutionize the power grids by replacing the traditional transformer with a new device made of solid-state power modules that will have multi-feature and multi-function ability and control facilities. The technology developed in this research will help make energy networks more efficient, smart, reliable and flexible, having direct benefits to renewable energy growth, with long-term impact on national economy.	95,874.50	190,234.50	144,360.00	50,000.00	0.00	0.00	480,469.00
	National Interest Test Statement The research of this project will contribute to the development of a low cost, modular, compact, lightweight, smart solid-state transformer (S3T) with multi-functions and multi features to replace the costly and bulky traditional transformer in the power grids. In addition to the voltage transformation, the proposed S3T will provide improved adaptability in energy distribution, such as faster and better voltage regulation, renewables and storage integration, reactive power compensation, power-flow optimisation and management, power quality improvement, seamless conversion between AC and DC, automatic control and protection. This research will contribute to revolutionize Australia's energy infrastructure by providing a new backbone of the power grid in the form of a revolutionary smart solid-state transformer technology with possible commercialisation. This new technology will have a great potential to improve the performance of our national grid and greatly strengthen the competitiveness of the Australian power industries in the world market, providing significant economic, social and environmental benefits.							
	University of Wollongong	1,186,146.00	2,435,834.00	2,243,981.50	994,293.50	0.00	0.00	6,860,255.00

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Western Sydney University								
DP200100007 Burnham, Prof Denis K	Language is one of the most sophisticated human abilities, yet infants learn it easily. The current view is that the origins of language are abstract representations of consonants and vowels that start to form at 6-10 months. However, recent evidence shows that abstraction begins before 3 months, and that carer-infant conversations are vital to the process. This study involves tracking infants' behavioural and brain development from 1 to 18 months and analysing carer-infant speech, to determine how early abstraction supports vocabulary growth, how carer speech assists this process, and what early conditions predict language development, thus benefiting earlier identification of language delay, and saving significantly on later remediation. **National Interest Test Statement** Comprehensive language development underlies most human endeavours – communication, social cohesion, and learning through the lifespan. This project involves tracking infant language development from 1 to 18 months of age using new behavioural and brain imaging tests and detailed analyses of speech between carers and infants. The aim of these new tests is to understand, for the first time, abstract sound representation processes that are crucial for infants to learn from the speech they hear around them. These processes help infants to establish a solid basis for later learning from parents, teachers and the wider environment. By understanding the processes and the environment underlying optimal language learning the conditions are in place to be able to identify language learning problems very early, avoiding later costly remediation. This will help to advance our children's socialisation, education and learning for generations to come, contributing to economic and social benefits for Australia.	80,000.00	158,500.00	165,250.00	86,750.00	0.00	0.00	490,500.00
DP200100057 Tam, Prof Vivian W	This proposal solves Australia's concrete-waste-storage problems, and lowers the life-cycle costs and greenhouse-gas emissions by creating CO2 Concrete as a world-first material for high-grade applications. Using an automation system with high-tech software, innovative mixing techniques are proposed to maximise bonding at interfacial transition zones, strengthening CO2 Concrete's quality. The new material CO2 Concrete is created, whose strength and durability are comparable to virgin concrete's, leading to new CO2-Concrete specifications for trials in the construction industry. This diversifies the construction industry, reduces landfill area, greening up Australia on a global scale. **National Interest Test Statement** The proposed research aims to create the world's first new building material: CO2 Concrete, for high-grade construction applications using carbonated recycled aggregate. By employing novel high-tech automation modelling, it is the first time in Australia that recycled concrete's quality is shown to match that of virgin concrete, offering the construction industry a worthy technical choice for building material, yet, at a fraction of the cost. This proposal thus will: (i) elevate Australia's standing in recycled-concrete research in the construction industry; and (ii) show the great potential of recycled concrete. Benefits for Australia include: (i) lowering Australia's greenhouse-gas emissions by efficiently re-using the abundance of CO2 in the atmosphere; (ii) reducing Australia's landfills by re-using recycled aggregate; and (iii) raising environment awareness among the Australian public and construction industry by effectively and efficiently utilising building waste. The new material is the first of its kind and will ensure Australia to meet its carbon-footprint targets for 2020-2025.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
DP200100876 Bailey, A/Prof Phoebe	Older adults are increasingly victims of financial fraud and abuse. While well-intentioned advice has the potential to improve financial decision-making, ill-intentioned advice can lead to exploitation. This project will use extensive behavioural testing to establish the factors governing how much weight older adults give to advice depending on the type of advisor, the type of advice, and feedback about advice quality. The outcome will be a model of the influence of advice on decision-making in ageing. This will provide an evidence base to create best practice guidelines, interventions, and decision aids that will reduce exploitation and increase the independence and wellbeing of Australia's rapidly ageing population.	43,607.00	85,644.00	92,078.00	50,041.00	0.00	0.00	271,370.00

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	National Interest Test Statement Elder financial exploitation is one of the fastest growing crimes, and older adults lose more than $2.5 billion to financial scams each year, which is more than any other segment of society. Financial and legal institutions have been ineffective in reducing the incidence, resulting in a significant public health issue. With Australia's growing population of older adults, financial losses place a tremendous and increasing burden on older adults, their families, and our health, financial, and social care systems. By establishing the factors influencing older adults' propensity to act on advice and how they integrate advice with new information, this research will provide a foundation of knowledge to inform the design of effective public information campaigns, interventions and decision aids. This will ensure older adults make better decisions and the institutions supporting them are able to communicate good advice in the most effective manner. The benefits are likely to include a reduction in aged-care costs to the economy as well as enhanced wellbeing among older individuals and their families.							
DP200101409 Rossiter, Prof Ned	Automation threatens economic disruption. The Project aims to understand how competition between China and the US to develop automated technologies shapes the future of work. Focusing on warehouses linked to Alibaba and Amazon in Australia, Germany and Malaysia, the Project asks how automation changes labour conditions and modifies geopolitical tensions. Digital simulations of automated technologies in warehouses key to the China-US rivalry will seek to augment knowledge about the governance of labour and territory. Intended outcomes include insights into how automation is a geopolitical and economic concern for policy makers. Benefits should offer strategies for organisations negotiating automation's effects on workforces.	53,000.00	124,500.00	135,000.00	107,635.50	44,135.50	0.00	464,271.00
	National Interest Test Statement Competition between China and the US to develop automated technologies shifts Australia's economic and regional position. The Project seeks to provide social and cultural benefits by producing knowledge relevant to policy makers tasked with managing the transition of workforces to a society of automation. Showing how automation's effects link to global trade and innovation rivalries enhances Australia's ability to ensure fairness and security for citizens at a time of technological and geopolitical change. The China-US competition in automation means Australia cannot benefit from advances in artificial intelligence and machine learning without also balancing economic and political relations with the world's two most powerful countries. The Project contributes to building a national knowledge base adequate to the financial and privacy needs of Australian businesses, social groups and citizens. Addressing the practical challenge of understanding changing attitudes toward a key digital activity, the intention is to alert policy makers to strategies for securing the future of work in digital economies.							
DP200102072 Robertson, Dr Shanthi K	Australia has seen a large influx of China-born migrants in the past few decades. Large numbers of them have taken up residency in various Sydney suburbs, where they now make up almost a third of the population. Focusing on four such suburbs, this project examines how these new Chinese migrants participate in everyday civic life, the barriers that may prevent participation, and how local civic organisations adapt to their growing presence in five domains of social life: education, culture, sport, religion and community service. The project will generate nuanced new knowledge on the local impacts of new Chinese migration, of benefit for urban multicultural governance and enhancing local community cohesion.	29,500.00	87,000.00	136,500.00	109,000.00	30,000.00	0.00	392,000.00
	National Interest Test Statement The rise of a more powerful and assertive China has caused tensions and anxiety surrounding the increased presence and visibility of new China-born migrants in Australia. It is in Australia's national interest to better understand these 'new Chinese', who now make up almost a third of the population in some Sydney suburbs. By generating new knowledge on how new Chinese migrants participate in local civic life in such suburbs, this project will assist local governments and organisations in responding more effectively to this unprecedented demographic change. It will provide tools and knowledge to facilitate social cohesion, civic responsibility and local democracy under the new conditions of cultural diversity, and enhance greater general understanding of the evolution of Australia's multicultural society as the nation adjusts to the realities and challenges of a more China-dominated world.							

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DP200102188 Davis, Prof Christopher W	The project aims to determine the factors that negatively impact older adults' ability to engage in conversation. This is an important health issue; conversations are essential for communicating needs and maintaining social links; reduced social engagement leads to serious health problems and anticipates cognitive decline. The project will compile profiles of older adults' auditory-visual conversation behavior and indices of perceptual, cognitive and social skills. A path model will link these data to ratings of social engagement and satisfaction. By identifying factors leading to low ranked conversations, evidence-based guidelines can be developed for older adults and their carers to enhance communication and improve health and well-being. **National Interest Test Statement** The loss of social engagement for older adults often carries risks of social isolation, serious health problems and cognitive decline. Unhealthy ageing costs the Australian community both socially and financially. This project aims to produce significant new knowledge that will enable the design of evidence-based tailored interventions to assist older adults and their family/carers in enhancing their communication. The project outcomes, including a publically-available comprehensive learning module, will be valuable for speech and social researchers concerned with effective elderly communication. This should help to identify and alleviate conversation difficulties and improve older adults' social engagement, health and well-being, bringing social and economic benefits to the Australian community.	70,353.00	132,582.50	135,448.50	73,219.00	0.00	0.00	411,603.00
DP200102616 Tjoelker, Prof Mark G	This project aims to characterise the biogeographic constraints on the physiological flexibility of eucalypts to accommodate climate warming. Do temperature tolerances of diverse taxa vary predictably with native geographic range sizes and climate of origin? In addressing this question, the project expects to generate new knowledge on the comparative physiological responses of diverse eucalypt taxa to warming and heat waves using controlled-environment studies and a unique facility at Western Sydney University for heat wave studies of large trees. Expected outcomes include an enhanced capacity to predict carbon exchange and growth responses of native trees to climate warming over large geographic scales. **National Interest Test Statement** The project will generate fundamental knowledge of eucalypt tolerance to climate warming and heatwaves. Publications and media outputs are expected to engage the scientific community and inform the wider public of the potential risks of climate change to Australia's native and managed forests. Moreover, this research will result in an environmental and social benefit to the Australian community by providing science-based knowledge to inform policy choices and reduce uncertainty regarding strategies to mitigate climate change impacts on forestry and natural resources in Australia.	66,500.00	138,000.00	145,000.00	73,500.00	0.00	0.00	423,000.00
DP200102727 Watkins, Prof Megan	This project involves a comparative analysis of Asian- and Anglo- Australian families' approaches to education. In the 'Asian century', there is a pressing need to understand the impact of migration and cultural diversity on Australian education and the factors underpinning the relations between parenting and schooling. The project will develop new ways of analysing education cultures beyond simplistic notions of 'tiger parenting' that are pitted against more liberal 'Western' approaches. It will produce new knowledge enhancing education practitioners' and community agencies' understandings of families' engagement with education, providing an evidence base to inform public debate and social and education policy.	52,496.50	127,627.50	128,229.50	53,098.50	0.00	0.00	361,452.00

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	National Interest Test Statement							
	This project offers social benefits to the Australian community and educational policy by providing evidence of the impact of migration on Australia's education system. Successful students of migrant backgrounds have raised the competitive stakes in schooling. This project examines the relationship between schooling, parenting and ethnicity to address anxieties about increasing competition and unequal access to high performing schools. The project contributes to greater social cohesion by enhancing mutual understanding and creating informed discussion about differing approaches between migrant and other Australian families' engagement with education. Through the use of stakeholder reports and symposia, it will also expand education and multicultural policy makers and practitioners' knowledge of the factors underpinning families' different approaches to education and enhance teacher capacity for working in increasingly culturally diverse school communities.							
DP200103716 Dune, Dr Tinashe M	The population of migrant and refugee youth in Greater Western Sydney is increasing exponentially each year. Little is understood about these young people's understanding of and ability to exert their sexual and reproductive health and rights. By centering their voices, we can better understand the social ecology of the barriers they encounter and the factors that facilitate informed sexual and reproductive health decision-making. This will result in a youth-determined model for policy and programming aimed at improving migrant and refugee sexual and reproductive health literacy, wellbeing and agency.	57,500.00	107,000.00	92,000.00	42,500.00	0.00	0.00	299,000.00
	National Interest Test Statement							
	This project is of social, cultural and economic benefit as it values migrant and refugee youth involvement and perspectives on their ability to make informed decisions about their sexual and reproductive health. This is important given that migrant and refugee youth often face a range of challenges that limits their knowledge, choices and behaviour, as well as restricting their ability to communicate about their sexual and reproductive health needs. Such barriers limit their opportunities to make fully informed and self-determined health decisions. By involving them in the development of a youth-determined, human rights-based support model, their social and cultural value can be reinforced, producing informed, empowered youth contributing to a healthier Australian community.							
	Western Sydney University	527,956.50	1,110,854.00	1,179,506.00	670,744.00	74,135.50	0.00	3,563,196.00
	New South Wales	15,042,082.00	30,636,146.50	30,155,635.50	15,370,011.50	963,440.50	155,000.00	92,322,316.00

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Northern Territory								
Charles Darwin University								
DP200101480 Wilson, Dr Tom G	This project aims to create more robust, detailed, and accurate small area population forecasts, and implement them in a sophisticated forecasting system for one jurisdiction in Australia, USA, UK and Canada. The project is significant as it expects to generate a suite of new and innovative methods, theory, and population forecasts that will be useful to researchers and planners both in Australia and overseas. Expected outcomes include new forecasting methods, associated computer code, many open-access academic papers, and new international collaborations. More detailed and reliable population forecasts will bring substantial benefits to those planning our future infrastructure requirements (e.g. schools, hospitals, housing and transport). **National Interest Test Statement** Australia’s long term economic, social and environmental development is dependent on more robust, detailed and accurate small area population forecasts. These forecasts will better inform planning for the billions of dollars spent each year on schools, hospitals, public transport, housing, and the supply of power, water and sewerage services in jurisdictions across Australia. Until now, small area forecasts have often been inaccurate and unreliable - as shown, for example, by the shortage of school places in many inner suburbs of Australia's largest cities in recent years. Research to improve small area forecasting has, for many decades, been very limited and many methods used today are mediocre and not fit-for-purpose. This project will develop new forecasting methods, associated computer code, and generate many open-access academic papers and new international collaborations. In short, more accurate small area population forecasts will enable better decisions to be made about major investments in local services and infrastructure, and place Australia as a leader in small area population forecasts.	39,730.50	101,497.50	134,537.50	72,770.50	0.00	0.00	348,536.00
	Charles Darwin University	39,730.50	101,497.50	134,537.50	72,770.50	0.00	0.00	348,536.00
	Northern Territory	39,730.50	101,497.50	134,537.50	72,770.50	0.00	0.00	348,536.00

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Queensland								
Central Queensland University								
DP200102252 Verma, Prof Brijesh	This project aims to develop a novel deep learning network architecture with contextual adaptive features for image parsing that can improve the object detection accuracy in real-world applications. A number of innovative methods for deep learning, contextual features and network parameter selection will be developed and investigated. The impact of the proposed architecture and features will be improved object-detection accuracy and advances in deep learning network architecture for image parsing. The intended outcomes are deep learning network architecture, contextual feature extraction techniques and network parameter optimisation techniques for image parsing.	80,000.00	160,000.00	160,000.00	80,000.00	0.00	0.00	480,000.00
	National Interest Test Statement Image parsing is one of the most important processes for many real-world digital imaging applications such as medical image analysis, surveillance systems and intelligent vehicle systems, so this project will have a huge impact on the Australian economy. The proposed approach will expand the knowledge base and research capability in image parsing and deep learning. The intended outcomes are new methods that will be employed in real-world industrial applications for object detection.							
DP200103272 Sargent, A/Prof Charli	Each year, the sleep loss and body clock disruption caused by night work cost the Australian economy $2–3 billion in lost productivity, impaired well-being, and poor health. Current regulations limit sequences of night shifts to a maximum of four in a row. However, recent research suggests that this blanket limit may be a well-intentioned, but ill-informed, policy. As a result, we may be inadvertently increasing, rather than reducing, work-related fatigue. This project will determine whether longer sequences of night shifts may reduce sleep loss and body clock disruption in some workplaces. The project will provide the evidence base for a more nuanced approach to fatigue regulation and a safer workplace for Australian shiftworkers.	58,989.00	157,304.00	196,630.00	137,641.00	39,326.00	0.00	589,890.00
	National Interest Test Statement Approximately 1.1 million Australians, or 9.8% of the workforce, regularly work at night. Night work is a particularly challenging and potentially dangerous form of shiftwork because it combines short sleep (5–6 hours per day) with the requirement to be alert during the low-point of the daily body clock cycle. Compared to day workers, those who work at night are far more likely to make errors and be injured at work, to have a crash driving home from work, to experience symptoms of anxiety and depression, and to suffer from obesity, cardiovascular disease, type 2 diabetes, and cancer. Each year, the sleep loss and circadian disruption caused by night work cost the Australian economy $2–3 billion in lost productivity, impaired well-being, and poor health. This project will create new guidelines for scheduling night work that could be used to improve the health, safety, and productivity of Australian shiftworkers. If we improve practice so that there is a 10% reduction in sleep loss and body clock disruption for 10% of the Australians who work at night, that would produce annual savings of $20–30 million.							
DP200103570 Naweed, A/Prof Anjum	This proposal will generate new knowledge about designing jobs with the right amount of human movement. Prolonged sitting is now a serious work hazard that contributes to cardiovascular risk and obesity. The high incidence of these conditions in many work systems, such as rail, also presents a critical safety hazard due to threat of sudden incapacity while driving. Expected project outcomes are a ‘Just Right’ Job Design model showing how tasks can be designed to enhance safety and health while maintaining productivity, and in the unlikeliest of workplaces. This will provide significant benefits for the many working Australians whose safety and health are compromised by exposure to prolonged sitting in seemingly intractable environments.	69,729.00	139,887.00	142,685.50	72,527.50	0.00	0.00	424,829.00

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	National Interest Test Statement							
	More than 10 million Australian workers across all industries now sit at work, with some spending 75% of their time in prolonged sitting. Excessive sitting and insufficient physical activity contribute a burden of more than $1.6 billion annually in Australia, associated with healthcare and lost productivity. In Australian rail drivers, coronary risk and obesity is significantly over-represented. The metabolic consequences of excessive and forced sitting poses a critical safety hazard when driving. There is no framework to assess and control the newly recognised work hazard of excessive and forced sitting. In this project, we draw inspiration from the Goldilocks fairy-tale to develop a 'Just Right' Job Design model for designing work to reduce prolonged sitting while retaining productivity. By developing a model in the context of an unsustainable and hazardous system of work, this project will provide methods for other at-risk occupations with maximum economic, environmental and social benefit. This will ensure the sustainability of Australian jobs that not only fit the person, but keep the person fit.							
	Central Queensland University	208,718.00	457,191.00	499,315.50	290,168.50	39,326.00	0.00	1,494,719.00
Griffith University								
DP200100033 Gould, Dr Timothy J	This project aims to provide new computer models of quantum systems, which can be used to design new quantum technologies that exploit fundamental quantum physics, such as light harvesting. The benefits of such an approach are broad, as innovative technology firms can use its outputs in a virtual laboratory design process, saving time and costs. The work is significant, as it will bring a new physics-led approach to quantum chemistry of excited states and open systems, which are likely to play a key role in future quantum technologies. It will also ensure Australia has well-trained computational chemists, who can take those skills to industry or academia; and will foster strong connections with Israel, a leader in the high-technology field.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
	National Interest Test Statement							
	The national and international demand for the technology that will evolve from this project is potentially worth billions of dollars, because the project will have a major impact on the second quantum revolution, an area of existing national strength; and other growing industries such as batteries and engineered catalysis. It will ensure models incorporate how quantum technologies behave in their unusual operating conditions. It will thereby let Australia firms compete with the deeper pockets of our Asian, European and US competitors, by using low-cost models to replace costly experiments. It will provide training in the high-level interdisciplinary skills that will be required to tackle future quantum engineering problems, which will ensure domestic industries can access much-needed skills. Its outcomes and deliverables will thus help Australia maintain its lead in the field when translating fundamental science into applied quantum technologies.							
DP200100742 Foster, Prof Michele M	The aim of the National Disability Insurance Scheme is to redress unfairness for disabled Australians. The sensitive question for government and citizens is how to determine what support is fair? The goal is support based on the perceived needs and choices of individuals. The government is additionally concerned to ensure financial sustainability by limiting expectations about reasonable and necessary support. This project will identify the dominant operating principles and debates concerning funded support, by analysing relevant frameworks, decisions, appeals and internal reviews. By taking an administrative justice perspective, it contributes to a critical debate about the values guiding funded support decisions and fairness outcomes.	42,576.50	88,736.00	95,907.50	49,748.00	0.00	0.00	276,968.00
	National Interest Test Statement							
	This project will deliver social and economic benefits to Australia by resolving tensions between the financial sustainability of the National Disability Insurance Scheme and the provision of reasonable and necessary supports for individuals with disability. The Australian Government currently faces a significant dilemma about how to allocate limited resources in a way that ensures the rights and entitlements of all Australians. Scheme officials and personnel urgently require clarity and consistency to improve their decision-making. Citizens with a disability, particularly those without advocacy support, require assurances that their rights are safeguarded within the Scheme. By enhancing the visibility and transparency of decision-making processes and priorities, and promoting informed public discussion, this project will contribute to making the National Disability Insurance Scheme a fair and sustainable scheme, and an international exemplar.							

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DP200100874 Rehm, Prof Bernd H	This project aims to develop an innovative and disruptive platform technology for designing and manufacturing tailor-made high-performance bioseparation resins to enhance biopharmaceuticals manufacturing. Bacterial cell factories will be developed to enable biotechnological production of innovative polyester bead-based bioseparation resins, which will revolutionise manufacturing of biopharmaceuticals. Expected outcomes of this project are cost-effective and strongly enhanced approaches for biopharmaceuticals recovery, thereby providing significant benefits to accelerate research and development in early stage discovery and manufacture of biologics, therapeutic proteins and vaccines. **National Interest Test Statement** The efficient separation of high-value compounds, such as biologics, from complex mixtures (plasma or cell culture supernatant or cell lysates) is a crucial and costly step, and is increasingly thought to be a bottleneck in biotechnological production of biopharmaceuticals in Australia and world-wide. Australia's biotechnology rates in the world top five. In 2017, Australia had 140 ASX listed life science companies with a total market capitalisation of >$50 billion. A total of 1,654 life science research organisations employed >200,000 people. It is anticipated that the global market for biologics and vaccines will double in the period 2014 to 2024 enabling Australia to capitalise upon this growth by developing innovative, highly competitive manufacturing processes implementing advanced bioseparation resins. The proposed bioseparation resin platform technology is therefore of great economic importance as it will advance life science research and biotechnological processes and support the fast developing Australian biotechnology and biopharmaceuticals sector.	85,000.00	170,000.00	170,000.00	85,000.00	0.00	0.00	510,000.00
DP200100965 Zhao, Prof Huijun	The current industrial-scale hydrogen productions are reliant on high temperature steam reforming fossil fuels, consuming large quantity of energy and fossil resources, and emitting huge amounts of CO2. This project aims to develop cheap and plentiful transition metal-based high performance water splitting electrocatalysts, enabling economically viable large-scale water electrolytic hydrogen production driven by renewable electricity. A theory-guided catalyst approach will be used to guide the efficient design and development of high performance electrocatalysts. The success of the project will lead to a suit of high performance water splitting electrocatalysts, leaping forward water electrolytic hydrogen production technology. **National Interest Test Statement** This project takes the challenge to develop nonprecious material-based high performance electrocatalysts for hydrogen production via electrolytic water splitting. The project outcome will set a solid scientific foundation to enable the economically viable technologies for eco-friendly hydrogen production, which will bring considerable scientific and socioeconomic benefits to Australia. The proposed project is at the forefront of emerging cutting-edge catalysis science and nanotechnology. The success of the project will advance knowledge in these cutting-edge research fields and enhance Australian international reputation. This project directly addresses the Australian Government Science and Research Priorities: Energy - New clean energy sources and storage technologies that are efficient, cost-effective and reliable. The cutting-edge science and enabling technology developed through this project will add to Australian capability to meet the challenge of energy and environment sustainability, and provide solid benefits to Australian clean energy and chemical engineering industries.	85,000.00	172,500.00	172,500.00	85,000.00	0.00	0.00	515,000.00
DP200100972 Becken, Prof Susanne	This project aims to bring sustainable reductions in resource use to mainstream tourism, one of the world's largest, most resource-intensive sectors. The project challenges the view that pro-environmental attitudes are a pre-requisite for pro-environmental behaviours, and in doing so promotes redesigning social practices in accommodation to achieve greater sustainability outcomes. Using an experimental design, this project will provide empirical evidence on the efficacy of combining smart technology and interpersonal communication into a smart-service intervention to change guest resource use. The desired outcomes will be less resource consumption, greater guest satisfaction, and an evidence-based approach to a greener mainstream economy.	105,191.00	168,371.50	123,744.50	60,564.00	0.00	0.00	457,871.00

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	National Interest Test Statement This project contributes to Australia's national interest by laying the theoretical foundation for a more sustainable service sector and empirically testing a means to combine economic growth, environmental sustainability (lower resource use) and social wellbeing within one of Australia so-called super growth industries, tourism. Current green economy initiatives focus on sectors such as energy and recycling, yet, the Reserve Bank of Australia (2017) lists the service sector as contributing more than 25% of the gross added value to our economy. This research will test ways of engaging consumers in significantly greener experiences, relying on much lower resource consumption and without impacting on their enjoyment or service satisfaction. The research will provide a blueprint for developing a mores sustainable economy based on a wellbeing approach. The findings will have implications for other service sectors in Australia, facilitating sustainable growth without impacting on consumer preferences.							
DP200103043 Yao, Prof Xiangdong	This project aims to address the most critical issue of electrocatalysis: identification of active sites for carbon-based metal free catalysts (CMFCs). Through the development of new methodologies, this proposal will, for the first time, controllably synthesise the vacancy defects that are the major active sites for CMFCs. The expected outcomes from this project include in-depth understanding of the fundamentals of electrocatalysis: the reactivity of active sites and the catalytic performance with the number of active sites; which will not only significantly advance knowledge but also achieve breakthrough technologies that greatly benefit to the society and economy both for Australia and worldwide.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
	National Interest Test Statement Hydrogen energy is becoming a huge market, particularly since fuel cell vehicles were introduced into the market. It is expected that the market for fuel cells alone will exceed $100 billion by 2030. The outcomes of this project will lead to catalysts with sufficiently high activity to replace Pt and Ru in fuel cells; for hydrogen production from water; and to include in metal-air batteries. The wider use of environmentally friendly, clean energy will significantly reduce the current dependence on fossil fuels, thus reduce the air pollution and greenhouse emissions, improving quality of life and environmental sustainability. These catalysts and devices also have high commercialisation potential, which will bring huge benefit to the hydrogen energy industries of Australia. It will also contribute to the hydrogen export chain, announced by the Australian government as one of the Australian economic priorities.							
DP200103734 Jennings, Prof Michael P	Meat and dairy products from cattle contain sugar structures (glycans) that are not made by humans. These structures can be recognised by the immune system and lead to allergic reactions, inflammation and potentially cancer. These non-human structures are called xeno-autoantigens or XAs. We have discovered individual cattle that do not produce one of these XAs. We will study the gene required to make XA in the XA-free cattle to find the underlying mutation. The same approach will be used to look for natural XA-free individuals in other food species. This knowledge may enable us to create a test to facilitate the natural breeding of non-GMO, XA-free livestock to benefit Australian primary producers and provide safer food for consumers.	78,174.50	165,349.50	161,942.50	74,767.50	0.00	0.00	480,234.00
	National Interest Test Statement Meat and dairy products from cattle contain certain sugar structures that can be recognised by the immune system and may lead to allergic reactions, inflammation and potentially cancer. These non-human structures are called xeno-autoantigens or XAs. We have discovered individual cattle that do not produce one of these XAs. We will study the gene normally required to make this XA to discover why these cattle are naturally XA-free. A test based on this new intellectual property may allow breeders to produce naturally bred (non-GMO), XA-free cattle that will benefit Australian primary producers and also deliver safer food for consumers. We will also use the same basic approach to look for lack of XAs in other commercial food species. The closest analogy to this general approach and potential benefit is the development of the "A2 milk" product. Like our observation, cattle were identified that naturally produce only the A2 milk protein, instead of the potentially inflammatory A1 protein. Screening for A2 production generated dairy herds that produce this healthy and profitable (A2M: ASX) product.							
	Griffith University	545,942.00	1,064,957.00	1,024,094.50	505,079.50	0.00	0.00	3,140,073.00

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James Cook University								
DP200100568 Junk, Prof Peter C	This project aims to investigate rare earth corrosion inhibitors by an interdisciplinary program of chemistry and materials science. The project will generate new knowledge as to how rare earth corrosion inhibitors function and can be improved. Expected outcomes include a better understanding of inhibitor induced protective films and improved inhibitors. Significant benefits are eventually better protection of infrastructure from corrosion with greener inhibitors and a new bulk use for rare earths to aid Australia's emerging rare earth industry.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
	National Interest Test Statement Corrosion of steel infrastructure, bridges, water cooling towers, car radiators, oil and gas pipelines, and in shipping and aviation is a persistent and expensive (billions of dollars) problem that can lead to catastrophic failure. Use of chemical corrosion inhibitors represents a method to reduce the impact. Rare earth inhibitors which have proven anti-corrosion properties and are relatively environmentally friendly are a potential solution. This project aims to understand their role by a comprehensive examination of the nature and function of the protective film formed by the inhibitors on steel surfaces. From this understanding and knowledge of the structure/activity of current inhibitors. Improved inhibitors will be prepared, characterized and tested leading to the ultimate outcome of reduced corrosion, preserved infrastructure, and considerable economic benefit. As Australia has extensive rare earth resources, this potential bulk use will greatly advance Australia' s emerging rare earth industry.							
DP200101365 Schwarzkopf, Prof Lin	Aims: This project will investigate using automated acoustic recording to efficiently census biodiversity assessment at a continental scale. Significance: To generate new techniques for analysing environmental acoustic data and assessing Australian biodiversity, verified empirical estimates of biodiversity, an understanding of causes of variation in biodiversity. Expected outcomes: methods for large-scale and accurate assessment of biodiversity, enhanced capacity to detect causes of variation in biodiversity, open-source software tools for analysing environmental audio data, biodiversity datasets. Benefits: measuring and understanding biodiversity change, allowing enhanced management, conservation, and use of Australian natural resources.	93,347.00	186,694.00	186,694.00	93,347.00	0.00	0.00	560,082.00
	National Interest Test Statement Humans rely on nature for food, water and wellbeing; yet the most basic measurement of nature, biodiversity, is prohibitively expensive to quantify using traditional manual survey methods. Measuring biodiversity is particularly important for a large, fragile, mega-diverse, yet sparsely populated continent like Australia. We will research the use of acoustic recordings for large-scale biodiversity surveys of vertebrates, by automatically listening to nature. We will develop new acoustic analysis techniques to recognise vocal species, including threatened, common, and invasive species. We will compare acoustic biodiversity assessments with manual surveys and predictive models of animal presence, to understand how well acoustics will inventory animals, and to understand variation in biodiversity over different areas of Australia. We will leverage our new infrastructure, the Australian Acoustic Observatory, to collect data, and in a world's first, assess and understand how biodiversity varies across Australia. This will benefit Australia by providing otherwise unavailable information on biodiversity variation.							
DP200103100 Laurance, A/Prof Susan L	This project aims to examine the vulnerability of tropical plants to drought and insect attack in a large-scale field experiment. We will pioneer a new research approach that focuses on the causes and stages of decline in plant health prior to death, in order to identify the characteristics of plant species that make them more susceptible to drought and insect attack. Expected outcomes of this project include an improved capacity to predict the function and composition of future forests. This project will provide significant benefits to communities concerned with the direct and indirect effects of droughts in protected areas, forestry reserves and agriculture.	67,500.00	132,500.00	130,000.00	65,000.00	0.00	0.00	395,000.00

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	National Interest Test Statement							
	Drought is one of the most serious threats to the integrity of Australia's forests and human landscapes. The benefits from this project include a greater understanding of plant vulnerabilities to environmental and insect threats provoked by droughts. Understanding these threats will improve our ability to manage ecosystems and hedge against these risks proactively. From an environmental perspective, Australia's rainforests are irreplaceable, providing unparalleled biodiversity and a great source of national pride. Their direct value for tourism is estimated at ~$500 million per year, and their cultural importance to the Indigenous peoples of the Wet Tropics is immeasurable. Managing these forests for future generations is in the nation's interest.							
	James Cook University	230,847.00	459,194.00	456,694.00	228,347.00	0.00	0.00	1,375,082.00
Queensland University of Technology								
DP200100127	Speech is crucial for facilitating human communication through language, yet there is a lack of clarity about where, when and what type of activity occurs in the brain	81,294.00	184,583.50	182,051.00	78,761.50	0.00	0.00	526,690.00
de Zubicaray, Prof Greig I	during key stages of production. This project will use intracranial recordings to characterise neuronal oscillations in combination with direct electrical stimulation, functional neuroimaging and non-invasive brain stimulation to establish critical areas and their timecourses with millisecond resolution. The outcome will be a better theoretical account of the brain mechanisms involved in spoken production. The benefit of this new theoretical account will be a better basis for prevention of post-surgical language impairment and neuromodulatory treatments after brain injury.							
	National Interest Test Statement							
	This project will enhance Australia's knowledge-base, capability and technical innovation in investigating and manipulating the brain mechanisms involved in producing speech. It will increase Australia's research standing internationally by leading collaborative research with colleagues in the United States of America and the Netherlands. It will offer high quality postgraduate training in the increasingly competitive field of neuroscience that attracts dedicated funding internationally, conducted in a world-class intellectually stimulating environment. The findings will inform future clinical research and improve the advice given to clinicians, patients and the broader community about the nature of speech production and its impairments. The potential benefits include knowledge gain that might prevent post-surgical language impairments and support more effective and economical treatments of speech problems following brain disorders such as stroke or dementia using brain stimulation techniques that are currently applied without knowledge of neuronal oscillations (brainwaves).							
DP200100177	Mathematical models have a long, successful history of providing biological insight, and new mathematical models must be developed to keep pace with emerging	82,500.00	165,000.00	165,000.00	82,500.00	0.00	0.00	495,000.00
Simpson, Prof Matthew J	technologies. Modern experimental procedures involve studying 3D multicellular spheroids with fluorescent labels to show both the location of cells and the cell cycle progression. This 4D data (3D spatial information + cell cycle time) provides vast information. No mathematical models have been specifically developed to interpret/predict 4D spheroids. This project will deliver the first high-fidelity mathematical models to interpret/predict 4D spheroid experiments in real time, providing quantitative insight into innate mechanisms and responses to various intervention treatments.							
	National Interest Test Statement							
	New mathematical modelling technologies are required to facilitate the design and interpretation of experiments. As new technologies emerge, so too must new mathematical models and mathematical modelling methodologies be continually developed to assist in the interpretation of experiments. High-fidelity mathematical models and mathematical modelling methodologies have immense potential for economic and commercial benefit since mathematical models can be used to provide rapid, inexpensive screening tools to both generate and test in silico hypotheses. This process provides rapid and meaningful insights before more complicated experiments are required to test the mathematical predictions and mathematical hypotheses. The use of mathematical models in tandem with biological research also provides significant environmental, social and cultural benefits since mathematical models have the potential to reduce wet-laboratory experimentation and associated hazardous waste. Furthermore, working with mathematical models completely circumvents ethical issues associated with purely experimental approaches.							

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DP200100519 Angus, A/Prof Daniel J	The advertising-driven business models of social media platforms increasingly depend on automation. The technologies used by platforms are rapidly advancing, and include 'machine vision' systems that automatically classify faces, expressions, objects, and brand logos in images. The results are used to provide targeted content to users, often without their knowledge and without sufficient public oversight. Using a novel combination of computational and cultural research methods, this project aims to: examine how machine vision works in platforms like Instagram; explore its role in everyday visual contexts through qualitative case studies of festivals, food, and lifestyle sports; and improve public understanding of machine vision systems.	46,000.00	126,000.00	145,000.00	65,000.00	0.00	0.00	382,000.00
	National Interest Test Statement Australians are enthusiastic adopters of social media, with image-sharing platforms like Instagram seeing rapid growth. These mostly US-based platforms are largely funded through advertising, and are invested in developing methods to profile and micro-target users with content. Platforms have begun to use artificial intelligence to detect visual objects such as faces, objects and logos in everyday user-generated images. Brands, including those in regulated markets such as alcohol, have responded by creating marketing campaigns that encourage the sharing of images containing distinctive visual brand objects that can be used to profile user activity. There is limited public knowledge or oversight of these new technologies in Australia, and our regulatory frameworks are inadequate. This project will provide the first critical account of the role played by these machine vision algorithms in everyday Australian social media. Our research will inform policy-makers, improve Australia's digital literacy, and help to ensure that public debates about the impacts of social media keep pace with technological change.							
DP200100547 Thambiratnam, Prof David P	Around 2000 vehicles crash annually into school, home and shop buildings located at close proximity to heavily trafficked roads in Australia and cause significant distress to occupants of building and vehicle. The impacted walls mostly of masonry, suffer severe damage often with vehicle intrusion into the building. Despite this, the intrusion mechanism is not understood and no effective mitigation strategies exist at present. This project will uncover the mechanics of vehicle intrusions through masonry walls and develop novel mitigation strategies using high energy absorbing auxetic composite render and innovative vibration isolation at wall edges. These innovations will lead to new theories that can save lives in the building and vehicle.	65,000.00	140,000.00	142,500.00	67,500.00	0.00	0.00	415,000.00
	National Interest Test Statement Population increase and land scarcity in major Australian population centres have led to buildings positioned close to road boundaries. This and driver frustration contribute to ongoing increase in vehicle intrusions into buildings with severe consequences, including the recent deaths of two primary school pupils in Sydney. Based on reported Australian incidents, it is estimated that around 2000 such intrusions occur in Australia/year, costing the public nearly $49M/year with a loss of 12,600 years of productive life due to incapacitation and death. This project aims to save the building and vehicle occupants as well as property by first discovering the intrusion mechanism of vehicles through building walls and then mitigating the intrusion severity through structural innovations of energy absorption at impact zone and detailing vibration isolators at wall edges. The discovery of the intrusion mechanism through masonry walls and the proposed mitigation strategy will be the first of their kind that will bring international prominence with significant societal and economic benefit to Australian communities.							
DP200100723 Blackler, Prof Alethea L	This project aims to address inactivity in the 3-5 age group through understanding and exploring innovative interactive active play experiences for children, with a view to increasing their physical activity over the long term. This project will be based on empirical research with real children undertaking real interactive experiences in real contexts, in order to understand issues around sustained engagement with these types of systems. We will design and develop solutions that may address the issues and test those interventions in a longitudinal manner. The outcome will be a framework which can be applied in a variety of situations and modalities by designers and developers of such systems, and feed into childhood technology guidelines.	95,000.00	205,000.00	220,000.00	110,000.00	0.00	0.00	630,000.00

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	National Interest Test Statement							
	Enabling more effective digital technologies for Physical Activity will address an issue of national importance, that being the tackling the sedentary lifestyles of Australian children. With only 8.1% of Australian 3- to 5-year olds meeting the Australian 24-Hour Movement Guidelines for the Early Years for both physical activity and sedentary screen time, there is a critical need to reduce children's exposure to passive digital technologies and develop new interactive technologies that fully engage children and promote greater levels of age-appropriate physical activity and positive child development. The proposed program of research will produce timely and novel evidence to assist designers/programmers/educators to understand what characteristics of interactive technologies are necessary to promote long-term engagement and increase physical activity in Australian children. The findings can be used to inform the design of future technologies which can be deployed in a whole range of settings (e.g. homes, childcare, public spaces, etc.), and to inform future physical activity guidelines.							
DP200101263 McGree, A/Prof James M	This project aims to develop the field of precision ecology, forging a new era of designed experiments where sampling is informed by research questions and what is known about the ecological process being studied. Through the development of novel statistical methods, new experiments globally will be designed to answer important ecological questions including what influence abiotic and biotic factors have on plant communities over time and different spatial scales. Expected outcomes include new methods and tools that will modernise how future experiments will be conducted in plant ecology. This will provide significant transdisciplinary benefits including new statistical methods that target scientific discovery in ecological studies.	60,000.00	130,000.00	120,000.00	50,000.00	0.00	0.00	360,000.00
	National Interest Test Statement							
	Long term and extensive experimentation is needed in ecology and agriculture where evidence across highly variable environmental conditions is essential to strengthen decision-making for resource management and adaptations to climate variability. In this project, we will develop and make widely available an innovative approach to experimental design in ecological science, called precision ecology. We will demonstrate the value of this approach to design and test new experiments in the Nutrient Network, a globally distributed experiment consisting of over 100 sites across 25 countries, including 4 sites in Australia. These new experiments will significantly enhance our understanding of ecosystem health and resilience by enabling targeted and informative experimentation over longer-time periods and different spatial scales. Further, these new methods will provide significant economic, environmental and social benefits through reduced use of resources in ecological studies, and new knowledge to better maintain ecosystem health in grasslands.							
DP200101317 Bruns, Prof Axel	Encompassed by the disputed term 'fake news', overtly or covertly biased, skewed, or falsified reports claiming to present factual information present a critical challenge to the effective dissemination of news and information across society. This project conducts a systematic, large-scale, mixed-methods analysis of empirical evidence on the dissemination of, engagement with, and impact of 'fake news' and other malinformation in public debate, in Australia and beyond. It takes a triangulated approach, combining computational big data analytics with deep forensic analysis, to reveal the complex 'fake news' ecosystem, replace 'fake news' with more precise terminology, and provide recommendations for policy responses based on robust evidence.	71,500.00	143,500.00	144,000.00	72,000.00	0.00	0.00	431,000.00
	National Interest Test Statement							
	This project represents the first large and systematic examination of the 'fake news' problem in Australia, generating significant new knowledge of national importance. The project produces substantial social, societal, and policy benefits for the Australian and international community: it determines the extent to which international trends towards the dissemination of malinformation are replicated in Australia; investigates what individual and institutional actors are involved in such efforts; assesses how online and social media users contribute to the transmission of such information; and recommends approaches to combatting the spread of 'fake news'. It builds on the excellent institutional support, internationally recognised methodological expertise, 'big social data' research infrastructure, and unique background data available at the partner institutions to generate important outcomes and impacts throughout its lifetime. The results from this research enable Australian research to maintain and extend its international leadership in the field of journalism, media, communication, and Internet studies.							

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DP200101640 Gonzalez, A/Prof Luis F	The aim of this research is to develop a framework for multiple Unmanned Aerial Vehicles (UAV), that balances information sharing, exploration, localization, mapping, and other planning objectives thus allowing a team of UAVs to navigate in complex environments in time critical situations. This project expects to generate new knowledge in UAV navigation using an innovative approach by combining Simultaneous Localization and Mapping (SLAM) algorithms with Partially Observable Markov Decision Processes (POMDP) and Deep Reinforcement learning. This should provide significant benefits, such as more responsive search and rescue inside collapsed buildings or underground mines, as well as fast target detection and mapping under the tree canopy.	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00
	National Interest Test Statement UAVs (drones) are the fastest growing sector in aerospace increasing fivefold since 2015. The UAV market was valued at USD 18.14 Billion in 2017 and is projected to reach USD 52.30 Billion by 2025, at a CAGR of 14.15% from 2018 to 2025. Drones have been used and considered for a number of civilian applications which can greatly benefit the Australian public and industries, including SAR, surf patrol, disaster management, police patrol, bushfire monitoring and plant biosecurity tasks. However, existing drones and navigation systems for drones have limitations when flying in GPS-denied environments. By developing a safer, more adaptable multi-drone navigation system, this project will have substantial impact on how the government, law enforcement agencies, search and rescue teams conduct surveillance tasks in time critical situations. The outcomes of this project will both strengthen the growing autonomous systems industry in Australia, and deliver significant economic benefits to the way the government and industry manages disaster management, bush-fire monitoring, biosecurity and the environment.							
DP200101658 Toh, A/Prof Yi-Chin	This project aims to mimic gut microbiome-organ interactions by developing a microbial-gut coculture chip, which can reversibly interface with other organs-on-chips. This is achieved through the systematic integration of highly customisable biofabrication and microfluidic technologies. This project fills a critical technological gap in the availability of an animal-alternative system to investigate microbiome-host interactions, which will greatly complement existing meta-omics approaches. The deliverables include a proof-of-concept system validated for gut-liver axis as well as the creation of new knowledge and framework to assimilate design thinking and advanced manufacturing to elevate tissue engineering into physiology engineering.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement This project aligns closely to Australia’s national research priorities in Advanced Manufacturing. By leveraging and integrating 2 key research strengths in biomaterials and microtechnology at QUT and the greater Brisbane area, the project will deliver a first-in-class R&D research tool, which provides a cost effective, animal-alternative means to study microbiome-host interactions. This is expected to not only distinguish the region as a hub for advanced bio-fabrication technologies internationally, but also create commercial translation opportunities as start-ups or industry partnerships. The project also synergises with Australia’s strategic thrusts in microbiome research in the future. In addition, a new knowledge framework rooted in design thinking and system engineering will be generated to assimilate the body of multi-disciplinary knowledge into a complex bio-engineering system. More importantly, the project will train a new generation of bio-engineers to expand beyond well-established bio-fabrication disciplines into the realm of human physiology engineering.							
DP200101942 Fookes, Prof Clinton	This project will develop neural memory architectures and dense spatial-temporal bundle adjustment to predict movement, behaviour, and perform multi-sensor fusion across large asynchronous video feeds. This capability will allow us to better interrogate and analyse mass video information recorded from the vast number of smartphones, action cameras, and surveillance cameras which exist at public events of interest. Outcomes include the ability to ingest multiple video feeds into a dense and dynamic 3D reconstruction for knowledge representation and discovery, and analysis of events and behaviour through new spatio-temporal analytic approaches. This will offer significant benefits for video forensic analysis, policing, and emergency response.	65,000.00	140,000.00	155,000.00	80,000.00	0.00	0.00	440,000.00

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	National Interest Test Statement To protect critical infrastructure and ensure public safety is one of highest priorities of the nation. When there is a threat to security in a public place, video feeds from CCTV cameras along with the numerous footage collected by the public using hand held mobile devices provide vital information for security agencies. Unfortunately, no proven techniques yet exist to automatically analyse and extract actionable intelligence from a large, disjoint video collection captured at different resolutions, frame rates, timings, and across different views. Our research, using advanced neural memory networks and deep learning, will enable for the first time the ability to ingest mass mobile video feeds along with static CCTV feeds into a system to densely reconstruct the scenes, objects and actors in an event of interest; and subsequently mine this for information on the events being performed at various granularities, from what an individual is doing at a given instant to the overall behavior of the crowd. Outcomes will provide significant benefits for forensic video analysis, policing, and emergency response.							
DP200102101 Drovandi, A/Prof Christopher	This project aims to develop efficient statistical algorithms for parameter estimation of complex stochastic models that currently cannot be handled. Parameter estimation is an essential component of mathematical modelling for answering scientific questions and revealing new insights. Current parameter estimation methods can be inefficient and require too much user intervention. This project will develop novel Bayesian algorithms that are optimally automated and efficient by exploiting ever-improving parallel computing devices. The new methods will allow practitioners to process realistic models, enabling new scientific discoveries in a wide range of disciplines such as biology, ecology, agriculture, hydrology and finance.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement Statistical models are ubiquitous across Australia's government, industry and research sectors across many fields. For example, models are useful for weather forecasting, assessing financial risk, understanding biological systems, risk calculations for invasive species, assessing the impact of medical interventions, and so on. Our ability to make accurate predictions, gain new insights and properly quantity uncertainty is limited by the statistical model's ability to capture complex real life processes. This project will develop automated and efficient statistical algorithms for handling complex models. This will allow practitioners and researchers across Australia in fields such as, but not limited to, biology, ecology, finance and meteorology to consider more realistic models. This will enable them to address scientific questions relevant to advancing their discipline, yielding economic, commercial and environmental benefits. This project will train students and researchers to build a critical mass in statistics/data science, which are the in-demand skills of the Australian economy.							
DP200102478 Soro, Dr Alessandro	This project will explore new socialised uses of Augmented Reality (AR) that expand creativity, social relations, and participation. We seek to better understand how AR content can be leveraged by people to create their own new ways of learning, collaborating, and relating with each other. To do so we will study and prototype new tools and platforms to allow non-experts to create their own AR media. We aim to enable people of all ages, education, and background, to imagine and create, and not just passively consume, AR contents, services, and applications. We will generate new applications of AR, a new platform to collaboratively create these applications, and a new theory of 'Augmented Sociality' to guide AR design.	101,000.00	181,000.00	153,500.00	73,500.00	0.00	0.00	509,000.00
	National Interest Test Statement Augmented Reality is set to become a dominant technology in the years to come, sustained by current investments from key actors. This project will create new opportunities for economic growth connected to Augmented Reality by developing new open source tools, design methods, and skills to generate and exploit the future market of services and applications. This project caters specifically for under-served users (children and older adults) and has a distinct focus on socialisation, creativity, and engagement. As such it will foster well being by promoting digital literacy and participation in the growing offer of AR technologies for people of all ages, educations, and background. Finally, the new theories generated in this project will inform and give a human centred approach to future designs of AR applications and platforms, as well as services, both in the public and private sector, therefore ensuring that this new technology becomes a motor of community building, participation and equality, accessible to all, and to everyone's benefit.							

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DP200102546 Gu, Prof Yuantong	This project aims to develop a novel, computationally-based framework to optimally and efficiently design new fibre materials based on the diamond nanothreads synthesized by the PI in 2014. The CIs (and others) have demonstrated the tremendous promise these materials hold to replace common carbon fibres. The proposed framework will combine advanced computer modelling, statistical learning, genetic algorithm-based optimal design and experimental validations. It will accelerate the design of these new carbon-based fibres as game-changing materials in a wide range of areas. Ultimately this project has the potential to deliver significant economic benefits and will place Australia at the forefront of the industrial revolution of the future. **National Interest Test Statement** This project will provide enabling technology for the efficient and optimal design of novel diamond nanothread-based nanofibres, which current research indicates having the potential to overcome limitations in reliability and strength of present carbon-based fibres. This will underpin significant economic benefit from manufacturers and users of these new materials in areas such as biomedical devices/implants, aerospace, civil, automotive. This pioneering research aims at exploring the recently synthesized diamond nanothreads, and will lead to new knowledge in materials science. It will produce a novel materials design tool, which will be available to support research on a diverse range of nanomaterials such as those used for 3D printing, and greatly benefit cutting-edge industries in Australia.	67,500.00	137,500.00	137,500.00	67,500.00	0.00	0.00	410,000.00
DP200102652 Zhu, Prof Dr Huai-Yong	This project aims to utilize visible light to control reactant adsorption on catalyst surfaces for accelerating reactions and tuning product selectivity. Visible light irradiation of plasmonic metal nanoparticles can generate a force that attracts reactant to the nanoparticles in a catalyst, and causes desorption of other reactant-types from the particles. These compound-selective effects can alter the concentrations of reactants at the catalyst surface, a new paradigm for optimising catalytic performance. This project expects to open new capabilities within fields of catalysis and light-matter interaction. The anticipated outcomes include significant advancement of knowledge in catalysis and new approaches for important chemical synthesis. **National Interest Test Statement** Verification of the proposed concept for altering surface concentrations of reactant molecules on catalysts will stimulate new developments in photocatalysis. The innovative nature of this research will contribute to maintaining the high profile of scientific research in Australia in this field. The research program has been devised to provide a meaningful contribution to the advancement of scientific knowledge in Australia in the fields of catalysis, chemical synthesis, optical physics and reaction kinetics. We are well-positioned to develop innovative, advanced chemical technologies using plasmonic photocatalysts in this field. The successful project will yield profound insight into a new way that photocatalysis can be harnessed, providing an advantage that can be used to increase the competitiveness of our knowledge-based economy. The proposal offers a significant opportunity train high-quality young researchers in a field that can contribute to Australia, by maintaining its strong base of expertise and technological capacities in a fundamental science that will be key to new technologies in the future.	88,000.00	155,500.00	135,000.00	67,500.00	0.00	0.00	446,000.00
DP200102704 Mahendran, Prof Mahen	The project aims to investigate the complex behaviour of light cold-formed-steel roof and wall systems involving localized failures under the combined action of wind and bushfire using wind suction tests at elevated temperatures combined with advanced numerical modelling. It will generate new knowledge of the behaviour and strength of cold-formed-steel roof and wall systems under bushfire conditions. Expected outcomes include new design models for wind, bushfire and cold-formed-steel Standards. This will significantly improve the bushfire safety of buildings, since non-combustible steel roof and wall systems are used as building envelopes in bushfire prone areas, but are not designed to withstand recently discovered bushfire-enhanced winds.	51,000.00	92,500.00	87,500.00	46,000.00	0.00	0.00	277,000.00

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	National Interest Test Statement Extreme bushfires are increasing in frequency in Australia as evident from the recent Queensland bushfires. Scientific and field studies have shown that bushfire-enhanced winds are real and have compromised the building envelope, increased ember attacks and caused significant building damage. However, the non-combustible cold-formed steel roof and wall systems used as the building envelope in both steel and timber-framed buildings in bushfire prone areas are designed to withstand bushfires alone and not the combined action of bushfire enhanced wind and bushfire. This project will provide new strength data and design models to enable the design and development of improved bushfire-resilient buildings using cost-effective cold-formed steel roof and wall systems. Early use of these models will give the Australian construction industry a competitive advantage in international markets, will provide safer housing to the community and significantly reduce bushfire damage costs and loss of lives. This project will contribute to the Australian government's goal of increasing community resilience to bushfire events.							
DP200103492 Li, Prof Zhi-Yong	Plaque growth is a chronic inflammatory response induced by the interactions between endothelial cells, lipids, monocytes/macrophages, smooth muscle cells and platelets in the arteries. It involves many different biological processes, such as lipid deposition, inflammation and angiogenesis, and their interactions with the microcirculation. To understand the underlying mechanobiology, we propose to develop a mathematical model to interpret plaque growth by integrating these dynamic biological processes. It will offer a systematic rational understanding of plaque growth. New models will be provided to better interpret biological data and contribute to our knowledge in quantifying complex biological mechanisms during growth and development.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
	National Interest Test Statement This project falls within the Science and Research Priority in Health. Cardiovascular disease remains as the No.1 cause of morbidity and mortality and a huge economic burden of the healthcare system in Australia. Growth and rupture of plaques often cause acute cardiovascular syndromes such as heart attack and stroke. This project will gain a quantitative knowledge of plaque growth and can serve as a theoretical platform for future in-depth exploration of plaque progression. This will improve our ability to early detect the high-risk plaques and predict such acute events, contributing to prediction, prevention and management of health threats. 14% of Australian economic activities relies directly on advances in the physical, mathematical and biological sciences. This project integrates mathematical and biological sciences and uses mathematical tools to understand biology. It can guide biological experimental deign and reduce research costs. The models and methods developed will be applicable to problems in biological and engineering sciences involving multi-scale, multi-physics, growth and moving geometries.							
DP200103568 Sun, A/Prof Ziqi	This project aims to design novel 2D heterostructures with ultrafast interlayer transport properties and to modulate the associated optical, electric, catalytic, surface and storage properties by using a combination of experimental and computational approaches for sustainable energy applications, such as fuel generation and energy conversion and storage devices. This project expects to generate new knowledge in materials science and nanotechnology and make fundamental breakthroughs in new sustainable energy technologies. The outcomes of this project will facilitate the development of novel materials and low-cost sustainable energy in Australia with access to an enormous global market.	60,000.00	115,000.00	105,000.00	50,000.00	0.00	0.00	330,000.00
	National Interest Test Statement This project will develop novel advanced nanomaterials via a combination of theoretical and experimental approaches and address the global energy challenges in sustainable energy conversion and storage. This project will produce significant new knowledge in materials sciences, nanotechnology, and green energy and environment. This project aligns well with Australian Science and Research Priority of "Advanced Manufacturing", particularly the practical challenge of "Specialised, high-value-add areas such as high-performance materials, composites, alloys and polymers", and "Energy", particularly the practical challenge of "New clean energy sources and storage technologies that are efficient, cost-effective and reliable". The outcomes of this project will be very promising to transfer to energy-related industry and provide commercial benefit to Australian and international community. The implementation of this project has potential to decrease the cost of electricity for Australian families, maintain a green environment in Australia by reducing CO2 emission, and boost the Australian economy.							

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DP200103582 Brereton, Prof Margot F	This proposal investigates the design of systems in which humans and machines use their different abilities to learn together for mutual benefit. Machine learning has been commoditised, applied in areas such as medical image reading and autonomous vehicles, however it typically operates separately from humans, supplanting human skills and leading to deskilling. Using human-computer interaction research techniques, co-design and iterative prototyping in the domains of radiology training and environmental learning, we will devise and evaluate exemplar systems that support humans to interactively frame problems, explore and learn, while utilising and improving machine models, leading to a guiding framework for designing human-machine teaming.	81,000.00	166,000.00	172,000.00	87,000.00	0.00	0.00	506,000.00
	National Interest Test Statement Australians are concerned about the growing use of automation and machine learning to supplant their skills. People across a range of professions and levels of expertise are at risk of becoming de-skilled, disengaged, displaced, depressed, and disenfranchised if technology development continues a narrow focus on squeezing increased performance from machine learning and AI algorithms in the quest for automation at all costs. This project proposes a radical shift in focus, by researching the design of human-machine learning systems in which people are helped by machines to think critically and up-skill, improving individual and combined performance of both human and machine. We aim to create more powerful human-machine systems that boost overall performance, create more satisfying jobs and products, and mitigate deskilling. The project directly addresses Australia's Research Priority in Advanced Manufacturing, with clear economic and social benefits. Furthermore the project will directly contribute expertise to Australia's medical device industry, currently an $8 Billion industry in Australia.							
	Queensland University of Technology	1,274,794.00	2,601,583.50	2,584,051.00	1,257,261.50	0.00	0.00	7,717,690.00
The University of Queensland								
DP200100250 Wong, Dr Emily S	This proposal aims to elucidate how regulatory elements in the genome, known as enhancers, determine the identity and function of animal tissues. Currently, it is believed that enhancers cannot be traced across evolutionarily distant animals. The project uses novel concepts, computational and molecular approaches to identify deeply conserved enhancers. It further dissects the mechanism of function by proteomics and high-throughput genomics. The expected outcomes will overturn our current view on enhancer evolution and reposition our understanding of how enhancers are functionally encoded in the genome. The work is an important contribution to understanding cellular complexity and species evolution with wide-ranging impact in genetics.	130,000.00	237,500.00	227,500.00	120,000.00	0.00	0.00	715,000.00
	National Interest Test Statement Understanding the genetic basis of transcriptional control has key implications for Australia both economically and environmentally. This project will generate basic knowledge to elucidate a fundamental aspect of how genes function. The knowledge can be applied to areas of biotechnology, in particular, the areas of personalised medicine, tissue engineering and synthetic biology. Increasing our basic understanding of gene regulatory networks and biological systems will impact population health and wellbeing and promote long-term economic benefits. As genetic applications in agriculture and conservation are growing areas of research, new knowledge generated from this project has the potential to improve agriculture and the control of pest species. The expected outcomes of the project be highly significant in the field of genetics and will place Australian science at the frontier of international scientific research. Finally, the project will also expand Australia's skill base in computational regulatory biology and developmental genetics through training of research scientist and students.							

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DP200100435 Launikonis, A/Prof Bradley S	Muscle in the body of animals and human has the ability to adapt to stress placed on it, to improve performance. This allows new physical tasks that have been unfamiliar to become easier. One form of stress on the muscle is the demand to work longer without fatigue. This can be important for animal survival or athletes training for sport. A single session of intense muscle contractions can lead to the muscle increasing its capacity for endurance within 24 hrs. This project aims to examine this phenomenon in animals and human to decipher the mechanism involved in the beneficial muscle changes experienced in such a brief time. It will provide benefits such as the potential to manipulate human muscle condition and animal muscle (meat) quality.	92,500.00	172,000.00	161,500.00	82,000.00	0.00	0.00	508,000.00
	National Interest Test Statement This is a fundamental biological project about how muscle can adapt to stressful changes in its use. That is, when muscle use is changed through acute, repeated, high intensity contractions, the muscle remodels itself within a day or so to be able to cope with similar, repeated challenges. The changes inside the muscle after intense, acute contractions affect the way the muscle produces its own energy. It is not understood how the muscle changes so quickly after a single session of intense, acute contractions. It is important to understand energy regulating mechanisms in muscle, as these processes: (i) affect muscle performance, relevant to exercise; and (ii) will apply to almost all cells in the body and therefore will benefit many areas of biological research. Furthermore, as the performance of the muscle is improved following the acute, intense contractions, so is the quality of the muscle. There is economic gain to be had from understanding how to improve muscle (meat) quality. This project expects to find potential ways to apply its findings in agricultural settings to improve livestock's meat quality.							
DP200100506 Sigler, Dr Thomas J	Technological disruption has created new possibilities for employment and social interaction in cities, yet comes with many associated challenges for policymakers. This project aims to formulate a critical understanding of the sharing economy as a disruptive social, economic, and political process in Australian cities. The project team will apply advanced spatial analytics and theoretical approaches to three distinct facets of the sharing economy, providing new empirical evidence to explain transformative change in cities. It applies a geographical lens to create to new knowledge regarding who benefits from the sharing economy, and how progressive regulation can enhance the outcomes of disruptive technologies.	15,000.00	78,404.50	118,360.00	72,767.00	17,811.50	0.00	302,343.00
	National Interest Test Statement As technological disruption transforms existing social, economic, and political systems, sustaining quality-of-life in Australian cities will be contingent upon delivering innovative solutions to address increasingly complex issues tied to housing, jobs, and transportation. This project provides a systematic spatial analysis of three distinct sharing economy platforms with a focus on the social and economic costs and benefits of each across Australian cities. The project team will apply advanced spatial analytics to evaluate the effects of socio-spatial change attributed to digital platforms, with an overarching focus on the broad impacts of the sharing economy as a dynamic technological phenomenon. In doing so, this project informs policymakers and regulators with balanced empirical evidence to support progressive urban strategies.							
DP200100521 Bell, Prof Stephen R	Institutional and other theories suggest large firms necessarily engage in public policy to mainly serve narrow firm-centric interests. Yet large firms sometimes also engage in national level policy, such as big business support for policy reforms in Australia in the 1980s. Our central question is: how do large Australian firms articulate their public policy interests and goals, what factors drive this, and with what outcomes? Do they pursue narrow or broader national agendas and how might the two overlap from the perspective of large firms? In this greenfield research we link questions of big business policy engagement with questions of business power and legitimacy and also to questions of national governance capacity.	67,024.50	86,247.00	35,677.50	16,455.00	0.00	0.00	205,404.00
	National Interest Test Statement We know little about how large firms operate in the public policy environment. Arguably, the national interest could be served if large firms, given their key role in the economy, could also make a useful contribution to national public policy making. However, institutional and other corporate theory suggest firms largely focus on narrow firm-centric policy advocacy related to bottom-line concerns. Yet evidence suggests that this is not always the case. We therefore aim to examine under what conditions large firms might usefully engage in national policy making in the public interest and how or whether this can be reconciled with narrower firm-centric agendas. This is greenfield research in Australia.The research findings will prove useful in helping us better understand business perspectives on public policy making, how business policy engagement interacts with business power and legitimacy, and how all this might best serve national policy making through strategies of business-government cooperation.							

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DP200100646 Schroder, A/Prof Kate	Animal health relies upon innate immune cells to rapidly detect invading microbes and induce inflammatory and antimicrobial responses to clear infection. Mechanisms of inflammation and immune defence are only partly understood. This project aims to elucidate a novel innate immune pathway (the inflammasome) that drives inflammatory cell death and antimicrobial defence. Using innovative multidisciplinary methods, this project will yield exciting new knowledge of mechanisms of inflammation and anti-microbial responses, and new paradigms for inflammasome action. Expected outcomes and benefits include high-impact publications, international collaboration, world-class training for young scientists, and new knowledge for future commercialisation.	92,500.00	187,500.00	190,000.00	95,000.00	0.00	0.00	565,000.00
	National Interest Test Statement This project will deliver exciting new knowledge of the immune system mechanisms that allow mammals to protect themselves from the countless number of microbes they encounter every day. Project findings will have high international impact across multiple research fields (microbiology, innate immunity and immunology, cell death, cell biology), thereby enhancing Australia's reputation for exceptional scientific research. This project will provide world-class training and career opportunities to train the next generation of Australian scientists. Knowledge generated in this project may be used in future to generate new products for commercialisation, such as anti-infective or anti-inflammatory drugs, generating significant economic and commercial benefits to the Australian community.							
DP200100737 Gordon, Dr Emma J	Blood vessels form complex branched networks composed of arteries, capillaries and veins. The development and maintenance of different vessel systems (arteries and veins) is dependent on cell adherence properties within each vessel, yet how these are established and maintained remains unknown. This project aims to analyse the differences in junctional dynamics between sprouting arteries and veins, and to identify arterial and venous signalling networks that make and maintain vessel identity. This project will reveal how adhesiveness is regulated in order to make a hierarchical, functional vascular network, with implications for engineering of functional, vascularised organs in the biotech sector.	75,000.00	155,000.00	160,000.00	80,000.00	0.00	0.00	470,000.00
	National Interest Test Statement This project will improve our understanding of how differentiated vascular networks form which is essential for mammalian life. The results will have important implications in the understanding of embryonic development, and will open avenues to aid in the bioengineering of functional, vascularised organs. We aim exclusively to generate fundamental knowledge on the formation and function of a differentiated, hierarchical vascular tree. The assembly and functionality of blood vessels is important in the ageing Australian population. This basic research has the potential to maximise social and economic participation in society through understanding how to make and maintain a functional vascular network. This project will enhance Australia's skill base in cutting edge science at a supportive and highly educational environment at UQ. The research will provide multidisciplinary knowledge in developmental genetics, cell biology and biophysics. Australia is currently gaining strength internationally in these areas, and this research will expand the scope of Australian research and enhance the national profile.							
DP200100760 Bernard , Dr Aude	The project aims to establish the geographical and occupational trajectories of different migrant groups after arrival in Australia. Migration within Australia is a key driver of economic, demographic and social change. Recognising the growing diversity of immigrants, including the rapid rise in temporary migration, the project examines post-arrival moves of immigrants by visa type, country of birth and year of arrival. It seeks to improve understanding of the incidence, spatial patterns and drivers of migrants' movement within Australia and the socio-demographic impact on regions and individuals. Such understanding is an essential first step to the formulation of effective immigration and settlement policies and programs.	18,393.00	71,048.50	91,762.50	39,107.00	0.00	0.00	220,311.00

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	National Interest Test Statement The project will build a timely evidence base to inform the development of government migration policies, programs and services. First, by establishing the impact of metropolitan and non-metropolitan residential locations on the occupational trajectories of different migrant groups, the project will support the design of migration schemes that balance the developmental needs of all regions of Australia while enhancing the economic resilience of the nation. Second, identifying regions that attract and retain migrants will provide insights into the factors reducing migrant population loss and churn, which is vital to foster place attachment, strengthen social cohesion and enhance community resilience. Third, by shedding light on the level and patterns of internal migration of different temporary and permanent migrant groups, the project will help improve the sustained provision and equitable delivery of key services, particularly for more vulnerable groups such as humanitarian migrants, with direct social and economic benefits to immigrants and their communities and gains that will benefit all Australians.							
DP200100790 Webster, Dr Nicole S	Microorganisms underpin marine ecosystem health, yet there is limited understanding of how they will respond to different environmental pressures. This project will resolve this critical knowledge gap by developing a unique molecular platform for deriving quantitative stress thresholds for microbial communities inhabiting key reef habitats (seawater, sediments, invertebrates). Quantifying how reef microorganisms respond to a broad suite of environmental perturbations (temperature, nutrients, contaminants), will generate stress-response data that can be incorporated alongside eukaryotic data in environmental assessments, greatly improving the ecological relevance and reliability of risk and vulnerability assessments.	100,000.00	210,000.00	210,000.00	100,000.00	0.00	0.00	620,000.00
	National Interest Test Statement Microorganisms underpin marine ecosystem health and have the capacity to exacerbate or mitigate ecosystem changes. The Great Barrier Reef is facing unprecedented pressure from elevated sea surface temperature and declining water quality, yet the impacts of these pressures on reef microbial communities remain undefined due to the difficulty in applying stress-response data in a way that has ecological relevance. Understanding how environmental stressors affect marine microorganisms was declared a priority in Australia's 2015-25 National Marine Science Plan. Critically however, despite investment into establishing a marine microbial baseline, there is no framework to reliably quantify and predict how marine microbes and their ecologically important functions respond to environmental stress. This project will develop and utilise novel molecular tools to quantify the sensitivity of reef microorganisms to environmental perturbations so that microbial data can be included alongside eukaryotic data in environmental risk and vulnerability assessments for use by industry, reef managers and environmental regulators.							
DP200101020 Douglas, Prof Heather A	This project aims to review the application and experience of the non-fatal strangulation offence as a response to domestic violence. Through a mixed-methods design, the project will generate new knowledge about the operation of the non-fatal strangulation offence in practice. This is crucial given that many women escaping domestic violence report non-fatal strangulation from their past partner. Expected outcomes of the Project include the development of law reform and policy recommendations to improve the operation of the offence, enhance service responses and develop professional education. This research will provide significant social and economic benefits through better understanding of the legal response to domestic violence.	73,000.00	137,500.00	104,000.00	39,500.00	0.00	0.00	354,000.00
	National Interest Test Statement Domestic violence is recognised as an issue of national importance due to the significant negative effects of domestic violence on health and well-being. This research will contribute to building healthy and resilient communities by providing evidence-based strategies towards the prevention of domestic violence. The project will analyse the impact of the criminalisation of non-fatal strangulation to inform policy decisions, especially those designed to minimise the risks associated with strangulation in the context of domestic violence in Australia. Focused on the high-risk behaviour of non-fatal strangulation, this Project will further contribute to addressing practical challenges associated with domestic violence to improve identification, tracking, prevention and response. Knowledge from this research will help to inform future development of legislative responses and service responses nationally to improve our response to domestic violence.							

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DP200101049 Kroese, Prof Dirk P	Partially Observable Markov Decision Processes (POMDPs) provide a general mathematical framework for sequential decision making under uncertainty. However, solving POMDPs effectively under realistic assumptions remains a challenging problem. This project aims to develop new efficient Monte Carlo algorithms to significantly advance the application of POMDPs to real-world decision problems involving complex action spaces and system dynamics. Both theoretical and algorithmic approaches will be applied to sustainable fishery management --- an important problem for Australia and an ideal context for POMDPs. The project will advance research in artificial intelligence, dynamical systems, and fishery operations, and benefit the national economy.	62,500.00	122,500.00	120,000.00	60,000.00	0.00	0.00	365,000.00
	National Interest Test Statement The project will yield multiple national benefits. First, this project addresses a fundamental problem lying at the interface of artificial intelligence (AI), operations research, statistics and dynamical systems; namely, sequential decision making under uncertainty. Hence progress has the potential to impact many scientific investigations, medical researches and business activities. Second, a main application is to provide improved strategies for sustainable fishery management, with important benefits for the national environment and economy. Third, the project will provide an exciting training ground for a postdoc and several research students to develop coveted skills in the areas of AI, machine learning, statistics and mathematical modelling, which are much sought-after by many industries. Lastly, the project will stimulate interdisciplinary collaboration between AI/computer scientists and mathematical scientists -- two disciplines with common roots that have somewhat drifted apart.							
DP200101144 Laycock, A/Prof Bronwyn G	Globally, governments are implementing policies to drive a move to a circular economy. In the process, new materials are being introduced whose potential impacts need to be understood before they are widely used. This project pioneers investigations into the rate and extent of biodegradation of biodegradable plastics in aquatic and soil environments and the associated ecotoxicology of this process. In particular, it aims to quantify the extent to which the surfaces of these materials accumulate environmental pollutants via adsorption and other mechanisms. The outcomes will include conceptual models of biodegradation across environments, including lifetimes and likely impacts, critical information for framing a sustainable plastics industry.	55,000.00	110,000.00	110,000.00	55,000.00	0.00	0.00	330,000.00
	National Interest Test Statement Plastic pollution is now a major and growing international issue. The need to deliver appropriate and holistic plastic waste management strategies is urgent and a key concern for the Australian public, governments and industries. Biodegradable/bioderived polymers will be part of the solution, particularly in agricultural and food packaging applications, and as such their market is growing rapidly. However, biodegradable polymer lifetimes and potential impacts across different natural environments are currently poorly understood. This project aims to deliver a deep understanding of the biodegradation processes of commercially relevant biopolymers and examine interactions between microbial communities and biodegradation rates in aquatic, soil & laboratory environments. Furthermore, it will assess the potential for negative impacts such as through selective uptake and concentration of hydrophobic toxins in the environment or release of harmful additives or degradation byproducts. This information will be critical as Australian governments implement policies to drive the use of bioderived/biodegradable plastics.							
DP200101152 Reichelt, Dr Melissa E	Aging is accompanied by a stiffening of the heart and reduced function, which is accelerated by cardiovascular disease and leads to heart failure. How the heart stiffens is poorly understood. A new mechanism is proposed here, involving structural membrane proteins (termed caveolae and cavins) and a signalling molecule (nitric oxide). The current research aims to unravel the interplay between cardiac cells and these proteins/signals to cause stiffness and to determine whether this process governs normal aging of the heart. This work will advance understanding of how heart function is determined and reveal how the human heart changes with normal aging.	80,000.00	150,000.00	140,000.00	70,000.00	0.00	0.00	440,000.00

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	National Interest Test Statement							
	Australia has an aging population and our capacity to provide well-being to the individual and the population requires understanding the ageing process in terms of changes in our bodies as well as its societal and economic impacts. The loss of mobility, cognition and welfare that can occur with aging, with associated reductions in independence and contributions to society, can often be linked to deterioration of the cardiovascular system – specifically, the failure of the heart to pump efficiently. This research aims to understand how/why the human heart ages and what processes control the degree of stiffness of the heart muscle. This basic mechanical property of the heart is critical to its pump function and how it responds to stress and exercise. Outcomes will advance our understanding of normal heart biology, improve knowledge of basic mechanisms of human aging and provide a platform for mitigating age-related morbidity.							
DP200101217 Shapter, Prof Joseph G	There are >300 2D materials like graphene with potentially exotic and useful electrooptic and superconductor properties that will drive novel industrial applications. This project aims to use advanced computational and experimental techniques to discover and fabricate new 2D hybrid materials built from different layers of 2D materials. This approach is essential as the number of possible hybrids is huge (millions) and current processes to identify and build 2D hybrids are technically challenging and slow. Expected outcomes include defining a new paradigm for efficient identification and synthesis of 2D hybrids with exotic, bespoke properties. The generation of a large database of materials for researchers/industry would be of wide benefit.	115,000.00	230,000.00	215,000.00	100,000.00	0.00	0.00	660,000.00
	National Interest Test Statement							
	2D materials have hitherto inaccessible exotic properties that can increase the efficiency of a wide range of industries. New computational and experimental methods established by this Discovery Project will accelerate 2D materials discovery by orders of magnitude, providing a step-change in solutions to some key problems in Australia and placing Australian industry in a market leading position. It will benefit industries in the energy (e.g. high capacity batteries, hydrogen sequestration systems, low cost high efficiency photovoltaics), electronics (e.g. organic semiconductors and displays), water (e.g. desalination, water filtration) and catalysis industries amongst many others. Accelerated discovery, synthesis, and scale up of novel hybrid materials will transform Australia's manufacturing industry and add value to Australian manufactured products. The project provides a world-class training environment for future Australian research leaders who will move into Australian industry and tertiary institutions to ensure Australia will drive innovations in materials critical for our future commercial success.							
DP200101238 Zhao, A/Prof Chun-Xia	This project aims to develop new platform technologies for making nanostructured hybrid core-shell materials with exceptionally high drug loading and programmed release. Building on this research team's recent breakthrough in the precision engineering of core-shell materials, this research will revolutionise current approaches for making drug-loaded polymer and inorganic particles. Significant outcomes will include a novel sequential nanoprecipitation platform technology for making drug-core polymer-shell nanoparticles, and a new bio-inspired approach for making hybrid drug-core silica-shell nanocomposites, and new materials for applications in programmed release and delivery systems.	71,000.00	144,500.00	148,500.00	75,000.00	0.00	0.00	439,000.00
	National Interest Test Statement							
	The poor water solubility of many chemical actives hinders the development of new pharmaceutical, agricultural, food products. For example, 40% of approved drugs and 90% of drugs in development are water-insoluble. New methods are needed for more efficient formulation and delivery of these drugs. This research will develop new platform technologies for making hybrid core-shell materials with exceptionally high drug loading capacity and programmed drug release, delivering new technologies for the manufacture of high-value pharmaceutical products. The novel core-shell materials will enable more efficient delivery of hydrophobic ingredients, and place Australia at the forefront of nanotechnology and drug delivery research. The future applications of these materials in a wide variety of fields, such as pharmaceuticals (controlled release of drugs), and agriculture (sustained release of hydrophobic insecticides, plant protection agents and fertiliser) may lead in the longer term to considerable economic and social benefits.							

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DP200101271 Moyle, Dr Peter M	Gene delivery systems are important tools in biological research and offer many exciting future prospects. Delivering gene material is very difficult in practice: rapid deterioration, poor cell uptake, and reaching the right tissue and cell types are major obstacles. Ways to overcome each barrier individually have been suggested in existing research but these components have not yet been combined in a single solution, which this project will tackle. This proposal aims to create a technology to stabilise and deliver active gene material to target cells. The gene delivery tool developed in this project will advance biological research greatly with many potential future applications.	87,000.00	172,000.00	170,000.00	85,000.00	0.00	0.00	514,000.00
	National Interest Test Statement The delivery of genetic material to specific cells or tissues will overcome issues that have hindered progress in the exciting and highly important field of gene delivery (e.g. the need to administer large amounts of genetic material for efficacy, and the associated potential for toxic/off target effects). This research will develop widely applicable and superior tools that will achieve these outcomes. Developing these tools is in Australia's national interest. Such tools are essential for increasing the utility of gene delivery, and will improve basic research opportunities/outcomes (e.g. enabling delivery of genes into cells where traditional technologies failed) where such techniques are widely used. Thus, this work will have significant commercial value, and associated potential to positively contribute to Australia's economy. This work will also provide social and cultural benefits by establishing Australia as a leader in the gene delivery field, opening opportunities to promote the Australian pharma/biotechnology industry, and foster the employment and training of young scientists.							
DP200101299 Craik, Prof David J	This project aims to identify, study, engineer and apply a new class of biocatalysts (called asparaginyl endopeptidase enzymes) as versatile tools for manufacturing of advanced therapeutics and bio-insecticides. The expected outcomes include fundamental new knowledge on the mechanism of action of these catalysts, an expanded toolbox for precision engineering of biomolecules and new strategies for production of high-value pharmaceuticals and crop protecting agents. The project is significant because it will contribute to high value biotechnology and agricultural industries in Australia, with the potential for economic, environmental, training and societal benefits.	73,500.00	158,500.00	170,000.00	167,500.00	82,500.00	0.00	652,000.00
	National Interest Test Statement The project's benefits to Australia are numerous and include the potential for substantial economic, environmental and social benefits. Specifically, the potential benefits of national interest to Australia include: 1) The development of innovative biotechnological approaches for the environmentally-friendly production of advanced high value products; 2) Economic benefits from returns on drugs and agricultural products that will arise from this work; 3) Economic and social benefits through the training of a next generation of researchers to drive a sustainable biotechnology sector in Australia; 4) Reputational benefits through international collaboration with one of the world's leading centers in biotechnological innovation; and 5) Social and environmental benefits due to reduced need for harsh chemical reagents and chemical insecticides.							
DP200101339 Links, A/Prof Jon R	This Project aims to open new avenues in quantum device engineering design. This will be achieved through the use of advanced mathematical methodologies developed around the notion of quantum integrability, and the breaking of that integrability. The expert team of Investigators will capitalise on their recent achievements in this field, which includes a first example of a quantum switch designed through broken integrability. The expected outcomes will encompass novel applications of abstract mathematical physics towards the concrete control of quantum mechanical architectures. These outcomes will promote new opportunities for the construction of atomtronic devices, which are rising as a foundation for next-generation quantum technologies.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement Ultracold quantum gases will underpin the infrastructure of emerging technologies based on atomtronics. Atomtronic devices are analogues of electronic devices, such as batteries and transistors, which utilise the unique properties of ultracold atoms instead of electrons. There are vast opportunities for mathematical physics research to forge deep insights into the nature of ultracold quantum gases, and to consequently expose new opportunities for the design and control of atomtronic devices. This project will benefit Australian Science and Technology by enabling expansion of the work conducted by world-leading proponents of mathematical physics developments in this field. It will also provide an exciting training ground for students and early career researchers in the mathematical physics field of quantum integrability, and in the mathematical modelling of ultracold quantum gases. These are both areas within STEM (Science, Technology, Engineering, Mathematics) research that will continue to grow for many years.							

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DP200101352 Pritchard, A/Prof David M	This project aims to transform our understanding of classical Athens. This Greek state is famous for developing democracy to an extremely high level and for being the leading cultural innovator of classical Greece. Less well known is the dark side of this success story. Athens revolutionised warfare, killing tens of thousands of combatants and civilians. There is a good case that democracy itself sustained this military record. But this case has hardly ever been studied. By filling this big gap in our knowledge this project will be highly significant. It will massively increase capacities in research training and international collaboration. The benefits will include new ideas for better understanding the wars that democracies wage today. **National Interest Test Statement** At any one time thousands of researchers worldwide are studying this famous ancient state. This project will completely transform how they understand classical Athens. By doing so it brings a clear cultural benefit: it will enhance Australia's reputation for innovation in the Humanities. Another cultural benefit is that it will stimulate young Australians to think deeply about their own democracy. In high schools Ancient History always raises questions about civics. This project will encourage students completely to re-assess their understanding of how democracies today wage war. There are clear economic and social benefits. Democracies are increasing in regions of strategic importance to Australia, but these regions are still plagued by wars. In order to prevent them or, simply, to reduce their cost in terms of casualties and lost trade, policymakers must understand democratic wars. At present there is no satisfactory explanation of the behaviour of modern democracies at war. By providing many important new ideas for formulating this explanation, this project will, in time, enhance Australia's security.	18,207.00	49,497.00	52,411.00	21,121.00	0.00	0.00	141,236.00
DP200101397 Zhu, Prof John	Solid oxygen fuel cells are a clean energy generation device with very high energy efficiency and if with hydrogen as fuel, the emission is zero. However, the utilisation of hydrogen is limited by on-board storage. Ammonia is a promising hydrogen carrier and can be directly fed to solid oxide fuel cells without fuel storage problem, and the products are just hydrogen and nitrogen. For direct ammonia solid oxide fuel cells, the key challenge is the anode. This project aims to develop a high performance anode for direct ammonia solid oxide fuel cells with both high activity and high stability at low temperature (below 600 degree C), thus addressing a key issue to make the direct ammonia solid oxide fuel cells commercially viable. **National Interest Test Statement** This project is of great national benefits: (1) Hydrogen is a clean fuel but its utilisation is limited by storage issue. Ammonia is a promising alternative hydrogen carrier without storage and delivery problems, and can be directly fed to solid oxide fuel cells. This project aims to develop high performance anode for direct ammonia solid oxide fuel cells, thus will be a great contribution to the transition to the future hydrogen economy in Australia. (2) This research is very unique, as we are developing anode for direct ammonia solid oxide fuel cells at low temperature (below 600 degree C). The catalyst to be developed for the anode will be very special, and will need to be highly porous, highly active and stable, and electronically conductive simultaneously. The fundamental research will put Australia in the frontier position in this promising area. (3) This project will also train promising postgraduates and young researchers for Australia in fuel cells, clean fuels, nanomaterials and chemical engineering areas.	75,000.00	140,000.00	130,000.00	65,000.00	0.00	0.00	410,000.00
DP200101408 Zhang, Prof Ming-Xing	This project aims to develop low-cost and corrosion resistant compositionally complex alloys and associated processes to concurrently achieve high strength and high toughness using an innovative design strategy. The project expects to overcome the major limitations of this new type of alloys, enabling their practical applications in industry, creating new knowledge of materials science. Expected outcomes include commercialisation ready new alloys, breakthrough fundamental understanding of the mechanisms and long-term institutional collaboration. This should provide significant benefits, such as enhancement of Australia's capacity of alloy development and manufacturing and strengthening the country's world leading position in this area.	72,500.00	145,000.00	145,000.00	72,500.00	0.00	0.00	435,000.00

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	National Interest Test Statement Over past decades, Australia has been one of the world leaders in metal productions, including steels, aluminium and zinc alloys. Although mining production is more important in contributions to the country's economy in recent years, Australia has strong potential to product high quality metal products. The expected outcomes enable production of the most advanced engineering alloys with superior properties that can be used in various industry sectors. This strengthens the Country's capacity in metal production and restores Australia's world leading position in this area. The research outcomes also attract international partnership, collaboration, commercialisation and investment to Australia, promoting the growth of Australia's aerospace, automotive, agriculture and electronic industries. In addition, the fundamental research makes breakthrough contributions to materials science, which dramatically raises Australia's reputation and maintains the country's world leading role in metal research. Thus, the research makes contributions to the national interest from economic, commercial and social aspects.							
DP200101476 Lichtwark, A/Prof Glen A	This project aims to further our understanding of the biomechanical stress and strains experienced by contracting human muscles. Using innovative imaging techniques such as microendoscopy and supersonic shear imaging, we expect to generate new significant evidence on the structural and neural factors that lead to areas of high stress in human muscles. Outcomes of this project include not only a new understanding of muscle design on multi-scale level, but also of muscle function and adaptation. This should provide significant benefits in better predicting muscle injury and prescribing safe exercise, knowledge that would benefit biomechanical engineers and sport and exercise professionals.	77,500.00	138,500.00	138,000.00	77,000.00	0.00	0.00	431,000.00
	National Interest Test Statement This project will generate new knowledge on how stress and strain is distributed through human muscles and if this distribution changes with certain exercise. Better understanding human muscle function will help draw conclusions on what constitutes safe and effective exercise, and therefore has the potential to help exercise and sport professionals who seek to optimise human muscle structure for performance or to prevent muscle damage from exercise. Our research could reduce injury risk to both professional and recreational athletes, enabling sport and exercise professionals to improve performance through targeted training. Ultimately, our proposal may have a social benefit by enabling safe exercise for a greater number of people and improving elite sporting performances. The project will also provide a basis for realistic computer simulations of how complex human muscles produce force. In turn, this may lead to potential commercial benefit, by influencing the design of human performance enhancing devices (in the military) or for tissue engineering (muscle regeneration).							
DP200101566 Rosenbaum, A/Prof Gideon	The uneven distribution of ore deposits in magmatic arcs is poorly understood. This project aims to provide new strategies for more effective mineral targeting by testing the hypothesis that anomalous magmatism enriched in metals reflects particular styles of deformation, such as tears in subducting slabs. We will use geophysical modelling to constrain slab structure along the northern boundary of the Australian plate, and geochemical data to establish spatio-temporal links with anomalous magmatism and ore deposits. By identifying the geochemical fingerprint of tear-related magmatism, outcomes are expected to benefit geoscience research and mineral exploration by providing context to similar rock associations in mineral-rich provinces.	45,000.00	91,500.00	89,500.00	43,000.00	0.00	0.00	269,000.00
	National Interest Test Statement Copper and gold deposits are heterogeneously distributed in modern and ancient subduction zones, indicating that special conditions are required for their formation. This project will investigate links between subduction zone heterogeneities, such as slab tears, and spatially and geochemically anomalous arc magmatism (SGAM) that is commonly associated with porphyry and epithermal ore deposits. By understanding the geodynamic origin and geochemical characteristics of SGAM, outcomes are expected to provide important information on the circumstances that trigger ore formation and their geochemical fingerprint. This fingerprint could potentially provide a tangible exploration tool in search for future resources in Australia. The availability of copper resources is crucial for modern societies and will become even more important in managing transitions to low-carbon economies. Given that current discovery rates do not meet future demand, it becomes increasingly important to understand the fundamental science of ore formation and to target exploration accordingly. This challenge will be tackled in this project.							

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DP200101602 Nielsen, A/Prof Mark	Children learn many important things by copying others. But how do we best facilitate this where it's culturally appropriate or encourage innovation to support more general learning? This developmental psychology project aims to provide answers, using novel experiments and comparisons of different cultural groups to show how children acquire skills while becoming valued community members. Expected outcomes include the refinement of core developmental psychology theory, introduction of new experimental techniques, and strengthening of international collaborations. This should provide significant benefits to educators, policy makers, parents and those invested in understanding and improving the inter-generational transmission of knowledge.	57,939.50	103,992.50	103,950.00	57,897.00	0.00	0.00	323,779.00
	National Interest Test Statement Our children learn much about how to do things by copying those around them. Sometimes we want our children to do things exactly as they've seen them done (e.g., because it is customary). But we also want our children to be able to think independently, and to see new ways of doing things. This project will establish what influences children to be imitative or innovative when learning a novel task, and determine how this decision-making process is effected by presenting actions as either culturally or functionally relevant. Anchored in developmental psychology research and theory, this integrated series of studies will impact Australia's social and cultural fabric, by detailing how young children learn, which will in turn better place us to know how to teach them appropriately. This information is critical for our understanding of the ways information and skills are passed from generation to generation, to understand how we can retain processes that are culturally important, while also encouraging change when that is more meaningful for the development of new skills.							
DP200101630 Zuryn, Dr Steven	How do humans and other organisms prevent the accumulation of dangerous mitochondrial genome (mtDNA) mutations across generations? This Project aims to uncover the cellular and molecular pathways that help prevent the inheritance of mtDNA mutations to offspring by employing cutting-edge genetic technologies that the laboratory has recently developed in the germline of an animal model system. This Project will generate new knowledge in the area of mitochondrial genetics and evolution. Expected outcomes include the development of new theories for mtDNA inheritance, which should provide significant benefits for agricultural breeding programs and the interpretation of mtDNA inheritance patterns in the human population.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
	National Interest Test Statement This Project intends to significantly advance our current fundamental knowledge of mitochondrial genome (mtDNA) inheritance in animals. It is anticipated that the knowledge acquired from this Project will contribute to the national interest through potential economic and commercial gains. By developing new theories for mtDNA inheritance, this work should ultimately aid in the design of agricultural breeding programs to maximise fitness. The knowledge gained from this Project is also expected to enhance our understanding of the inheritance patterns of human mitochondrial mutations within the population. The combination of novel methods proposed here, some of which are potentially translatable for mtDNA diagnostic purposes (e.g. mtDNA mutation genotyping), together with the expected conceptual advances, are also likely to promote the development of further innovative experimental paradigms to study mitochondrial genetics, thereby strengthening Australia's research capability through academic leadership and training of the next generation of researchers, and delivering maximum value for investment.							
DP200101847 Goodhill, Prof Geoffrey J	This project uses theory and experiment to investigate how neural coding emerges in the developing brain. It adopts the larval zebrafish as a model system, because neural activity can be recorded at whole-brain scale but with single neuron resolution. The project expects to generate new knowledge regarding how neural activity comes to represent sensory stimuli, and new statistical models for interpreting large-scale patterns of neural activity. This will provide significant benefits including greater insight into normal brain development, and the formulation of new concepts potentially relevant for brain-inspired computing. The expected outcomes also include enhanced capacity at the interface between neuroscience and computation.	100,000.00	200,000.00	205,000.00	105,000.00	0.00	0.00	610,000.00

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	National Interest Test Statement							
	By better understanding what computations biological brains perform we will be able to design improved artificial intelligence (AI) algorithms, and ultimately be in a better position to understand the underlying causes of neurological dysfunction. The huge current economic impact of AI depends on algorithms inspired by relatively old concepts for how biological brains work. By developing our understanding of brain computation using the very latest experimental and theoretical tools, this project has the potential to inspire new AI algorithms which could have significant economic impact. Furthermore, by expanding our knowledge of the mechanisms driving normal neural development, it has the potential to improve our understanding of what could be going wrong in abnormal neural development, which has a significant social and economic impact.							
DP200101900 Wang, Prof Lianzhou	Sustainable hydrogen production is highly significant towards decarbonised economy. This project aims to develop new classes of organometal halide perovskite quantum dots (OHPQDs) for efficient photoelecrochemical hydrogen production. The key concept is to design toxic Lead free/less OHPQDs for use as stable photoelectrode materials in self-powered sunlight driven water splitting devices. Expected outcomes include new generation advanced materials and revolutionary technologies for efficient solar hydrogen generation. The successful completion of this project will significantly benefit Australia by positioning the nation at the frontier of renewable hydrogen supply technologies.	85,000.00	170,000.00	170,000.00	85,000.00	0.00	0.00	510,000.00
	National Interest Test Statement							
	The key challenge for practical solar hydrogen production is the lack of suitable semiconductor materials to achieve the targeted 10% solar-to-hydrogen conversion efficiency. This project aims to develop new classes of functional materials for next generation solar hydrogen production system in a sustainable manner. The proposed program aligns well with the Science and Research Priority (SPR) of Energy, addressing a Practical Research Challenge of “New clean energy sources and storage technologies that are efficient, cost-effective and reliable”. The success of this project underpins important technological advances which will lead to significant economic and environmental benefit to Australia. The expected impacts are the expansion of Australia's knowledge base and the improvement of R&D capability in functional materials and clean energy utilisation sectors.							
DP200101930 Marshall, Prof Justin N	This proposal aims to unlock the power of a 400 million year old evolutionary arms race between two of earth's most successful predators, cephalopods (e.g. octopus) and mantis shrimp (stomatopods). New knowledge in vision (sensor design), neural coding (circuits and information flow) and behavioural (decisions and actions) innovations from these two groups will have fundamental and applied outcomes. The interdisciplinary and comparative nature of the project aims to amplify outcomes in questions of efficient neural coding, optical design and bio-inspired solutions. Benefits from the study include GPS-free navigation in marine engineering and rapid exposure of research results to millions of people through existing communication programs.	117,066.00	236,045.00	237,958.00	118,979.00	0.00	0.00	710,048.00
	National Interest Test Statement							
	Australia's national interest is benefitted in 3 areas: (1) Economic / Commercial – The project aims to produce bio-inspired technology. Previous innovations that benefit humankind from the animal models chosen include: improved computer data storage, satellite design, cancer detection, driverless vehicles, GPS-free navigation (Aim 3). Navigation without surfacing or GPS underwater is a significant problem the CI aims to solve. (2) Social / Cultural – Generating and passing on new knowledge around the charismatic proposal subjects: the Great Barrier Reef, octopus, and mantis shrimp, has societal and cultural benefit. Results will contribute to six documentaries that the CI is consulting on, including working with Sir David Attenborough on his latest "Life in Colour". (3) Environmental / Economic - The Great Barrier Reef is under threat. New knowledge about its inhabitants, applications useful for human endeavour and the public interest the project will create, is of great significance. It will drive the desire to preserve this natural and economically important asset for future generations.							
DP200101943 Barrett, Prof Margaret S	This project aims to develop a model of the signature pedagogies and environmental supports that foster the 21st century skills of creativity, innovation, collaboration and cooperation. The project's significance lies in its unique focus on pedagogies of expert creative collaborative practice in four internationally renowned chamber music training environments. These are characterised by individual risk in performance, intensified need for collaborative exchange, and the capacity to juxtapose individual accountability within collaborative practices. Expected outcomes and benefits of the project include a model that has translational application and impact for those professions that rely on generating new knowledge in collaborative settings.	49,825.00	113,070.50	130,531.00	112,014.00	44,728.50	0.00	450,169.00

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	National Interest Test Statement The Australian graduate attributes identify work-ready skills that arise from young people's tertiary education including Independence and Creativity, Effective Communication, Critical Judgement, and Ethical and Social Understanding. Implicit in these are skills of creativity, innovation, collaboration and cooperation. Chamber Musicians learning in advanced workshop environments are engaged in an authentic (real-world), risk-laden (frequent public performance) creative collaborative practice as they are guided through an apprenticeship in the cognitive, moral, and practical aspects of being a professional musician. Identifying the signature pedagogy that supports this practice holds significant economic, social and cultural benefits for Australia. A pedagogical model for creative collaboration will (1) assist industries, professions and higher education practices where knowledge generation relies on individual and collective capacities for effective creative collaboration; (2) position Australia as an international leader in innovative tertiary music pedagogy; and (3) enhance musician career development.							
DP200101948 Rakic, Prof Aleksandar D	This project proposes a new broadband, high-power, laser technology for THz sensing. This semiconductor laser based THz technology is crucial for a wide range of applications requiring the acquisition of THz spectral signatures of materials and high-frame rate hyper-spectral THz imaging. We propose two pathways to engineer this novel THz technology: using a tuneable, coupled-cavity quantum cascade semiconductor laser and by creating the broad emission spectra through active mode locking in a THz semiconductor laser. The THz laser coupled with the self-detection technique is the key to realising this, and will be explored both in model and experiment.	75,000.00	147,500.00	145,000.00	72,500.00	0.00	0.00	440,000.00
	National Interest Test Statement This project will result in a technology platform for broadband THz sensing and imaging which will address problems of significant scientific, commercial, and societal relevance in Australia. There are two key application areas which align with Australia’s Science Priorities. The first application area relates to health, notably in the early detection of skin cancer. The second application area relates to enhanced food production, where we envisage potential for disease surveillance and identification in crops as well as food safety, by detecting the presence of bacterial and fungal organisms in packaged food.							
DP200101949 Nogita, Prof Kazuhiro	The aim of the proposal is to develop an entirely new way of joining functional elements of circuit boards using tailored intermetallic joints that replace traditional solders. The outcome will be that electronic devices, from smart phones to smart grids and electric vehicles, will become more reliable and less susceptible to cracking and circuit failure. Electronics will last longer and less E-waste will be generated. This would revolutionise electronics manufacturing. The project has a high probability of achieving this breakthrough based on unique, world-class expertise in intermetallic compounds and characterisation that has already been established by the international network of Investigators.	75,000.00	145,000.00	140,000.00	70,000.00	0.00	0.00	430,000.00
	National Interest Test Statement As an advanced industrial economy Australia is increasingly reliant on electronics in all aspects of personal life, business and the economy in general. Although Australian engineers have a track record of innovation in electronic design, very little electronics are now manufactured in Australia. Australia is a high labour cost country so that local manufacturing of electronics can be justified only when significant value can be added by unique technological advantages. The advanced joining technology developed by this project would provide that value premium. A capacity for innovative design combined with manufacturing based on a new joining technology that could provide a significant longer service life would provide the basis for a renewed electronics manufacturing industry that would be competitive in the global market.							
DP200101980 Hugenholtz, Prof Philip	The gut microbiome is central to animal health and immune function, however we have an incomplete understanding of how this important symbiotic ecosystem evolved. By approaching this knowledge gap from a historical perspective and using real-time observation, this project will address how the gut community evolved with the rodent host and how members of that community respond to new selective pressures. The significance of these findings is in their capacity to inform our understanding of the relationship between host and microbe, not only within a key model system, but by extrapolation to other host-microbe systems.	132,000.00	267,500.00	260,500.00	125,000.00	0.00	0.00	785,000.00

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	National Interest Test Statement							
	The proposed study will contribute to fundamental understanding of host-gut microbiome evolution and the effects of modern environmental stresses on this essential symbiotic relationship. By focusing on the most widely used animal model in science, findings have the potential to alter current research practices and to improve the relevance of the mouse model. The study involves development and application of cutting edge genome analysis methods that will advance Australian science and publicise Australian research internationally. This will contribute to achieving Innovation and Science Australia's vision for 2030 which calls for advancing Australia's technology training and education, specifically identifying genomics as an important growth area.							
DP200102011 Wells, Dr James W	The overall aim of this proposal is to understand the mechanisms through which a rare population of regulatory cells maintains skin integrity. Despite their importance, little is known about the regulatory pathways these cells utilise. Previous work from the team has described an innovative technique to enrich these cells for in-depth study and demonstrated their potent regulatory capacity in vivo. This project will enhance our understanding of these cells and uncover their mechanisms of action. The outcomes of this work will therefore provide fundamental new knowledge of skin physiology, and lead to novel insights regarding how healthy skin, which is essential for the very survival and function of a living organism, may be maintained.	80,000.00	162,500.00	162,500.00	80,000.00	0.00	0.00	485,000.00
	National Interest Test Statement							
	This proposal aims to characterise a new cell population that can regulate immunity in the skin. These cells have remained poorly studied for decades. However, due to our recent advancements in understanding how to physically isolate these cells, we are now perfectly positioned to research these cells and learn about their unique features and the regulatory mechanisms that they employ. Our results will be of high interest to the biomedical and commercial communities by generating a greater awareness of how mechanisms in the skin may be controlled to increase vaccination immunity, maintain skin integrity, or decrease unwanted immunity to readdress normal skin balance. As we move toward an ageing society, the pressures on maintaining skin integrity are increasing and the skin is increasingly becoming more open to damage. Therefore, a better understanding of how the skin immune system is regulated will have a major impact on societal healthcare issues, and support Australian industries as they seek to tap into a larger share of the global dermatology market, which is predicted to reach $33.8 billion in 2022.							
DP200102159 Najman, Em/Prof Jackob M	This is a study to determine the rate and predictors of child and adolescent experiences of victimisation in an Australian population based sample. This study will address widespread concerns about the experiences of violence by Australian children. No previous population based studies have addressed this issue. Expected outcomes are published papers in major journals, policy relevant data provided to Commonwealth and State governments as well as relevant NGOs. The consequences of child and adolescent victimisation are substantial. This study will point to both the causes and prioritise strategies to reduce the level of violence experienced by children.	91,305.50	188,968.00	188,928.50	91,266.00	0.00	0.00	560,468.00
	National Interest Test Statement							
	Children and adolescents are all too frequently the victims of a range of potentially criminal behaviours.The consequences of experiencing victimisation by the developing child are great and include a continuing cycle of violence, reduced education and occupational outcomes, increased criminal offending behaviour, a less stable family life, and poorer mental health.There is now ample evidence that child and adolescent victims have a future life trajectory that is one of diminished potential for a "successful" life course. The absence of relevant Australian research which identifies the extent to which children and adolescents are victimised constitutes a major gap in knowledge which this study will address.There is also a need to know more about the perpetrators of those who victimise children and adolescents and the factors that contribute to victimisation. Electronic media introduce a range of new concerns about contemporary forms of child and adolescent victimisation. Policies to reduce likely levels of victimisation need to be based upon evidence which this study will be the first in Australia to obtain.							
DP200102227 Arnold, A/Prof Derek H	Human vision is shaped by predictive signals in the brain. Despite a century of speculation, we do not know how this interplay is implemented - particularly during natural viewing. This project will establish and validate new psychophysical protocols for investigating predictive coding in human vision. Experiments will involve natural viewing and eye tracking, so results will generalize to real-life. Studies will seek to clarify how predictions are formed and signalled. This could inform future developments in artificial intelligence, as that cutting edge technology continues to be informed by our understanding of predictive coding in human vision.	71,500.00	132,500.00	111,000.00	50,000.00	0.00	0.00	365,000.00

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	National Interest Test Statement							
	Human vision is shaped by predictions generated by the brain. While this fact is well established, we do not know how this interplay is implemented, particularly during daily natural viewing. We will create and validate new psychophysical protocols, which will allow investigators to determine how successful and unsuccessful predictions are signaled during natural viewing. This will be important to a broad range of neuroscientists, as there is a lot of interest in how predictions are formed and signalled, so the project will enhance Australia's reputation for cutting edge research. International collaboration will strengthen the skill set of Australian researchers by providing training opportunities for junior Australian scientists, from senior Australian and international experts in human vision and psychophsyical investigations. Results may have long-term implications for artificial intelligence, as this cutting edge technology continues to be informed by our understanding of predictive coding in human vision.							
DP200102239 Davis, Prof Matthew J	Magnetic spin vortices are stable whirlpool-like objects that can spontaneously form when magnetic materials are rapidly cooled. This project aims to understand and manipulate spin vortices in a magnetic quantum fluid, one of the cleanest and most controllable magnetic systems. The significance is that spin vortices are potentially fundamental elements of future electronic technologies for advanced storage and logic. The expected outcomes are the ability to create spin vortices on demand, and the characterisation of their suitability for future applications. The benefit is an improved fundamental knowledge of spin vortices, and laying the groundwork for the use of magnetic structures in future spin-based electronics.	100,000.00	180,000.00	140,000.00	60,000.00	0.00	0.00	480,000.00
	National Interest Test Statement							
	This project addresses the manipulation, control, and detection of novel magnetic structures in an ultracold quantum gas, as fundamental elements of future electronic technologies for advanced storage and logic. Ultracold quantum gases are ideal testbeds for understanding these magnetic structures, and the breakthroughs arising from this research have the potential to redefine, and be incorporated in, next-generation integrated circuits. This project will also tackle how these magnetic structures can be developed as a sensing technology. Quantum gases are exquisitely sensitive to magnetic fields, and could be used, for example, to detect signalling in the brain and nervous system, or as passive magnetic sensors in defence applications. Significant investments have recently been made in Australian quantum technologies, with the expectation that the next wave of development will transform billion-dollar industries. While some applications such as quantum computing are likely more than a decade away, magnetic sensing technologies using ultracold quantum gases will become practical in the near future.							
DP200102268 Stokes, Prof Jason R	The project aims to generate viscoelastic soft materials with programmable anisotropy using aqueous suspensions of colloidal rods that have tunable surface coatings. The project expects to generate new knowledge in the rheology and structural characteristics of this unique class of materials. A key innovation is the use of charge-directed polymer self-assembly to control colloidal interactions, suspension rheology and phase behaviour. The intended outcome is spatial control over the orientation of nanostructures, potentially mimicking the structural hierarchy found in nature. This should provide significant benefits to the creation of viscoelastic materials with complex rheology as well as structural, mechanical and optical heterogeneity.	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00
	National Interest Test Statement							
	Nanocellulose is derived from renewable sources that include cotton and timber, which are economically important Australian primary industries, and notably as by-products from these sources. Emerging commercial opportunities exist for producing it from waste - an area of community concern – as well as native grasses in regional Australia. It is showing remarkable potential in diverse applications from advanced polymer packaging to microelectronics. The project should create new opportunities for enhanced utilisation of nanocellulose that adds value to these industries and enables their commercial potential to be realised. The programme will provide competitive advantage by advancing knowledge in viscoelastic rheology, flow properties, structure and complex phase behaviour of aqueous suspensions of colloidal rods, and their modification with polymer. Advanced research training will be provided in rheology, colloidal and interface science, and polymer science, as well as multiscale structural analysis, leveraging Australia's investment in large-scale facilities and enhancing employability.							

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DP200102273 Romero, Dr Mary Jacquiline	This project aims to develop experimental and theoretical tools for increasing security in the future quantum networks. This project expects to generate new knowledge in the area of quantum communication by leveraging on the properties of high-dimensional quantum systems. Expected outcomes of this project include novel protocols for quantum secret sharing that are resistant to experimental noise and an experimental implementation of such protocols. This should provide significant benefits to the development of the quantum internet and its security.	118,000.00	243,000.00	179,000.00	54,000.00	0.00	0.00	594,000.00
	National Interest Test Statement Maintaining information security is a major cost for our modern economy. In 2018, Accenture reported that Australian companies spent $81 billion on information security. More worryingly, even with this spending companies detect only 57% of data breaches. With communication that is based on quantum science 100% of these data breaches can be detected. Our proposal allows us to share secrets among multiple parties in real-world scenarios in the advent of a new internet which exploits more of quantum physics. Our project narrows experimental and theoretical gaps by exploiting a quantum alphabet afforded by particles of light. Our project lays the ground for technology that would give significant advantage to many key Australian industries, such as finance and communications, that require unflagging security. We will cement Australia's place as a leader in a global landscape of increased interest and support for quantum technologies.							
DP200102310 Tyson, Prof Gene W	Our understanding of microbial diversity on Earth has been fundamentally changed by metagenomic characterisation of natural ecosystems. Traditional approaches for visualising microbial communities are time-consuming and provide limited information about the identity of specific microorganisms. The proposed research aims to combine single cell genomics and super resolution microscopy for novel, high-throughput, genome-based techniques to visualise microorganisms, plasmids and viruses, with strain level specificity. The application of these highly scalable approaches will provide comprehensive and unprecedented insight into the fine-scale dynamics and evolution of environmentally and biotechnologically important microbial communities.	98,247.00	198,461.00	201,221.00	101,007.00	0.00	0.00	598,936.00
	National Interest Test Statement The techniques developed in this project will become the new gold standard for visualisation in microbiology. The ability to simultaneously track microorganisms and their plasmids and viruses will give unprecedented insights into the dynamics and evolution of key functional complex microbial communities. Our understanding of such microbial communities, and our consequent ability to manipulate them for our advantage, is essential to most of the critical challenges facing mankind, many of which are central to Australia’s research priority areas of Soil and Water, Environmental Change, Human Health, Energy (e.g biogas) and Food (e.g. agriculture). The application of these new visualisation techniques to the temporal monitoring of wastewater treatment will provide a better understanding of the role of these systems in the spread of antibiotic resistance-encoding plasmids and the influence of viral predation on periods of process inefficiency or failure. The thousands of probes targeting microorganisms, plasmids and phage will also be made available for use by other research groups.							
DP200102316 Rasmussen, A/Prof Jorgen	Aims: To construct and analyse indecomposable representations of significance in conformal field theory. Significance: Conformal field theory plays a key role in many developments in mathematics and physics. Logarithmic conformal field theories govern important systems such as two-dimensional critical percolation. This proposal aims to develop the representation theory necessary for understanding salient features of critical systems described by logarithmic conformal field theory. Expected Outcomes: Novel representations of fundamental importance in logarithmic conformal field theory. Benefit: Resolution of open problems in logarithmic conformal field theory, thus continuing the strong tradition in the field in Australia.	69,390.50	139,390.50	140,000.00	70,000.00	0.00	0.00	418,781.00
	National Interest Test Statement As noted by the World Economic Forum's recent Global Competitiveness Report, the quality of research and education in science and mathematics is one of the pillars of a competitive economy. Indeed, modern advances in mathematics and physics have underpinned many recent technological breakthroughs in information technology, such as GPS systems and artificial intelligence. This proposal is part of the larger aim of providing the necessary mathematical framework for understanding modern physics, in particular, symmetries of physical laws.							

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DP200102363 Richards, Prof Linda J	This project aims to understand how mature brain cells form during foetal life. The central hypothesis is that a specific transcription factor family, called NFI, regulates the epigenetic state of the cell, allowing chromatin accessibility and subsequent transcriptional activation and repression to control cellular differentiation. Aims 1 and 2 will investigate how brain cells transition from proliferating progenitor cells to differentiated mature cell types. Aim 3 will investigate how differentiation is maintained in the adult brain. Methods used involve genome and chromatin analyses of cells isolated from transgenic mouse models. Outcomes and benefits are substantial knowledge gain applicable to stem cell regulation and brain health.	107,500.00	207,500.00	200,000.00	100,000.00	0.00	0.00	615,000.00
	National Interest Test Statement This proposal will investigate how developing brain cells mature into specific cell types that makeup the adult brain. The research thus has the potential for social and economic benefit for Australians in the longer term through better health knowledge that explains the mechanisms required to form and maintain a healthy brain. This is a fundamental science project aimed at discovering how the maturation of brain cells could be controlled by the epigenome. It applies unique, sophisticated mouse models, whole genome and chromatin analyses to a relatively new area of epigenomic research within Australia. In the long term, the results could have broad impacts in the areas of stem cell biology to control cellular maturation for organ replacement therapies, cancer biology across a range of different organs of the body, and mechanisms of brain formation that promote normal cognitive development. The work further contributes to Australia's national interest through supporting the expert training of young scientists who will also lead new discoveries in the future.							
DP200102367 Charles-Edwards, Dr Elin	Migration is a defining issue of the 21st Century. Despite its significance, migration is poorly understood because different types of movement are conceptualised, measured and studied separately. This project aims to develop an integrated understanding of multiple forms of population movement in Asia incorporating both internal and international migration and temporary and permanent moves. It will establish the intensity, spatial patterns and interaction between the different forms of migration for countries in Asia, and its impacts at origins and at destinations. The results are expected to provide significant benefits including a strong evidence base for the formulation of national and international migration policy in the 21st Century.	18,977.00	60,344.50	64,978.50	23,611.00	0.00	0.00	167,911.00
	National Interest Test Statement Migration has transformed the size, composition and distribution of populations across the globe. The countries of Asia account for more than half of international migration flows, an estimated 78 million Asians are living outside their country of birth and a further 280 million people in Asia are internal migrants. Australia is integrated into the Asian mobility systems as a major destination country, with more than half of migrants to Australia being of Asian origin. A better understanding of the level, spatial pattern, and composition of different forms of migration and mobility (internal and international; permanent and temporary), and the links between these will allow us to better forecast, plan for, and manage immigration in the 21st Century. This will have a clear benefit for the national economy as well as society at large, providing Australian policymakers with insights into migration processes in major source countries, and strengthen the evidence base to assist in tailoring Australia's migration program in line with our national interests.							
DP200102377 Vetter, A/Prof Irina	Venoms are complex secretions containing biologically active components that have evolved over millions of years to specifically target the nervous systems of predators and prey. Two novel classes of toxins from snake and plant venoms that act on voltage-gated sodium channels, key proteins that regulate neuronal excitability, were recently identified by the research team. The project aims to develop and apply state-of-the-art chemical, structural and biological techniques to unravel the molecular mechanisms through which these novel toxin classes act at their targets. Insights gained from this project will help identify and develop novel channel-modulating molecules that may have applications as neuroscience tools, diagnostics or drugs.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00

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	National Interest Test Statement							
	The research team have recently identified two new classes of bioactive molecules from the Giant Australian stinging tree Gimpi Gimpi as well as snakes (tiger snake, coral snakes) that target proteins important for nerve signalling, called ion channels. The project proposes to develop innovative new chemistry methods to make these compounds, and to define how these new compounds act on ion channels. This project will develop new knowledge relating to how Australian fauna and flora affect nerve function, contribute to Australian bioprospecting, and will provide information required for future rational design of drugs, research tools or 'green' insecticides that target ion channels. The project will train the next generation of researchers and will contribute to a sustainable biotechnology sector in Australia. Thus, the project contributes to Australia's national interest through its potential economic benefits resulting from translating this research to commercial outcomes.							
DP200102551 Collins, A/Prof Brett M	Eukaryotic cells are distinguished by the presence of membrane-bound compartments called organelles. This project will use structural biology to determine how essential proteins called sorting nexins (SNXs) regulate membrane interactions required for lipid droplet formation. These interactions are essential for life, controlling protein and lipid homeostasis needed for cell survival. The major outcome of this proposal will be a fundamental understanding of how SNXs control this process, and the work will significantly strengthen our international collaboration in this emerging area. The knowledge has potential future translation in the treatment of neurodegenerative disorders where dysregulation of these proteins is known to cause disease.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
	National Interest Test Statement							
	Australia is home to many world leading life science and biomedical research scientists and has made major investments in these areas over the past decades. Of key relevance to this proposal has been the funding of the Australian Synchrotron Facilities that have allowed Australian structural biology research (the study of proteins and drug targets at molecular resolution) to remain at the cutting edge. New investments by the ARC in cryoelectron microscopy, including the installation of new microscopes at the University of Queensland, further cements Australia's reputation in this field. This project aims to understand how cellular machines work, using these new technological innovations to probe how proteins are normally assembled and how they are affected in disease. Recent papers in high impact journals including Nature demonstrate our international competitiveness in this area. The current proposal will provide new insights into how a conserved protein family regulates lipid metabolism at the fundamental level and provide a scientific basis for therapeutic targeting of these pathways in the future.							
DP200102559 Hall, Dr Thomas E	For a muscle to contract efficiently in response to an electrical signal it requires the formation of an extensive system of hollow membranous tubules through which the signal can be propagated. This proposal addresses the molecular mechanisms involved in the formation of this tubule system in skeletal muscle. This project will develop cell biology in a whole organism rather than a cell culture system and provide a new framework for Australian and international cell biologists. It will generate new knowledge, train young Australian scientists, help build international collaborative networks and engage the public outside the research community.	105,000.00	205,000.00	200,000.00	200,000.00	100,000.00	0.00	810,000.00
	National Interest Test Statement							
	This project is in the national interest because it will i) provide hands on training and experience for two PhD students and a research associate in a world class environment, who will, at its completion, be highly qualified to pursue careers either in the Australian academic, biotechnology or pharmacy sectors, ii) push the limits of current super-resolution and single molecule microscopy, 3D electron microscopy, state-of-the-art molecular biology, genome editing and proteomics techniques providing the opportunity for technology transfer to the commercial sector iii) develop international collaborative networks that will benefit Australian science through transfer of knowledge, reagents and ultimately specialist personnel.							

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DP200102573 Zhao, Prof Xiu Song G	This project aims to investigate sodium ion behavior when electrochemically interacting with hard carbon electrode materials by using both in-situ and ex-situ techniques in combination with advanced computational methods. This project expects to generate new knowledge and establish structure-property-performance correlations, thus providing guidelines and strategies for synthesising cost-effective electrode materials from biomass for developing sustainable sodium-ion batteries. The intended outcome of this project includes knowledge advancement, enhanced capability to build international collaborations, training of early career researchers and students, and positioning Australia on the world map as a world-leading nation in energy storage.	55,000.00	130,000.00	145,000.00	70,000.00	0.00	0.00	400,000.00
	National Interest Test Statement Energy storage is increasingly demanded for coping with the intermittency of renewable energy sources such as solar and wind. While lithium-ion batteries can meet the demands, safety concerns on lithium-ion batteries and rapidly rising costs of lithium resources have driven the industry towards cost-effective and safe energy storage technologies, such as sodium-ion batteries. This project will lead to a complete understanding of sodium ion storage mechanism in biomass-derived carbon electrode materials, thus providing guidelines for developing the sodium-ion battery technology. This project will benefit Australia's economy because a method for converting biomass (e.g., spinifex grass) to high value-added product – carbon electrode materials for fabricating sodium-ion batteries will be developed. The cost of sodium-ion batteries can be 30-40% lower than that of lithium-ion batteries, benefiting Australia's energy storage industry. The sodium-ion battery technology is suitable for large-scale energy storage applications (e.g., electric vehicles), benefiting Australia's environment.							
DP200102723 Kumeria, Dr Tushar	The current gold-standard assays for examining receptor-ligand interactions require expensive and costly fluorescent or radioactive labels or proteomics processes. This project aims to develop Artificial Photonic Cells by directly coating photonic crystals with cell membranes. The Artificial Photonic Cells retain the protein receptors in their native cell membrane environment and allow for label-free monitoring of the receptor-ligand interactions using inexpensive miniature spectrometers - radically transforming these assays. This would generate fundamental and applied knowledge of materials sciences, photonic, and biointerfaces for label-free, ultra-sensitive, and selective assays to enable future drug and diagnostics target discovery.	69,000.00	138,000.00	138,000.00	69,000.00	0.00	0.00	414,000.00
	National Interest Test Statement Australian life sciences (including pharmaceutics) sector contributes over $50 billion to our economy and generates over 200,000 jobs (AusBiotech survey 2017) with a focus on the discovery of new drugs and diagnostic targets. Our life sciences sector has huge potential to grow but is limited by costly and time-consuming specialised assays and equipment. This project will address these issues and fulfil national interests by: 1. Generating new knowledge in the field of materials science, photonics, biointerfaces, and surface chemistry, useful for a number of our other industries. 2. Advancing our life sciences research by developing advanced tools to examine critical receptor-ligand interactions at the cell membrane. 3. Training a new generation of researchers for STEM careers and establishing a high-tech instrumentation industry in Australia to deliver long-term economic, commercial, and social benefits. 4. Ultimately, reducing the time and cost associated with the discovery of a drug molecule or a diagnostic target through new technological outcome, furthering our lead in the life sciences sector.							
DP200102837 Gillam, Prof Elizabeth M	This project aims to develop robust protein cages derived from the coats of viruses to contain heat-stable P450 enzymes, for use as specialised protein bio-catalysts in chemical industries. A valuable chemical precursor of renewable bio-plastics will be produced from seed oils by enzymes, reducing the use of fossil fuels. This synthetic biology approach combines biotechnology, nanotechnology and protein engineering to establish a plant-based platform biotechnology for using enzymes as catalysts to make high-value molecules. The project aims to show how to engineer clean, sustainable chemistry in designer nano-environments. This should make synthetic processes more sustainable and enhance advanced chemical manufacturing in Australia.	90,000.00	158,846.50	135,642.00	66,795.50	0.00	0.00	451,284.00

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	National Interest Test Statement Biocatalysis holds enormous potential for the development of a bioeconomy tailored to maximising value from Australia's abundant natural resources. The main outcome of this project will be a platform technology to create heat-stable, reusable, protein catalysts to make high value molecules in a clean, sustainable way. This should enable better use of agricultural feedstocks, enhancing the efficiency and diversity of sustainable chemistry in Australia and, potentially, a route towards decreasing reliance on fossil fuels. While this project uses biopolymer production to exemplify the significant benefits of reusable biocatalysts in the chemical industries, this advanced manufacturing approach can equally be applied to agricultural, food and beverage, and pharmaceutical industries. Both the biocatalysts and the products of these tools (novel chemicals) will benefit research and development in diverse sectors. Anticipated benefits include novel intellectual property, new knowledge in biocatalysis, and increased opportunities for sustainable chemical manufacturing in Australia.							
DP200102867 Walker, Dr Andrew A	This project aims to investigate the structure, function and evolution of peptide toxins in venoms made by caterpillars in superfamily Zygaenoidea. Caterpillars in this group are covered in spines that inject pain-causing venoms, and this protects them from vertebrate and invertebrate predators. This project will test if peptides in this venom cause pain by pharmacological modulation of mammalian ion channels and signalling receptors, and if they have insecticidal properties. The first three-dimensional structures of caterpillar venom peptides will also be solved. Genomes of representatives of two different zygaenoid families will be produced, and genomic techniques will be used to elucidate how venom use evolved at the molecular level.	70,500.00	149,000.00	152,000.00	73,500.00	0.00	0.00	445,000.00
	National Interest Test Statement Biological toxins adapted over millions of years through evolution are recognised as a powerful tools for applications in medicine, biotechnology, agriculture, and science. Over the course of this project, many hundreds of novel toxins are likely to be discovered and characterised. Thus, this project will build on the competitive advantage in biodiscovery offered by Australia's unique fauna. The insights into toxin function gained in this project may also lead to improvement in clinical treatment of caterpillar envenomations. Other benefits of this project include increased employment and training of scientists, and economic activity associated with return of most funds into the Australian economy. Thus, this project will contribute to society, economy, industry, and efforts to improve health outcomes.							
DP200102885 Scott, A/Prof Ethan K	Our senses perceive the outside world and permit appropriate behaviours, but the underlying brain circuits are poorly understood. This project will use new technologies to observe all active brain cells in zebrafish during the important behaviour of visual predator avoidance and characterise the underlying circuits comprehensively. This approach's significance is in its breadth, spanning functional imaging, anatomy, computational modelling, and behaviour, with the major outcome of producing the first complete map of a visual behaviour at the level of brain circuits and the individual brain cells composing them. Benefits will include new insights into visual processing and the refinement of new genetic, optical, and informatics approaches.	80,000.00	155,000.00	152,500.00	77,500.00	0.00	0.00	465,000.00
	National Interest Test Statement The outcomes from this work will have three major benefits for Australia. The first is in the basic discoveries that it will provide about brain function. Discovering the circuit-level mechanisms of vision will benefit fields as diverse as animal welfare (social/cultural benefits), behavioural ecology (environmental benefits), and medicine (health benefits). The second is in technology development. The CI has been central to the development of new technologies in behavioural analysis, microscopy, optical physics, and neuroinformatics, and the current proposal aims to merge these new technologies in a novel way that will allow important biological questions to be addressed for the first time. Combinations of these technologies, as described in the proposal, also hold the prospect for future commercialisation. Finally, this technically challenging work will be an excellent training ground for young researchers who are developing their skills in optical engineering, computer programming, big data analysis, and other fields that will be in great demand in the academic and commercial sectors in the future.							
DP200102896 Bowles, Dr Josephine	This project aims to determine how germ cells are regulated in the mammalian embryo. Germ cells go on to form the sperm and eggs and are, therefore, critical for reproduction. In particular, this project expects to generate new knowledge about the process of meiosis, a cellular process that is specific to the germ cells. Expected outcomes will inform efforts to control fertility and infertility in livestock, humans and other mammalian animals (e.g. pets and endangered species). They are also likely to inform the discipline of stem cell biology in general.	82,500.00	172,500.00	170,000.00	80,000.00	0.00	0.00	505,000.00

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	National Interest Test Statement							
	This project aims to discover the mechanisms underlying the process of meiosis, which is critical for the production of functional gametes (sperm and eggs). Knowledge generated in this project may have economic benefits (e.g. improve livestock production), environmental benefits (e.g. conservation of endangered species), social benefits (e.g. inform efforts to generate eggs and sperm 'in a dish', extend female reproductive life) and cultural benefits (e.g. enhance Australia's research reputation, train new scientists, spark new international collaboration).							
DP200102909 Brown, Prof Deborah J	This project aims to address the question about which animals feel pain by framing multiple current debates into a single narrative focused on the fundamental principle in evolutionary biology that structure determines function. This project is significant because the question as to whether or not an animal (such as a fish or octopus) feels pain is highly contentious across both science and philosophy and arguments are plagued by simplistic anecdotes and poor analogies. The ramifications of this confusion for animal welfare and food security are considerable. Expected outcomes include the development of shared principles of reasoning and structural constraints on the attribution of pain that promise to move the debate towards consensus.	33,341.00	66,682.00	68,682.00	35,341.00	0.00	0.00	204,046.00
	National Interest Test Statement							
	This research project has the potential to make important contributions to Australia's national interest through impacts on animal welfare, science, food security and industry. The Australian Government has recognized food (and fisheries) as a science and research priority. While the Australian Fisheries Research and Development Corporation recognises the huge financial benefit of Australian fishing and aquaculture (including fish, crustaceans and molluscs) to our economy, there are, as yet, many unanswered questions regarding best practice for animal welfare across these industries. There remain huge gaps and considerable challenges in welfare guidelines between commercial wild capture and aquaculture practices. Operating guidelines are also poorly developed for restaurant owners involved in live food. The outcomes of this project — particularly defining biological criteria or biomarkers for pain — will serve to strengthen scientific, ethical and practical approaches towards animal welfare guidelines and best practice across the fisheries industry and associated organisations in Australia.							
DP200102919 Faulkner, Prof Geoffrey J	Genetic diversity is the variation in DNA sequence among individuals. We now know that there are also differences in the DNA sequences of cells within the same individual, known as genetic mosaicism. The aims of this proposal are 1) to develop a system to visualise genetic mosaicism 2) arising during embryonic development and 3) in the brain, driven by mobile DNA activity. The expected outcome of this proposal is an unprecedented understanding of the scope and consequences of mobile DNA-driven mosaicism. This work will have significant impacts in developmental genetics and neurogenetics, and has the benefit of introducing an innovative experimental system with the potential to spark international scientific collaboration and recognition.	65,091.00	136,224.00	144,564.00	137,272.00	63,841.00	0.00	546,992.00
	National Interest Test Statement							
	Mobile DNA-driven genetic mosaicism, and its influence on basic cellular function and genetic neurodiversity in the mammalian brain, has gained massive international attention as a topic of research in the past 10 years. The two CIs on this project, both based in Australia, are the #1 and #6-ranked researchers worldwide in the mobile DNA field over the past 5 years, and during this time their research program has involved extensive international collaboration and achieved widespread recognition. The research outlined in this proposal has the potential to further distinguish Australia as an international leader in this rapidly-advancing field, generate a novel experimental system with the potential to be adopted by researchers across the world, and provide excellent training opportunities for PhD students, contributing to the next generation of Australian scientists.							
DP200102921 Morgan, Prof Richard G	This project aims is to study the non-equilibrium aerodynamic processes involved in hypervelocity flight. The design of vehicles for high speed flight is critically dependent on modelling the interactions between the flow field and the airframe, and the current lack of understanding is restricting the scope and benefit of viable activities in space. The expected outcomes include the ability to design optimised heat shields and air-frames with minimum mass and maximum payload, precisely targeting specific flight conditions and vehicle shapes. The prospective benefits include increased productivity and reliability and reduced cost of missions to and from space, and a proliferation of new applications which this understanding will facilitate.	85,000.00	170,000.00	170,000.00	85,000.00	0.00	0.00	510,000.00

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	National Interest Test Statement							
	The importance of the Space Industry to our economic future was recognised by the creation of an Australian Space Agency in 2018, and the perceived opportunity to create an extra 20,000 space-related jobs by 2030 (www.sbs.com.au/news/new-australian-space-agency-to-produce-20-000-more-jobs). The combination of reusable launchers and advanced hypersonic flight vehicles enables high speed travel and cheap access to space, which will support transformation of the space industry. Australia can play a major role in this revolution due to our position as research leaders in hypersonics, and our geographical location offering a diversity of potential space centres. The group on which this proposal is based has contributed to establishing the required skilled workforce (139 HDR graduates to date), many of whom are now embedded in our aerospace and defence industries. By addressing a critical area of fundamental scientific unknowns, this proposal will help position Australia and Australian R&D as leaders and partners in the development of future spacecraft, on which the growth of the industry depends.							
DP200102962 Yu, Prof Chengzhong	This project aims to engineer a multifunctional nanoparticle platform tailored for mRNA delivery. An innovative assembly approach will be used to design nanoparticles with adjustable composition, asymmetry and surface topography. Uniquely, three functions will be integrated in one nanoparticle, with the goal to enhance transfection efficiency in target cells. This project expects to advance knowledge of mRNA transfection mechanisms, and determine how cell-type dependent particle-mRNA interactions correlate with the nanoparticle structure and delivery performance. Outcomes include a new family of functional materials with improved mRNA delivery performance over benchmark systems to facilitate and broaden the application of mRNA technology.	67,500.00	132,500.00	130,000.00	65,000.00	0.00	0.00	395,000.00
	National Interest Test Statement							
	The global market for drug delivery systems is predicted to reach 2.2 trillion USD by 2020. This project will provide a new family of multifunctional (as both delivery vehicles and translation modulators), high-performance (protection against enzyme digestion and high transfection efficiency) and safe (biodegradable) nanoparticles for mRNA delivery. These novel nanoparticles have the potential to overcome the limitations of conventional transfection agents and be used as both nanocarriers and potent regulators delivering genetic molecules for mRNA technology applications. By advancing understanding of the interactions between nanoparticles and biomolecules/biosystems, the expected outcomes will help guide the rational design of next-generation materials with improved delivery performance. On completion, the project is likely to generate IP and attract commercial interest, supporting and enhancing Australia's leading role in bionanotechnology. It will also train and mentor our future research leaders to use the power of nanotechnology and multidisciplinary skillsets to solve problems in the biotech industry.							
DP200103036 Lo, A/Prof Shih-Chun	The proposal aims to apply new materials design theory to create new classes of highly efficient materials and overcome device efficiency roll-off issue for next-generation transparent electronics. The project expects to advance new see-through technology through new materials and device architectures innovations. Expected key outcomes include novel highly efficient multi-nuclear metal complexes generation, establishment of new knowledge of materials' structure-property relationship and fundamental understanding of device physics, creation of new transparent display pixels, new training of young scientists and new IPs generation, which will provide benefits to maximise Australia's competitive advantages and meet with global innovation need.	70,000.00	145,000.00	125,000.00	50,000.00	0.00	0.00	390,000.00
	National Interest Test Statement							
	This frontier research program will drive new breakthroughs and knowledge impact in the emerging area of organic semiconductor materials and device advancements. The project uses cross-fertilisation of ideas built on the collective efforts of international leading experts to: produce innovative materials science, speed up the devices and materials development cycle, and deliver significant value for money by combining the team's unique research capabilities with outstanding infrastructure. Australia will benefit from research training for early career researchers, and significant intellectual property creation in the multi-billion dollar electronics industry, including a platform for attracting local investment for joint technology development and research translation to the related sectors actively developing transparent electronics technologies. These technologies span augmented realities like navigation systems for direct car windscreen information displays, and head mounted goggles for biomedical or surgical applications.							

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DP200103049 Connelly, Prof Luke B	This project aims to examine the early effects of two recent initiatives by the Australian government to improve children's dental health by providing funds to cover essential dental services for children from disadvantaged families. It explores the factors affecting eligible children's access to benefits from these initiatives and identifies the causal impacts of these changed health care financing arrangements on children's consumption of dental services, indicators of oral health and general health, and other indicators of cognitive and non-cognitive development. Using advanced econometric techniques and panel datasets, this project is expected to contribute to the development of effective policies for promoting health and wellbeing.	40,950.00	84,046.50	84,046.50	40,950.00	0.00	0.00	249,993.00
	National Interest Test Statement This project will produce knowledge on the early determinants of oral health, in childhood and adolescence. It will identify the role that economic inequalities may play in the dental health of children and teenagers. This is important because poor oral health is also known to cause of other types of ill health (including cardiovascular disease). We also know that, even in countries such as Australia which have systems to provide widespread access to health care services, there are considerable differences in the health of children from poorer and richer households. Furthermore, that health gap tends to widen as young children get older. Finding ways to improve the oral health of children, especially relatively disadvantaged children, may help to narrow this health gap and, in turn, help to prevent health-income poverty traps. The results of the research will help decision-makers to design effective policies to improve the health of young Australians, especially those Australians who are susceptible to health disadvantages early in life.							
DP200103087 Lewis, Prof Richard J	The marine snails of the genus Conus have evolved one of the most complex venoms that has emerged as a rich source of novel bioactive peptides. However, < 0.1% of their true potential has been characterised to-date. Using advanced genomic, proteomic, structural and pharmacological approaches pioneered in our laboratory, this study will decipher how conotoxin diversification from ancestral worm hunters facilitated the shift in diet to modern fish and mollusc hunting species by determining the evolutionary trajectories of positively selected conotoxins. Investigation of the structure and function of these highly optimised venom peptides will provide new research tools and potential leads to new pharmaceuticals and agrochemicals.	100,000.00	190,000.00	170,000.00	80,000.00	0.00	0.00	540,000.00
	National Interest Test Statement The proposed project will greatly enhance the understanding of unique structural and functional adaptations underlying the evolution and diversification of cone snail venom peptides while uncovering new families of peptides with potential applications in the pharmaceutical and agrochemical sectors. The outcomes will result in advancements in methodologies and technologies for Australia's biotechnology sector, novel research tools to study human physiology, patentable ligands with applications in human health and agriculture which will interest industry partners and entrepreneurial spin-offs, increase in Australia's knowledge base with trained higher degree students and research staff, attract national and international scientific collaborations, and further enhanced recognition and competitiveness for Australia in venom research.							
DP200103093 Suarez, Dr Rodrigo	This project aims to generate fundamental knowledge on the origin of diversity in mammalian brain circuits by studying development of marsupials and rodents. The expected outcome is to elucidate how differences in the timing, rate and sequence of development of gene expression, cell differentiation and circuit formation can relate to the origin of key evolutionary innovations in the mammalian brain. The significance of understanding the dynamics of developmental systems that shape complex brain traits includes establishing new developmental paradigms in evolutionary theory, generating new tools to investigate and manipulate brain gene expression in vivo, and the potential discovery of the causes of neurodevelopmental dysfunction.	76,000.00	158,125.00	148,625.00	66,500.00	0.00	0.00	449,250.00

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	National Interest Test Statement							
	This research capitalises on the rich biodiversity of Australian native fauna (e.g., marsupials) to elucidate the fundamental mechanisms that direct brain formation and diversification in mammalian species, including humans. The brain regions investigated here are essential for normal brain function, and defects in their development are the main cause of autism and intellectual disability, which affect more than 4% of Australians under the age of 10 (Australian Bureau of Statistics). Therefore, benefits to the national interest include: 1) Increasing knowledge about the Australian biological heritage, in particular about the development and evolution of the mammalian brain, 2) The establishment of innovative biotechnology tools for the biomedical sector (e.g., big-data genetic screenings and cell-specific gene manipulations in live animal models), and 3) The potential elucidation of the mechanisms involved in healthy brain development, including the main causes of abnormal brain formation. Together, these could provide substantial and long-lasting economical and societal benefits.							
DP200103386 Cunnington, Prof Ross	This project will examine the structure and function of the sensory cortex of the human brain using ultra-high resolution functional magnetic resonance imaging (7 Tesla MRI). The project pushes new boundaries for resolution with ultra-high field MRI (7 Tesla) and, as such, will advance techniques for the acquisition, analysis, and computational modelling of high-resolution fMRI brain imaging, providing detail of the functional organisation of the sensory cortex at a level never previously possible in the living human brain. This will provide new understanding of the neural-level networks that underpin attention and touch perception in the human brain.	83,193.00	166,541.50	173,194.00	89,845.50	0.00	0.00	512,774.00
	National Interest Test Statement							
	The project will develop new techniques and greatly advance capacity for ultra-high field (7 Tesla), ultra-high resolution functional MRI of the living human brain. Ultra-high field MRI at 7 Tesla is at the cutting-edge of technology for human brain imaging, and only 2 such scanners are located in Australia. The development of new acquisition and computational techniques for ultra-high resolution brain imaging will push beyond the current boundaries for research imaging on this state-of-the-art MRI technology. The focus on sensory cortex of the human brain will provide new understanding of the neural-level networks that underpin attention and the conscious experience of touch perception.							
DP200103650 Zhou, Prof Xiaofang	This project aims to establish a methodology for spatiotemporal entity linking by utilising object movement traces to support database integration and data quality management for the next-generation of data where spatiotemporal attributes are ubiquitous. It expects to develop a novel entity linking paradigm for automatic, efficient and reliable spatiotemporal data integration together with a new data privacy study in this context. Expected outcome include new database technologies for data signature generation and similarity-based search, and improved location data privacy protection methods. This project should provide significant benefits to all areas where high quality spatiotemporal data fusion is essential to meaningful data analysis.	83,500.00	163,500.00	163,000.00	83,000.00	0.00	0.00	493,000.00
	National Interest Test Statement							
	Monitoring, understanding and predicting moving objects such as people, vehicles, animals and natural phenomenon is a common mission for modern information systems. This project will develop new enabling database technologies to support spatiotemporal data fusion which is a critical precursor to data analytics with moving objects. It will make a direct contribution to information technology, data science and big data analytics to extend Australia's strong capacity in these areas to be a leader in making sense of massive amounts of spatiotemporal data. Areas that can benefit from this study include but are not limited to: Transport with enhanced capacity for data integration and analysis for improved logistics, modelling and regulation, urban design, autonomous vehicles, sensor technologies, real time data and spatial analysis; and Cybersecurity, with the ability to link moving objects in the physical space as well as the cyberspace based on their movement history, rather than their IDs which are often not available or reliable to enable a wide range of new applications.							
DP200103742 Henderson, Prof Ian H	Worldwide markets for biotechnology-derived products are projected to grow to at least $50 billion per year for the next 10 years. The cornerstone of biotechnology is the production of proteins. The applicant has discovered a new pathway for protein production in bacteria. The primary objective of this project is to use a diverse array of biochemical and biophysical techniques to understand how this new protein production platform works. We will also assess this new pathway for the production of proteins of interest to the biotechnology sector. This project expects to determine how this system can be exploited for use in the growing Australian bioeconomy.	65,000.00	132,500.00	135,000.00	67,500.00	0.00	0.00	400,000.00

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	National Interest Test Statement							
	The biotech industry produces revenues in excess of $1 trillion annually. It relies on the production of proteins to produce biopharmaceuticals, biofuels and bioproducts. The standard mechanism for making proteins is to produce them in E. coli. We recently discovered a new protein secretion system in E. coli. By understanding how this system works Australian industry can exploit it in synthetic biology programs to produce novel products or promote the bioconversion of other proteins by exploiting its unique ability to add lipid groups to proteins.This system also plays an important role in the ability of E. coli to cause disease in both animals & man; according to the Queensland state government these E. coli cause losses to the pig farming sector of more that $7 million annually. The farming sector in Europe lost over $1 billion in an outbreak of one of these pathogens in 2011. By understanding this Australian discovery we may provide opportunities to attenuate disease or to prevent disease from occurring. Reducing costs to the agricultural sector and building the bioeconomy is in the National interest.							
DP200103760 McCulloch, Dr Ian P	This project aims to develop new machine learning techniques based around the close correspondence between neural networks used in deep learning, and tensor networks used in quantum physics. Tensor networks are a form of information compression that is useful in machine learning to construct a compact representation of a large data set in a way that is more amenable to understanding the internal structure than a deep neural network. Expected outcomes of this project include more resilient algorithms for machine learning, and new ways to represent quantum states that will impact fundamental physics. The resulting benefits include enhanced capacity for cross-discipline collaboration, and improved methods for future industrial applications.	67,500.00	135,000.00	135,000.00	67,500.00	0.00	0.00	405,000.00
	National Interest Test Statement							
	Consultancy firm PwC estimates that global GDP will be up to 14% higher in 2030 as a result of machine learning technologies. This project will provide research training in this highly sought-after area, and facilitate workshops and conferences to disseminate the project outcomes to the broader scientific and industrial community. Expected outcomes include better methods for analysing large data sets which will lead to improved decision making with reduced risk, impacting many areas of life. This project brings together researchers from Australia and the USA, and is likely to lead to long-term international collaborations and enhanced cooperation between researchers and industry for the benefit of Australia.							
	The University of Queensland	4,671,450.00	9,351,434.50	9,128,031.50	4,756,928.00	308,881.00	0.00	28,216,725.00
University of the Sunshine Coast								
DP200100399 Salmon, Prof Paul M	It is widely acknowledged that a failure to implement appropriate controls for the next generation of Artificial Intelligence, Artificial General Intelligence (AGI), could have catastrophic consequences, including in the worst case - the extinction of the human race. This research aims to forecast the risks associated with AGI systems and identify the controls required to ensure that risks and existential threats are minimised. The expected outputs will provide designers, organisations, regulators and governments with a framework to support the design, implementation, and management of safe and efficient AGI systems. This will ensure that the potential far-reaching benefits of AGI are realised without undue threat to society.	65,593.50	152,203.50	164,667.50	78,057.50	0.00	0.00	460,522.00
	National Interest Test Statement							
	Australia has an opportunity to be at the forefront of risk management research and practice for the next generation of Artificial Intelligence, Artificial General Intelligence (AGI). If implemented safely, AGI has the potential to eradicate many of societies most wicked problems, including disease, hunger, poverty, terrorism, political corruption, and issues associated with climate change. However, a failure to implement appropriate controls could lead to catastrophic consequences, including in the worst case - the extinction of the human race. A failure to undertake the proposed research now, at this critical embryonic stage in the development of AGI, will lead to potentially unsafe and uncontrollable AGI systems. This project will provide designers, organisations, regulators and governments with the information required to support the development, implementation, and operation of safe and efficient AGI systems. In turn, this will ensure that the far-reaching benefits of AGI are realised, bringing widespread economic, commercial, environmental and social benefits.							

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DP200103013 Cummins, A/Prof Scott F	Novel climate solutions are crucial as agriculture is responsible for 25% of global greenhouse gas emissions. This project aims to understand the molecular components for the production of bioactive natural products in a seaweed that, when fed to cattle and sheep, cuts out methane emissions. The project will apply genomic techniques to determine the key genes involved and the ecological factors that influence their expression across the seaweed life cycle. The findings will provide a platform to harness the full potential of seaweed as a natural additive in livestock feeds. This multidisciplinary project will enhance research capacity and strengthen international collaborations. **National Interest Test Statement** This project investigates a unique species of red seaweed that produces natural compounds that suppress methane production in livestock. We intend to identify the genetic and ecological mechanisms that will maximise compound production, which will fast-track the aquaculture development of the seaweed to meet demand by agriculture and do so with economic and ecological viability. By making the outputs of the genomic research publicly available, the full commercial potential of Australian patents on the use of this seaweed in methane reduction can be realised. The findings will enable researchers and companies alike to take the next steps in addressing climate change for livestock agriculture. This knowledge provides a platform to develop alternative applications and therapeutics from the antimicrobial natural products and to create new biomaterials based upon the cellular structures within which these highly bioactive compounds are stored.	73,737.00	147,536.00	139,146.00	65,347.00	0.00	0.00	425,766.00
	University of the Sunshine Coast	139,330.50	299,739.50	303,813.50	143,404.50	0.00	0.00	886,288.00
	Queensland	7,071,081.50	14,234,099.50	13,996,000.00	7,181,189.00	348,207.00	0.00	42,830,577.00

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South Australia								
Flinders University								
DP200100090 Chalker, Dr Justin M	This project aims to establish design principles for the manufacture of polymers made from sulfur, an abundant yet underused building block. These novel materials will be tested as next-generation rubber and plastic. This project expects to generate new knowledge in how these materials can be assembled and recycled, and also how they can be used to extract valuable gold from ore and e-waste. Anticipated outcomes of the project include access to entirely new materials useful in sustainable plastic manufacturing and sustainable gold extraction. These outcomes should provide significant benefits including functional replacements for non-recyclable plastics and elimination of toxic mercury and cyanide in gold mining and e-waste processing.	55,000.00	130,000.00	150,000.00	75,000.00	0.00	0.00	410,000.00
	National Interest Test Statement This research will introduce new and sustainable plastics, rubbers, and glasses to the Australian and global markets. These novel materials have significant potential in the plastics and rubber industry, as well as the mining industry. An attractive feature of this technology is the capability to assemble, repair, recycle and reform these materials in ways that is not possible with current plastics and other construction materials. These unique materials featured in this research project also have the potential to benefit the environment through their use in sustainable mercury- and cyanide-free gold mining. The fundamental science in this project will provide methods for the manufacture of these materials, which can directly benefit the Australian economy with high-tech jobs and production of useful materials for domestic use and global export.							
DP200100559 Wesley, Dr Daryl L	The narrative of culture contact in Australia is dominated by British colonisation, yet Indigenous Australians in Northern Australia had a much earlier connection with global explorers and traders. We aim to conduct the first systematic maritime and terrestrial archaeological investigations of the Tiwi Islands, alongside the study of material culture, oral history and archival materials associated with early Dutch explorers, British colonists, and Macassans. This multi-disciplinary approach will broaden our understanding of long-term race relations in Australia, the past presence of foreign visitors to Northern Australia, develop cultural heritage public policy and consolidate Tiwi cultural identity and history into the historical record.	113,900.00	233,150.00	233,950.00	114,700.00	0.00	0.00	695,700.00
	National Interest Test Statement This project will redefine, deepen and reconcile divergent narratives of early cultural encounters between the Dutch, Macassans, British and Indigenous Australians and the responses of Traditional Owners to globalisation. Focussing international attention on the Tiwi Islands will contribute to the Northern Territory tourism economy. National heritage areas have significant potential to contribute to local Indigenous tourism enterprises. The project will create substantial international collaborations between Australia, the Netherlands, Indonesia and Indigenous Australians. It will contribute to capacity building for Traditional Owners to manage the nationally and internationally outstanding cultural heritage values of the Tiwi islands and provide many allied social, health and economic advantages for the Indigenous community to be on country.							
DP200101105 Raston AO FAA, Prof Colin L	The project aims to develop versatile continuous flow thin film microfluidic device technology incorporating different external fields, including innovative magnetic or electric fields coupled with pulsed lasers, for gaining access to novel nano-carbon material for which current methods are ineffective or of limited utility. The technology will allow exquisite control, with real time monitoring, on reforming of carbon into functional material with tunable properties, along with the self assembly of nano-carbon, and fabricating composites of nano-carbon material. Understanding their fundamental properties including photoluminescence will be targeted, for leveraging the properties in applications to generate new processes and products.	80,000.00	160,500.00	162,500.00	82,000.00	0.00	0.00	485,000.00

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	National Interest Test Statement							
	Continuous flow thin film processing technology using an in-house developed vortex fluidic device (VFD) coupled with different alternating and static external fields (including electric, magnetic, lasers) will provide ready access to well defined novel nanocarbon materials for a diverse range of applications. The integrated VFD-external field processing will allow exquisite control for fabricating nanocarbon material, not possible using conventional batch processing. The technology has in-built strategies for de-risking scale up, and low capital and small footprint, while minimising environmental impact. These are attractive to industry and implementing such processing will maximise Australia's competitive advantage in advanced manufacturing for high value added nanocarbon materials, while opening new processing opportunities. This will be an integral part in positioning Australia for replacing toxic and depleting metals with nanocarbon in device technology, while providing high level training in an innovative multidisciplinary research environment, and capturing the imagination of the community.							
DP200101106 Raston AO FAA, Prof Colin L	The project aims to develop the use of electric and magnetic fields to control chemical and biochemical reactions in high shear thin films under readily scalable continuous flow conditions to then be able to precisely build complex functional molecules. Depending on the orientation, strength and frequency of external electric and magnetic fields, and novel shear stress induced electric fields in solution, rates of reactions can be enhanced, with higher yields and tunable selectivity, and reduced waste and energy usage, which is not possible using traditional batch processing. This will be translated into molecular assembly line processing and the development of a new synthetic toolbox, with applications in preparing pharmaceuticals.	110,000.00	235,000.00	200,000.00	75,000.00	0.00	0.00	620,000.00
	National Interest Test Statement							
	The proposed research focuses on continuous flow processing using the versatile vortex fluidic device (VFD) in the presence of different fields (electric and magnetic), with a design strategy which dramatically de-risks scaling up in translating the new knowledge into downstream applications. VFD processing is significantly less expensive relative to traditional batch processing, has a smaller footprint and lower environmental impact (lower waste generation and energy usage), with just in time safer processing capabilities. These sustainability (green chemistry) metrics capture the imagination and support from the wider community. They are attractive to industry and implementing VFD processing will maximise Australia's competitive advantage in advanced manufacturing for new industries. In addition, the multidisciplinary research will promote an innovative research culture, in linking chemistry, biochemistry, engineering and fluid dynamics, in precisely building functional molecules, for applications in a number of areas, including drug discovery and synthesis, while providing high level research training.							
DP200101921 Thomas, A/Prof Emma F	There is evidence of growing political apathy in many countries. Yet, political disengagement is a serious problem for processes of democracy and the adaptiveness of society. This project draws on recent theorising within the psychological sciences to investigate the role of prospection - the creative imagining of ideal worlds ('utopian thinking') - as a key driver of political engagement. The project will test whether and how utopian thinking stimulates a questioning of the status quo, moral engagement, and the formation of new groups to address social change: outcomes critical for a society to adapt and advance. Educators, government and non-government organisations can draw on project findings to re-engage a disaffected populace.	67,756.50	126,202.50	124,268.50	65,822.50	0.00	0.00	384,050.00
	National Interest Test Statement							
	The past decade has witnessed continued and worsening disadvantage experienced by Indigenous Australians, alongside widespread environmental degradation and global human suffering. Addressing these challenges requires Australians to adapt, reform, and change. Our democratic institutions are arguably designed to afford us this ability, but democracy requires a politically engaged and informed citizenry. Adaptation requires people who tolerate, support and initiate social change. We draw on cutting-edge social psychological theory and methods to test the role of utopian thinking – that is, prospection about an ideal, positive future – in motivating political engagement with issues of racial and global equality, and environmental justice. Project findings can be used by educators, government, community and non-governmental organisations as part of their efforts to connect to, and engage with, citizens about pressing social issues.							

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DP200102328 Lee, Prof Michael S	This project aims to generate unprecedented insights into the fangs of venomous snakes, focusing on elapids (taipans, tiger snakes etc). We will examine fang shape diversity, correlation with behavior and ecology, evolutionary history, and biomechanical properties. Data will be collected using cutting-edge micro-CT technology and analysed using 3D geometric morphometrics, computer simulations, and advanced phylogenetic techniques. This should greatly improve understanding of the evolution of venom fangs in all snakes. Other benefits include a large 3D reference database allowing identification of fossil fangs, with applications for studies of past climates, and a characterisation of fang biomechanics, relevant to biodesign and biomimicry.	70,615.00	141,585.00	142,350.00	71,380.00	0.00	0.00	425,930.00
	National Interest Test Statement Australia is (in)famous for its diversity and abundance of venomous snakes. This project will harness our uniquely diverse venomous snake fauna to greatly improve our understanding of the diversity of snake fangs, and reveal how their shape has driven the evolutionary success of snakes. A correlation between fang shape and taxonomy will allow accurate identification of snake species in the fossil record from isolated fangs, releasing a valuable and untapped source of biodiversity data that improve estimates of palaeoclimates and climate change. The study will also biomechanically evaluate novel structures found in snake fangs, with potential applications in biodesign, like micro-needles, an important area of research in medical engineering. Finally, it will improve public appreciation of one of Australia's most diverse, ecologically and medically important animal groups.							
DP200102880 Gardner, A/Prof Michael G	Parasites have been proposed to be drivers of population divergence, and ultimately speciation, yet the dynamics of this process are not well understood. This project will utilise new genomic techniques, novel hybrid zone analyses, and data on mate choice, to investigate the hypothesis that parasites drive population divergence through an interaction with immune response genes in the sleepy lizard Tiliqua rugosa. This species provides an unprecedented system, backed by 37 years of long term host-parasite and behavioural data, and recent genetic analyses. This project intends to produce significant data to allow an examination of the early stages of host-parasite evolution in action, providing novel insights into the speciation process.	76,877.50	148,503.50	123,637.50	52,011.50	0.00	0.00	401,030.00
	National Interest Test Statement Parasites are predicted to change their distributions under climate change. Some parasites may increase their ranges and the incidences of infectious disease may rise. The consequences to wildlife, agriculturally important species, and also humans, is unclear. Understanding how parasites may drive host population divergence of immune genes in this well studied lizard system can provide a crucial window onto the early stages of evolutionary divergence and how species may adapt to parasites, and hence inform our understanding of what effects the movement of parasites might have in a wider context. To improve predictions and responses to climate change it is imperative that we deepen our understanding of mechanistic factors involved. This project will bring together a team of Australian and international researchers to help develop the next generation of scientists in Australia to take on the challenges to our wildlife, agriculture and human health that lie ahead.							
DP200103398 Long, Prof John A	The evolution of terrestrial animals from fish was one of the most significant events in our evolution, yet little is known about how the brain evolved during this transition. This project aims to investigate the major novelties acquired in the evolution of the early vertebrate brain in order to determine the functional reasons for such changes, as well as identifying the timing and environmental factors driving such changes. This project expects to generate new knowledge on the anatomy of the vertebrate brain with improved methods for reconstructing fossil brains to better understand our own neurological evolution. Expected outcomes include enhanced institutional collaborations within Australia, and between Australia, Canada and the USA.	74,025.00	139,185.00	130,125.50	64,965.50	0.00	0.00	408,301.00
	National Interest Test Statement This research contributes towards better understanding of Australia's and Antarctica's natural environment through novel interpretation of its palaeontological resources. Fossils housed in Australian Museum and University collections at the WA Museum, Museum Victoria, Queensland Museum,Australian Museum and ANU Geological collections are valuable resources owned by the Australian public. New studies of these fossils will add new information to aid interpreting the past environments that these organisms inhabited, and enhance understanding of the geology of these formations. Such research contributes new data that can be of value to exploration for mineral and hydrocarbon resources. The East Gondwana Province, that existed when these fishes lived, spans across Australia and Antarctica, so the study of these fossils contributes to the better interpretation and correlation of geological strata across the continents. Enriching knowledge of these attractive fossils makes them more appealing for museum exhibitions, adding cultural value to our public museum's collections.							

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	Flinders University	648,174.00	1,314,126.00	1,266,831.50	600,879.50	0.00	0.00	3,830,011.00
The University of Adelaide								
DP200100190 Eagle, Dr Antony R	This project aims to critically examine a number of accounts of how and if we may reconcile what we know about ordinary objects with the unexpected things science has taught us about space, time, and the fundamental building blocks of nature. The project anticipates generating new knowledge in metaphysics, exploiting the recent 'locative turn' to revitalise perennial questions about existence and change. Expected outcomes of this project include publications and conference activities, the initiation of new international collaborations, and enhanced research capability in scientific metaphysics in Australia. Benefits include improved understanding of our place in the natural world and enhancing Australia's reputation and research skill base.	29,000.00	67,000.00	83,336.00	45,336.00	0.00	0.00	224,672.00
	National Interest Test Statement This project aims to conduct basic philosophical research, develop Australian research capacity, and initiate and sustain international research connections. The intended outcomes of the project will enhance and deepen Australia's distinctive contribution to this cutting edge area of research and help to maintain our tremendous international reputation in theoretical philosophy. The project anticipates developing a framework to scaffold further research in philosophy and relevant to projects in foundations of physics, which we aim to communicate through traditional scholarly channels as well as engagement activity with the scientifically interested general public, including public lectures and other accessible forums. Projected benefits to the community are cultural (improving our understanding of the complexity of our ordinary world-view, and developing our ability to ask and answer big questions about our place in the physical world) and social (increasing our international links, developing Australia's research reputation, and building Australia's skill base in foundations of science).							
DP200100451 Dawson, Prof Bruce R	This project aims to harness the capabilities of the upgraded Pierre Auger Observatory to identify sources of the highest energy cosmic rays, the most energetic particles known in the Universe. Their origin is one of the longest standing mysteries in astrophysics, but answers are now within reach. Expected outcomes of the project include mass estimates for every measured cosmic ray, and sky maps of cosmic ray arrival directions that take into account the cosmic ray charge, minimising the effects of path deflections by cosmic magnetic fields. These maps will reveal new information on the types of astrophysical objects capable of accelerating particles to extreme energies, a major step towards solving this difficult problem.	95,000.00	190,000.00	190,000.00	95,000.00	0.00	0.00	570,000.00
	National Interest Test Statement This project aims to solve one of the longest-standing astrophysics problems, the origin of the highest energy cosmic rays, the most energetic particles in the Universe. Australian scientists and students will work in an international collaboration of 400 physicists and astrophysicists, using highly sophisticated particle detection equipment and applying new analysis techniques for big data. This work enhances and broadens Australia's reputation as a leader in astrophysics. It will provide excellent training and international exposure for at least 8 PhD students, who will go on to apply their knowledge across a range of physical science careers in Australia and worldwide.							
DP200100729 Varghese, Prof Mathai	Coarse geometry is the study of the large-scale structure of metric spaces, in terms of operator algebras. This project aims to use coarse geometry to develop novel approaches to Callias index theory and its applications, and to topological phases of matter, where the Nobel Prize in physics in 2016 was awarded. This will yield new techniques in index theory and other areas, and solutions to several important problems. Outcomes include a noncompact generalisation of the famous Guillemin-Sternberg conjecture that quantisation commutes with reduction, and new models of topological phases of matter in terms of K-theory of operator algebras. This project will benefit Australia by reinforcing its position in these highly active areas in science.	81,213.00	168,356.50	172,506.00	85,362.50	0.00	0.00	507,438.00

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	National Interest Test Statement							
	This project involves interaction within and between various disciplines in mathematics and physics, and their Australian practitioners. It will undoubtedly lead to advances in all of them, and provides the fertiliser and framework for such interaction, strengthening Australia's position. Due to the popularity of the research area, this project will help us attract and train many bright postgraduate students and researchers from all over Australia and overseas; this is a key part of this proposal. Support for the provision of fundamental research, often the spark for innovative applications in the longer term, remains an essential aspect of the research landscape in Australia. Our results on topological matter may lead to the development of new materials with applications in industry. Applications mentioned in the literature include heat-to-electricity conversion, superlenses for microscopes, and transistors. The US Department of Energy recently opened the Center for the Advancement of Topological Semimetals, which studies applications of topological matter to spin-based electronics, computing and sensing.							
DP200100784 Rowell, A/Prof Gavin P	This project aims to reveal the highest energy cosmic-ray particles in our galaxy, produced in extreme and still unknown astrophysical processes. Their interaction with nuclei in space produces the highest energy gamma ray light. Our project will make use of this extreme gamma ray light with upgraded and next-generation gamma-ray telescope arrays. With accompanying data from Australian radio telescopes, and computer models of the cosmic ray interactions, our project can finally determine from where these cosmic rays originate, yielding insight into our galaxy's evolution. Complex machine learning methods will be needed in a project that provides a world-leading student training ground, motivated by a century old mystery in astronomy.	37,500.00	105,000.00	137,500.00	70,000.00	0.00	0.00	350,000.00
	National Interest Test Statement							
	Astronomy is one of Australia's world-wide strengths in fundamental scientific research, and it is one of the best ways to lead young generations into a career in science, and space science in particular. This project taps into the world's leading teams in high energy gamma ray astronomy to study Nature's extreme phenomena in outer space. It will also utilise Australia's world-class suite of radio astronomy telescopes. This project will provide students and young researchers opportunities to develop into world-leading scientists in their own right. The project will further strengthen the tradition in Adelaide of providing students a rich training ground in the diverse areas of high speed electronics, complex data analysis, machine learning techniques, and mathematical skills, leading to rewarding graduate careers in high-technical industry, space science industry, defence and surveillance research, meteorology and information technology. This is particularly important in the new era of Australia's Space Agency.							
DP200100834 Stokes, Prof Yvonne M	This project aims to develop mathematical models to predict migration of particles suspended in flow through curved microfluidic ducts and their focusing by size to different regions in the cross-section of the duct. New knowledge in mathematics and engineering will be generated through models that capture the two-way force balance between fluid and particles and by a novel use of asymptotics for computational efficiency. Expected outcomes are understanding of the physics that drives particle migration and the parameters that may be used to control particle focusing. This will benefit design and operation of microfluidic devices for particle sorting as required for "liquid biopsy", the isolation of cancer cells in a routine blood sample.	60,000.00	120,000.00	130,000.00	70,000.00	0.00	0.00	380,000.00
	National Interest Test Statement							
	This research on mathematical modelling of particle migration and focusing in microfluidic ducts is capable of providing quantitative information, not available through experimental studies, of great benefit to improved design and operation of microfluidic inertial particle sorters used in medical diagnostics and the chemical and pharmaceutical industries. There is potential for Australia to reap commercial benefits through development of particle sorting technologies. An important application is isolation of circulating tumour cells (CTCs) from a blood sample. CTCs allow early detection and screening of cancers such as aggressive melanomas which, due to our sunny climate, are more prevalent in Australia than elsewhere. Further, they signal the possibility of metastasis, responsible for more than 90% of cancer-related deaths in the world. A key challenge to unlocking the utility of CTCs is the ability to detect and isolate them. Thus this research promises economic and social benefit to Australia. Further, it will enhance Australia's research reputation and provide research training to a new PhD.							
DP200101009 Semmler, A/Prof John G	The ability to execute and learn skillful actions deteriorates with advancing age, but the cause remains elusive. The main aim of this project is to use new neurophysiological techniques to examine the age-related changes in brain function that contribute to reduced movement control in healthy older adults. The research will use multimodal approaches to reveal the causal role of age-related changes in specific brain networks to motor behaviour and learning. The outcomes will provide significant new knowledge that may help to optimise the design of targeted interventions aimed at rejuvenating brain function and movement quality in the elderly.	50,374.50	99,310.50	98,436.00	49,500.00	0.00	0.00	297,621.00

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	National Interest Test Statement In today's society, the ability to acquire new motor skills is essential for most daily activities, including independent living. However, deterioration of brain and motor function within the ageing population are major causes of loss of independence and reduced ability to work, which results in a substantial personal, social and economic burden. This is particularly relevant to Australia as we now enjoy one of the highest life expectancies in the world, resulting in older Australians making up a growing proportion of the total population. This project will inspire new ways to maintain adequate brain and motor function throughout the lifespan, delaying the functional declines that often lead to frailty, and improving the quality of life for older adults.							
DP200101191 Wheeler, Prof Sarah A	This project aims to evaluate the consequences of, and lessons learned from, the past two decades of water reform in the Murray-Darling Basin (MDB). In particular, it will examine the recent economic and farm consequences of water recovery. Australia is over halfway through implementation of the MDB Plan, and has spent over $6 billion in water recovery to achieve basin-wide resilience, with billions more still committed. Project expected outcomes include pioneering new methods to track how MDB irrigation efficiency, productivity and other farm outcomes have changed as a response to water reform. It will also draw lessons from both national and international case studies to consequently inform more effective water management.	26,772.00	52,484.50	52,077.50	26,365.00	0.00	0.00	157,699.00
	National Interest Test Statement How to secure cost-effective water reallocation in the face of ongoing water scarcity and many different water users and stakeholders in the Murray-Darling Basin has been one of the most politically contentious questions Australia has faced in the past decade, and will continue to face in the future. The distress that has been felt nation-wide in regards to both: a) drought impacts on farmers and b) large-scale fish deaths in Menindee, illustrates the key importance of this topic for Australia. This project, consisting of independent worldwide water economic and policy experts, will inform this debate and identify the consequences of current water reform in the MDB; namely the impact of: i) buyback of water entitlements on farm outcomes; ii) subsidies for irrigation efficiency (both at farm and basin level) on on-farm outcomes; and ii) water policy reform on water and land assets. Research insights will have great relevance for many practitioners in the water sphere, in Australia and internationally. The project addresses three key National Priorities: 1) Food; 2) Soil & Water; and 8) Environmental change.							
DP200101498 Doko Tchatoka, Dr Firmin Sabro	This project aims to develop consistent model selection criteria even if the target model only provides a weak signal about the parameter of interest. This project expects to generate new knowledge on model selection using new and innovative techniques. Expected outcomes include the quantification of the maximum information on parameter from weak-signal models; new entropy-based model selection criteria; and a robust investigation of the still debated hypothesis in environmental economics that with open and liberalized trade, developing countries would become pollution havens for dirty industries of advanced countries. Success in this undertaking will dramatically enlarge the pool of applied work involving economic models with weak signals.	40,000.00	80,000.00	80,000.00	40,000.00	0.00	0.00	240,000.00
	National Interest Test Statement The project will create new statistical methods to guide the Australian government and businesses to formulate effective environmental and economic prudential policies based on the exploitation of large datasets. Given the emergence of digital technologies and big data-driven innovations, common quantitative measures used to assess economic policies and to build informed decisions in governments and businesses are failing due to their inability to extract the maximum information available. For many Australian businesses and partner economies, new techniques for processing and analysing big data are becoming an important resource that can lead to new knowledge, drive value creation and foster new products, processes and markets. The project will develop new quantitative tools to extract efficient predictions from big datasets. These tools will be of significant relevance for the Australian community in the age of big data.							
DP200101675 Chin, Dr Tat-Jun	Outliers inevitably exist in visual data due to imperfect data acquisition or preprocessing. To enable computer vision applications that can perform reliably, robust fitting algorithms are necessary to counter the biasing influence of outliers. However, current robust algorithms are unsatisfactory: they are unreliable (due to using randomisation) or too computationally costly (due to using exhaustive search). This project will develop new robust algorithms to mitigate these shortcomings. It will do so by investigating two new paradigms of kernelisation and polyhedral search, which offer unprecedented theoretical insights into the problem. The outcomes will contribute towards computer vision applications that are more practical and reliable.	60,000.00	122,500.00	125,000.00	62,500.00	0.00	0.00	370,000.00

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	National Interest Test Statement With a large land mass and an ageing population, it is crucial for Australia to develop autonomous systems to help maintain our living standards, protect the environment, provide services to remote communities, and reduce healthcare costs. Current autonomous systems are mainly confined to factory floors and workshops, due to their lack of capability to function robustly in unstructured environments such as urban streets, fruit plantations, hospitals and underground mines. A fundamental source of difficulty lies in the outliers (i.e., corrupted data) that inevitably exist in the sensory inputs (e.g., images, videos, 3D point clouds) from challenging environments. To build autonomous systems that can work reliably in the real world, it is necessary to develop perception algorithms that are inherently robust. The project will devise robust perception algorithms by investigating new fundamental insights into the problem called kernelisation and polyhedral search. The project outcomes will contribute towards extending the usability and practicality of autonomous systems to challenging real-world environments.							
DP200101764 Balasuriya, A/Prof Sanjeeva	This Project aims to quantify the uncertainty of a model output in terms of uncertainties in modelling assumptions, by developing new mathematical techniques and applying them to real-world data. This will be in the context of assessing the accuracy of tracking coherently moving structures (e.g., hurricanes, oceanic biodiversity hotspots, pollutant patches, insect swarms) from experimental/observational data sets. Novel, data-tested, mathematical methods for uncertainty quantification of coherent structures will be developed as Project outcomes. Project benefits include new insights into protecting the environment, improved uncertainty quantification in climate modelling, and the generation of interdisciplinary knowledge and training.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
	National Interest Test Statement This Project will provide new insights into protecting the environment and improving uncertainty quantification in weather and climate modelling. This will contribute towards national security and safety by helping take relevant action in protecting areas, and making informed decisions regarding evacuations, due to impending environmental disasters such as hurricanes or pollutant spills. Improved risk assessment will lead to less damage to the Australian economy. Furthermore, the Project will generate new interdisciplinary knowledge and training of highly-skilled researchers through interaction with one of the world's top universities.							
DP200101768 Tyler, Dr Jonathan J	This proposal aims to investigate the response of the East Asian Monsoon to abrupt climatic change, under baseline states of both warm and cool climate. The research is significant as it utilises unique, precisely dated sediments from Japan, and novel approaches to quantifying spatial and temporal climate patterns. The research will improve understanding of the nature and causes of decadal-scale changes in monsoon precipitation, with relevance for constraining the trajectory of the future monsoon, and the risks of prolonged drought and flood. The findings will benefit the Asian people, for whom the monsoon has major economic, social and environmental importance. In turn, this will benefit Australia, via economic and climatic ties to Asia.	81,500.00	157,000.00	150,500.00	75,000.00	0.00	0.00	464,000.00
	National Interest Test Statement The East Asian Monsoon dictates water resources and water-borne geohazards for approximately one third of Earth's population - in China, Korea and Japan - with direct economic, socio-political and environmental consequences globally, including Australia. Understanding the dynamics of the East Asian Monsoon has direct relevance to the climatology of northern Australia and Australia's surrounding oceans. Multi-decadal projections for future monsoon precipitation are contradictory, reflecting the complex spatial and temporal nature of the phenomenon. The proposed research will therefore reduce this uncertainty by quantifying natural variability and spatial patterns in monsoonal precipitation under a range of warmer and cooler global climatic states. The proposed research will strengthen collaborative links between Australia and Asia, particularly Japan, creating opportunities for Australia's innovation and education sector. Through the proposed research, new analytical and statistical methods will be developed and refined to benefit Earth and environmental science research on Australia.							
DP200101792 Jackson, A/Prof Paul D	This project aims to investigate the most significant deviations from our model of how nature works at the most fundamental level by taking a multi-messenger approach to mining data from particle collider experiments. The project expects to make definitive statements as to whether the current deviations measured in data are the result of as yet unmeasured particles and forces. Expected outcomes of this project are to build advanced algorithms and methods of data interrogation that will be applied at the CERN Large Hadron Collider in Europe and the Super KEKB collider in Japan. This should provide significant benefits such as training junior researchers in advanced machine learning techniques and applications to big data analysis.	50,000.00	105,000.00	115,000.00	60,000.00	0.00	0.00	330,000.00

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	National Interest Test Statement							
	This project will fulfil the chief role of the ARC in supporting the highest-quality fundamental research and research training. Placing Australia at the forefront of the international pursuit to challenge our understanding of the Universe, and to build and operate the tools we use to do so, is vital to our national interest. It is only by cementing this leadership position that we will continue to play a leading role in discovery science. If we miss out on providing our young, curious researchers the opportunity to pursue breakthrough science on a global scale, we do them and future generations of ambitious Australian scientists a disservice. Australians take pride in their scientists achieving great things and this enriches communities with a social and cultural strength and belief in their nation. The project herein will provide more tangible outcomes still, as it provides a cost-effective way to fund this science, developing leading researchers throughout their PhDs, who are likely to remain in Australia and become the scientific leaders of tomorrow.							
DP200101881 Glorie, Dr Stijn	This project will establish apatite as a new tool to study the evolution of the continental crust. The crust shaped the composition of the atmosphere and the oceans with consequences for the evolution of life through the availability of oxygen and nutrients. However, when and how the continental crust was generated remains a core question. Current models for continental crust development rely on the mineral zircon. However, zircons only record the history of evolved rocks. To address this bias we will use the mineral apatite which forms in less evolved rocks. We will develop a detrital apatite database of Pb-Nd (model) ages and integrate this with the zircon record to provide a more holistic description for how our planet developed.	65,000.00	130,000.00	95,000.00	30,000.00	0.00	0.00	320,000.00
	National Interest Test Statement							
	The use of apatite to look into the evolution of the crust is novel and the scientific outcomes that will be generated from this project will contribute to Australia`s standing as a leader in geochronology. The project offers some unique benefits over more conventional approaches, including resolving the contribution in crustal growth from mafic rock types. The data-set for this project will provide absolute age constraints on tectonic events that are of crucial importance to the mineral and hydrocarbon exploration industry. With several target sample areas within Australia, the data-set will provide direct economic benefit through providing geochemical signatures of regional background and fertile domains that may provide mineral vectoring information to reduce exploration search space. Another economic/commercial benefit for the Australian community related to this project is the training of students in highly specialised skills (geochemical analysis, team work, critical thinking) that are transferable to the relevant national job markets (mineral exploration in particular).							
DP200101961 Arjomandi, A/Prof Maziar	This project aims to reduce skin friction drag by developing a novel passive flow control method using micro-perforated surfaces. Advanced analytical and experimental modelling will be used to develop specific design solutions to improve efficiency in many real life applications, such as to reduce drag in the aerospace, maritime, gas pipelines and wind turbine industries. Expected outcomes include widely applicable knowledge and skills, improved modelling and experimental techniques and tools, and enhanced collaborations. Benefits to Australia are expected to include significant improvements to the efficiency of the aerospace and energy industries, a boost to the Australian economy, and a reduction in carbon emissions.	95,000.00	180,000.00	175,000.00	90,000.00	0.00	0.00	540,000.00
	National Interest Test Statement							
	By attempting to find a way to reduce drag on aircraft, ships and other applications, this project has the potential to reduce carbon emissions through lower fuel consumption and enhance the long term viability of Australia’s transportation and aviation industries. It will also result in improved design, performance and efficiency of air, marine and land transport vehicles, and of energy systems. It will make use of world-class facilities and engage national and international researchers with proven track records. Finally, it will increase modelling and experimental capabilities, and enhance research facilities and tools, to advantage a wide variety of industres including transport, energy, aerodynamics and marine engineering.							
DP200102291 Pukala, A/Prof Tara L	Variations from the classic DNA double helix structure are proposed to play key roles in a range of cellular processes, particularly gene regulation. However, the biological function and therapeutic potential of these unusual DNA structures are poorly explored, since the fundamental molecular details which govern their formation and interactions with cellular machinery are not well described. This project aims to develop innovative methods to investigate, and importantly modulate, DNA and RNA triple helix assembly, specificity and molecular interactions. Resulting insights will underpin novel approaches to gene regulation, principally in the context of designing new antibacterial agents to address the antibacterial resistance problem.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00

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	National Interest Test Statement							
	The use of synthetic oligonucleotides (such as chemically modified short stretches of DNA) in gene therapy has had transformative impact in biotechnology and medicine. This project will pioneer a unique combination of experimental and theoretical approaches to provide an unprecedented molecular view of triple helix DNA and its role in gene regulation, which will drive further Australian innovation in this field. In the context of developing new antibacterial agents critical in the growing fight against antibacterial resistance, this can have longer term translational benefits leading to reduced national health costs and better health outcomes. More broadly, development of antigene technologies ultimately presents widespread potential for economic impacts in the Australian bio-pharmaceutical sector through commericalisation of currently under-explored antigene oligonucleotides. Finally, this project provides opportunities to enhance collaborative, interdisciplinary research capacity and provide research training particularly relevant to areas of national economic importance such as the biotechnology industry.							
DP200102300 Kotooussov, Prof Andrei G	The microstructural damage accumulation stage often consumes a significant portion of the total fatigue life of structures. However, its progressive evaluation is beyond the reach of safety inspection techniques which are currently employed to maintain structural integrity and prevent fatigue failures. This project aims to fill this gap by developing innovative methods for the measurement of material properties related to fatigue damage and establishing a new theory which links these properties to the remaining life of the structure. The project outcomes will facilitate the global trend towards predictive maintenance strategies, thereby generating substantial cost benefits, specifically, for high-value assets and ageing infrastructure.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
	National Interest Test Statement							
	The project will expand Australia’s knowledge base, foster international research collaboration, and promote Australia's leadership in several fundamental research disciplines including material characterisation of metals and composites, ultrasonic guided waves, acoustoelasticity and damage mechanics. The project outcomes will lead to the development of novel methods for structural life prognosis and safety inspections, possessing intrinsically new capabilities. These new capabilities will support innovative engineering design, efficient operation of high-value assets and life-extension programs of Australia’s ageing infrastructure. The proposed research will directly contribute to DST’s current cost reduction activities associated with the maintenance and fatigue life management of military aircraft platforms. New solutions will also be developed to address the existing fracture and fatigue problems in the railway and power industries. The training of students and early-career researchers with skills related to fatigue and fracture will contribute to the prevention of large structural failures in Australia.							
DP200102411 Doonan, Prof Christian J	This research will advance the fundamental chemical science required for the emerging field of Metal-organic Framework (MOF) biocomposites. A significant challenge to the commercial use of enzymes (biocatalysis), proteins (protein-based therapeutics) and virus-based vaccines is their instability to elevated temperatures and/or non-biological media. MOFs can encapsulate and protect biomolecules, thereby overcoming this limitation. This project will develop fundamental parameters that govern the formation, stability and activity of these biocomposites, expanding the scope of MOF materials available for bioprotection, and enable new developments in the areas of industrial biocatalysis and protein/virus-based therapeutics.	95,000.00	185,000.00	180,000.00	90,000.00	0.00	0.00	550,000.00
	National Interest Test Statement							
	The storage, transport and manipulation of proteins (as therapeutics), enzymes, and virus-based vaccines is a critical component of the biotechnology sector. However, biomolecules are inherently fragile and typically require sophisticated handling procedures and costly infrastructure that prohibits their widespread use. This project will advance a strategy - called biomimetic mineralisation - that can protect biomolecules from degradation and thereby benefit Australia's biotech industry and companies using biocatalysis for fine chemical synthesis. The importance of this to Australia's national interest will be demonstrated in two ways, by preserving the structure and activity of enzyme biocatalysts for fine chemical synthesis under extreme conditions, thereby enabling their wider use in industry; and by investigating the stability virus-based vaccines in challenge conditions that might enable their deployment to remote areas without a "cold chain". The protocols developed for and the insight gained into biomolecule protection will facilitate translation of this innovative concept into commercial use.							

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DP200102427 Reid, Prof Ian D	This project will develop a new method for robotic navigation in which goals can be specified at a much higher level of abstraction than has previously been possible. This will be achieved using deep learning to make informed predictions about a scene layout, and navigating as an active observer in which the predictions informs actions. The outcome will be robotic agents capable of effective and efficient navigation and operation in previously unseen environments, and the ability to control such agents with more human-like instructions. Such capabilities are desirable, and in some cases essential, for autonomous robots in a variety of important application areas including automated warehousing and high-level control of autonomous vehicles.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
	National Interest Test Statement Robotics and automation are key to the future competitiveness, safety and prosperity of Australian industry, in diverse sectors including as manufacturing, mining, agriculture, construction and health. They are a tool to unlock human potential (e.g by automating drudgery or dangerous tasks) and to modernising Australia's economy. The benefits include: improved productivity; creation of new jobs; re-shoring of jobs by allowing Australia to compete with low-labour-cost economies. These factors are discussed in much greater detail in the 2018 "Roadmap for Robotics in Australia" and in the 2018 Synergies report "The robotics and automation advantage for Queensland" (with findings that extrapolate nationally). Further, it is estimated that a robotics industry will be worth US$23B by 2025 and Australia is well-positioned to share in that market by participating in fundamental developments in the field. This project is one such advance; developing ways for more flexible operation of robots to unleash their potential to operate more effectively with humans, and in unfamiliar and/or remote environments.							
DP200102447 Legrand, Dr Timothy	This project aims to investigate the use of anti-terrorism proscription powers in illiberal democracies after 2002. Although promulgated by the archetypal liberal institution – the United Nations – proscription powers are increasingly recognised as important tools of illiberal regimes in legitimising human rights abuses and suppressing political dissent. Using studies of Cameroon, Nigeria, Pakistan and Sri Lanka, the project explores the intersections of colonial proscription, UN anti–terrorism norms and illiberal regimes' security. The project will generate new comparative knowledge on the deployment of colonial instruments of control in the ‘war on terror’ and innovate conceptual insights into the global security politics of exclusion.	21,358.50	57,850.50	78,709.00	42,217.00	0.00	0.00	200,135.00
	National Interest Test Statement This project’s investigation of Illiberal states’ use of anti-terrorism proscription powers since 2001 delivers clear national benefits. Australia has made commitments to the United Nations Human Rights Council to work towards promoting and protecting global freedoms of expression and to seek early warning of mass human rights violations and abuses. Yet around the world today, illiberal states destabilise these aims by using proscription powers to suppress political dissent, legitimise human rights atrocities and subjugate ethnic minorities under the pretext of counter-terrorism action. This project addresses this troubling problem by uncovering how such proscription powers are enacted, and their relationship to international security norms endorsed by the United Nations. This project’s findings aids public understanding of global forms of oppression, enhances Australia’s policy capacity in better understanding of methods of suppression within illiberal regimes, and further improves institutional knowledge of how illiberal security norms become mobilised.							
DP200102571 Bi, Prof Peng	Climate change has had a negative impact on human health. However, few studies have assessed burden of diseases (BOD) for these climate-sensitive/heat attributable diseases. We will generate the first national picture of the climate attributable BOD in Australia, measured in Disability-Adjusted Life Year (DALY), the attribution from climate, and project future BOD under various climatic/demographic change scenarios. This project will rank Australian climate-sensitive/heat attributable diseases by their current burden and projected increase under climate changes, and provide needed scientific evidence to policy-makers in the development, prioritization and implementation of current and future climate change and health adaptation strategies.	78,446.50	155,812.00	165,781.50	88,416.00	0.00	0.00	488,456.00
	National Interest Test Statement This project cuts across two national strategic research priorities: ‘Environmental Change’ and ‘Health’. Specifically, they include 1) Mitigating, managing or adapting to changes in the environment, especially climate change. By predicting and measuring the burden of disease of climate change contributing to an increase in health risk, it will improve accuracy and precision of adaptation response; 2) Options for responding and adapting to the impacts of climate change on Australian communities and improving the health outcomes for all Australians; and 3) Encouraging stronger partnerships between researchers, health, social and emergency services leaders, decision makers and all levels of government.							

* Note - Indicative funding for approved projects will be made available through a funding variation under section 54 of the ARC Act

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(Columns 1 and 2)	(Column 3)	2019-20 (Column 4)	2020-21 (Column 5)	2021-22 (Column 6)	2022-23* (Column 7)	2023-24* (Column 8)	2024-25* (Column 9)	(Column 10)
DP200102670 Harris, Prof Hugh H	This project aims to examine how dietary selenium is converted into essential proteins and beneficial compounds that mitigate against a broad range of human diseases; or alternatively, into toxic molecules. Cutting-edge methodologies should resolve significant unknowns in selenium metabolism, to provide definitive dietary guidelines and to explore how selenium can treat and protect against disease. Expected outcomes from this national and international collaboration include expert training for young biochemical researchers and refinements to novel analytical techniques. Results should benefit the food and agricultural sectors to provide tailored products locally and for export, as well as enhanced health opportunities for all Australians.	70,000.00	160,000.00	160,000.00	70,000.00	0.00	0.00	460,000.00
	National Interest Test Statement Selenium is essential for human health, yet it is unclear how different dietary forms are metabolised in the body. Too little selenium, common in Queensland and Tasmania, contributes to cancer, neurological, cardiovascular, inflammatory, and other diseases; while too much has been implicated in increased mortality rates. This project will examine how various selenium sources behave in cell and animal models under pathological and oxidative stress, to inform dietary guidelines for enhanced human health. More broadly, these results will impact food and agricultural practices in Australia and worldwide where selenium intake is sub-optimal. Cutting edge methodologies will deliver a new understanding of selenium physiology, connecting experts in biochemistry and oxidative stress biology with key infrastructure at the Australian Synchrotron. This research will strengthen and expand multi-disciplinary collaborations in Adelaide, Sydney and internationally to provide an exceptional environment in which to train the next generation of researchers and to pioneer new methods for examining complex biochemical questions.							
DP200102828 Bennetts, Dr Luke	Sea ice is a crucial part of the Australian and global climate systems, and the most sensitive indicator of the alarming climate changes in motion. This project aims to deliver a vital component in next-generation sea-ice models, by modelling ocean waves in the ice-covered ocean, and implementing it in the leading large-scale sea-ice model. The waves-in-ice model will be accurate for the range of possible wave–ice conditions, using understanding derived from state-of-the-art experimental measurements. Powerful mathematical approximation methods will be developed to generate model efficiency. The outcomes will create a new standard in sea-ice modelling, with significant benefits for sea-ice forecasting and climate studies.	57,000.00	113,000.00	117,500.00	61,500.00	0.00	0.00	349,000.00
	National Interest Test Statement Australia is experiencing increasingly frequent, extreme weather, with significant environmental, economic, and social costs. This trend will continue throughout the 21st century, and it is essential to prepare for future impacts. Earth-system models are the most powerful tools for projecting future climate scenarios; advancing models increases resilience to climate change through better-informed mitigation and adaptation policies. Australia has a particularly urgent need to improve models of the Southern Ocean and Antarctic, as these regions exert an enormous influence over the Australian climate. But there is low confidence in model projections of Antarctic sea ice, which is a crucial component of the Southern Ocean/Antarctic climate system. The project will tackle a key knowledge gap in sea-ice modelling, by generating a new model of ocean waves in the ice-covered ocean, motivated by recent findings that waves regulate Antarctic sea ice over 100s kilometres. This will result in more accurate representations of sea ice in models, leading to improved understanding of observed changes and projections.							
DP200102964 George, A/Prof Jonathan H	Nature can assemble complex organic molecules from simple starting materials with apparent ease, but the laboratory synthesis of these natural products is very difficult. This project aims to mimic the way in which Nature constructs organic compounds and thus develop more efficient, greener synthetic processes in which there is a rapid build up of molecular complexity via “biomimetic” reactions. We will integrate this approach with modern methods of catalysis, including electrochemistry, photochemistry and biocatalysis. As a result, this work will expand the chemical space available to synthetic chemists working in the pharmaceutical industry. A further benefit is the training of the next generation of Australian synthetic chemists.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00

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	National Interest Test Statement The use of natural products as antibiotics and anticancer agents has revolutionised human healthcare. However, many natural products are very complex molecules isolated in minute amounts from their natural source. The chemical synthesis of these molecules is therefore crucial to allow their future application in medicine. This research project aims to develop new ways of making complex natural products very quickly by using strategies that are inspired by their biosynthesis in Nature. A further important national benefit of this research program will be the training of highly skilled organic chemists that are essential for the growth of the Australian chemical and pharmaceutical industries.							
DP200103097 Roberts, Prof Anthony J	This project develops and implements a systematic approach, both analytic and computational, to extract compact, accurate, system level models of complex physical and engineering systems. Our wide ranging methodology is to construct computationally efficient "wrappers" around fine scale, microscopic, detailed descriptions of dynamical systems (particle or molecular simulation, or PDE or lattice equations). Comprehensively accounting for multiscale interactions between subgrid processes among macroscale variations ensures stability and accuracy. Based on dynamical systems theory and analysis, our approach will empower systematic analysis and understanding for optimal macroscopic simulation for forthcoming exascale computing.	85,000.00	170,000.00	170,000.00	85,000.00	0.00	0.00	510,000.00
	National Interest Test Statement In current modelling the underlying microscopic mechanisms are known, but the closures to translate microscale knowledge to a system level macroscopic description are rarely available. Our computational methodologies underpinned by mathematical analysis will circumvent this stumbling block to radically improve the modelling, exploration and understanding of complex systems in engineering and sciences. This in turn will improve the prediction and management of complicated systems in industry, commerce and the environment.							
DP200103206 Wang, Prof Shaobin	This project aims to develop robust and low-cost nanocarbon hybrids and advanced remediation technology to address globally emerging microplastic contaminations. The project expects to boost innovations in development of novel magnetic nanomaterials, process of microplastic purification, and green catalysis. Expected outcomes of this project will include efficient strategies in materials fabrication and a cutting-edge nanotechnology. The success of the project will underpin the scientific bases of carbocatalysis, provide significant benefits to the Australian industry and society for a sustainable future with clean water, and increase the leading capacity of Australia in fundamental research and frontier technology.	105,500.00	196,000.00	183,500.00	93,000.00	0.00	0.00	578,000.00
	National Interest Test Statement This project is designed, based on the status quo, to address the severe pollution by microscopic plastics which have been long widespread in Australian coastal areas and sewage wastewaters. The developed technology in this project will lead to breakthroughs in the practical viability of microplastic remediation with low-cost, green, and advanced nanotechnology. The outcomes of this project intend to advance Australia's world-leading roles in utilisation of functional nanocarbon materials for green environmental remediation. The completion of this project will help address national water and soil contamination and ensure Australia's sustainable economics, environmental wellbeing, food and water safety, as well as provide scientific innovations with cutting-edge technologies.							
DP200103795 Abbott, Prof Derek	Communication security protocols and computer algorithms are expressible in terms of strategic interactions between competing agents, which can be analyzed in a game theory setting. This project will exploit the recent advances in extending this game theory framework to multidimensional spaces, thereby strengthening the theoretical foundations. This will provide new insights into the working of algorithms, potentially improving future secure key distribution. Multi-agent interactions in higher dimensional spaces are considered intractable using traditional matrix methods and this project will build on our exciting new breakthrough showing that such interactions are tractable using geometric multivectors.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00

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	National Interest Test Statement							
	The project will analyze the optimization of competitive strategic interactions in order to open up a pathway for the discovery of new types of computer algorithms and security protocols. This will support Australia's leading position in information technology and cybersecurity. It will provide rigorous foundations for downstream digital technologies of strategic importance. Cybersecurity is of vital importance for computer networks that serve the e-commerce, banking, energy, and health sectors. Also emerging game changing cryptocurrencies such as 'bitcoin' create an urgent imperative to investigate means for increased levels of digital security.							
DP200103797 Shen, Prof Chunhua	Deep learning has dramatically improved the accuracy of a breathtaking variety of tasks in AI such as image understanding and natural language processing. This project addresses fundamental bottlenecks when attempting to develop deep learning applications at scale. First, this project proposes efficient neural architecture search that is orders of magnitude faster than previously reported, abstracting away the most complex part of deep learning. Second, we will design very efficient binary networks, enabling large-scale deployment of deep learning to mobile devices. Thus this project will overcome two primary limitations of deep learning generally, however, and will greatly increase its already impressive domain of practical application.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement							
	Machine Learning is in the process of revolutionising the way we live our lives, and a strong Australian capacity in the area is critical if we are to keep up. The approach that we propose here will enable training of deep learning as well as deployment at a much larger scale than that has currently been possible, a capacity which will drive the next generation of Machine Learning-based business and social opportunities. These opportunities will not arise purely as a result of this project, as deep learning at large scale is a trend in AI, and Computer Vision specifically, with companies like Google, Facebook, and Qualcomm investing heavily in the area as a result. If Australia is to benefit from this next generation of Machine Learning technology then we need to participate in its development. The tangible short-term benefit for Australia in developing the technologies proposed, and the associated expertise, is that they might be applied to problems of interest to Australians.							
	The University of Adelaide	1,783,664.50	3,614,314.00	3,659,846.00	1,829,196.50	0.00	0.00	10,887,021.00
University of South Australia								
DP200101210 Li, Prof Jiuyong	This project aims to develop data mining methods to detect algorithmic discriminations and to build fair decision models. It expects to provide techniques for regulatory organisations to detect discriminations in algorithmic decisions, and for various companies and organisations to build fair decision systems. Expected outcomes are novel and accurate methods for discrimination detection, practical and versatile techniques for fair decision model building, and improved understanding of the relationships between privacy preservation and discrimination prevention to enable new techniques to achieve both goals. The developed techniques enable society to tackle ethical challenges in the big data era where many decisions are analytics based.	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00
	National Interest Test Statement							
	Potential algorithmic discriminations form a major concern for artificial intelligence based decision systems. This project aims to develop novel and accurate methods for discrimination detection and practical, and versatile algorithms for fair decision model building. The developed techniques are for regulatory organisations to detect discriminations, and for various companies and organisations to build fair decision systems. The developed methods enable Australian society to tackle ethical challenges in the big data era where many decisions are personalised and algorithm based.							

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DP200101387 Kulik, Prof Carol T	This project aims to understand why a few exceptional organisations make substantive progress toward gender equality when so many of their competitors fail. Gender equality has social and economic value but despite decades of equal opportunity legislation and investment in gender initiatives, gender inequality persists in organisations all around the world. The project's case study methodology examines how gender diversity front runners align their diversity policies and practices with their internal identity and external reputation to produce substantive change. Understanding these dynamic processes will identify strategies that laggard organisations can adopt to make greater progress toward gender equality.	55,135.50	95,236.50	96,572.00	56,471.00	0.00	0.00	303,415.00
	National Interest Test Statement Australia has been slipping on international indicators of gender equality, dropping from a world rank of 15 (2006) on the World Economic Forum's global gender gap index to 39 (2018). Despite decades of equal opportunity legislation and financial investments in gender diversity initiatives, most Australian employers fail to make substantive progress toward gender equality. This project focuses on exceptions to this general rule. It uses a case study methodology to uncover the dynamics that differentiate gender diversity front runners from their laggard competitors. Gender equality has clear economic value: Analysts estimate that gender equality could generate a 12% increase in Australia's GDP by 2025. Many countries are adopting regulatory measures (including quotas) to address gender inequality, but these measures are controversial and resisted by organisations. This project is designed to identify practical strategies that Australian organisations might adopt to achieve gender equality from within, mitigating the need to increase external regulatory pressures.							
DP200101737 Ma, A/Prof Jun	Multifunctional Polymer/nanosheet composites have not yet been widely scaled up in polymer processing and composite industries mainly due to cost and inhaling hazard. This project proposes a novel methodology which embeds nanosheet preparation within polymer melt to both remove the inhaling hazard and lower the cost; the key is to develop two groups of nanosheet intercalation compounds which can expand at the polymer processing temperature, to exfoliate and disperse nanosheets in polymers. It is expected to generate new knowledge of the structure-property relationships and fracture mechanisms of these composites, for industry to scale up this technology and to develop new product.	60,000.00	120,000.00	115,000.00	55,000.00	0.00	0.00	350,000.00
	National Interest Test Statement Polymer processing and functional composite industries are major manufacturing sectors. Polymers are currently processed with micron-sized fillers, which may add functionality but compromise mechanical durability of the resulting composite product. In spite of extensive research on nanomaterials, multifunctional polymer/nanosheet composites have not yet been extensively manufactured. This project will provide composite fundamentals for industrial sectors to produce multifunctional polymer/nanosheet composites for domestic applications, such as underground mining, valving for constant flow control, and sea farming; the project team has received Expressions of Interest from Australian and international manufacturers. It also has great potential to promote Research and Development for Australian industry to increase the variety, quantity, and quality of exports.							
DP200102752 Dollard, Prof Maureen F	This national project will investigate the plausible link between distress at work and Australia's high levels of antidepressant use, through creative linkage of data from the Australian Workplace Barometer (10-year longitudinal study) to antidepressant medication data (via the national Pharmaceutical Benefits Scheme). The project advances theory by probing the role corporate climate plays in work design, distress, mental health problems and antidepressant use. It will determine if antidepressant use has led to an underestimation of work stress effects. It will estimate the $AUD cost of work related antidepressant use. The project will yield evidence to stimulate corporate climate change to protect worker psychological health and wellbeing.	207,500.00	238,891.00	31,391.00	0.00	0.00	0.00	477,782.00
	National Interest Test Statement This project aims to identify how corporate climate and workplace conditions contribute to Australian employee wellbeing and distress that culminate in them using antidepressant medication. It will also estimate the financial costs of work-related antidepressant use. This new knowledge will show public policymakers where to focus future attention to prevent work-related mental health problems such as depression and suicidal thoughts. The research will also identify which workplace processes can be changed to reduce unnecessary medication costs, which could significantly reduce the burden on Australia's health system and on disability and workers compensation systems, and provide new ideas to create safer, better quality work. The project addresses the national research and innovation agenda by developing new evidence that may be used in the future to improve worker mental health as well as to reduce health system inefficiencies and inform Australian health decision making through linking different major government public datasets.							

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DP200103168 Miklavcic, Prof Stanley J	Salt and drought are the two major abiotic stresses affecting crop plant health, growth and development. We aim to understand salt and water transport in plants and the physiological effects of soil salinity. Using biophysical models, we will quantify the movement of salt through plant organs, tissues and cells, from root to leaf. We aim to answer the question of how salt moves across the different tissues and major organs, how salt accumulates in root, leaf and shoot cells, and how movement and accumulation is controlled by the diversity of transport mechanisms operating in plants. We aim to quantify tissue tolerance, osmotic tolerance and ionic tolerance and discover new mechanisms by which plants can stave off the effect of salt stress. **National Interest Test Statement** Salt and drought are the two major abiotic stresses affecting crop growth and development in Australia. The increasing aridity of farmlands leads to inadequate leaching of root zone salts, while increased irrigation results in increased water salinity levels. Consequently, Australian agriculture is often forced to operate under poor conditions where salinity and drought are prevalent. To improve the yield of Australia's cereal, fruit and vegetable crops requires a better understanding of how plants are affected by salt. Unfortunately, our picture of the fundamental mechanisms and impact of salt uptake, transport and accumulation in plant tissues is incomplete. This project will generate new appreciation of the biophysical and biochemical factors influencing the uptake and transport of salt in plants. It will thus allow a more precise and more effective targeting of the genetic control of ion-sensitive mechanisms to enhance the sustainability of Australia's agricultural industry, lift productivity and improve the economic viability of Australian farms.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
	University of South Australia	452,635.50	714,127.50	502,963.00	241,471.00	0.00	0.00	1,911,197.00
	South Australia	2,884,474.00	5,642,567.50	5,429,640.50	2,671,547.00	0.00	0.00	16,628,229.00

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Tasmania								
University of Tasmania								
DP200100395 Ezzy, Prof Douglas M	This research aims to identify constructive strategies to manage religious freedom and LGBT+ rights in religiously affiliated workplaces in education, health care, and social welfare. The project will carefully describe workplace experiences, religious beliefs, and current legislation associated with religious freedom and LGBT+ rights. It will evaluate different policies and managerial practices in terms of their impact on religious practitioners and LGBT+ workers. The research combines systematic empirical research with legal and philosophical analysis. It will produce findings that policy makers and religiously affiliated social service providers can immediately use to guide their responses to religious freedom and LGBT+ rights. **National Interest Test Statement** The project will contribute to Australia's national interest through identifying effective Australian policies and practices for managing religious freedom and LGBT+ rights in the workplace. This addresses a pressing contemporary social and cultural issue. In the medium to longer term, the research will provide economic and social benefits through identifying ways in which religious freedom and LGBT+ rights can be successfully negotiated in the workplace so as to inform institutional decision-making and public dialogue. Our comparative research will place Australia in the context of other modern democracies' responses to religious freedom and LGBT+ rights. The research will enhance the international visibility of uniquely Australian solutions to these complex issues.	106,500.00	212,000.00	181,000.00	75,500.00	0.00	0.00	575,000.00
DP200100655 Heathcote, Prof Andrew J	Eyewitness identification error is common and costly. This project aims to improve the quality of information provided by eyewitnesses, and the ability of police officers and triers of fact (e.g., juries, judges) to evaluate this information. Laboratory investigations will determine how best to test memory and confidence to achieve this aim. A new class of cognitive models will provide a unified account of response accuracy, response time, and confidence, suitable for application to computerized testing scenarios. The models and testing methods validated in the laboratory will be refined for application in eyewitness memory settings, facilitating better evaluation of identification evidence, and potentially reducing wrongful convictions. **National Interest Test Statement** Mistaken identifications are the leading cause of wrongful conviction in many criminal justice systems. Critical decisions (like eyewitness identification decisions) are usually made under great uncertainty, and are often based on uncertain choices made by other decision makers (e.g., when a juror must decide whether to convict based on eyewitness identification evidence). This project aims to develop new methods for eliciting decisions, and mathematical models of the way humans make choices, which predict the speed and confidence with which they are made. These developments will improve choices and quantify their quality so that they can be properly weighted when combined. Programs will be developed to take these new methods from the laboratory to the police station and courtroom, enabling investigators to better evaluate whether a witness is correct in her or his decision. This will potentially reduce wrongful convictions, benefiting innocent individuals, the Australian justice system (e.g., reduced court and prison costs), and society at large (i.e., increased public safety and trust in the legal system).	49,455.50	100,281.00	98,601.00	47,775.50	0.00	0.00	296,113.00
DP200101406 Wapstra, A/Prof Erik	Sex-determination controls the largest variation within animals—the division into males and females. While the different systems of sex-determination—involving genetic or environmental control—are fairly well understood, transitions between these systems remain enigmatic in evolutionary biology. This project aims to address this gap by revealing the molecular change required to transition between systems, using one of only two known lizard species exhibiting both genetic and temperature control of sex. This knowledge will have important implications for species conservation, facilitating predictions of highly biased sex ratios under climate change, plus potential commercial applications for species where production of one sex is favoured.	73,281.00	145,160.50	131,279.50	59,400.00	0.00	0.00	409,121.00

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	National Interest Test Statement Our project aims to determine how species transition between “genetic” and “temperature” sex-determination. This is significant because under climate change, the production of highly skewed sex ratios threatens the persistence of species in which sex is influenced by temperature, including several Australian reptiles. The expected outcome of our study is new knowledge of the ease by which species can transition between modes of sex-determination, which informs the risk of their exposure to potential negative consequences of climate change. This proposal relates to the ARC Science and Research priority “Environmental Change”, and the Practical Research Challenge “Improved Accuracy and Precision in Predicting and Measuring the Impact of Environmental Changes Caused by Climate and Local Factors”. Knowledge of the mechanism for transition to temperature sex-determination is also of commercial benefit, as many aquaculture species exhibit sexual dimorphism in important traits relating to reproduction, growth, and quality, and production of the favoured sex could be simply achieved through temperature manipulation.							
DP200101432 Palmer, Prof Catherine	This project aims to investigate emerging relationships between women and alcohol in Australian sport. We will examine the meanings that drinking may have for sportswomen and female fans, and identify new theoretical frameworks for rethinking drinking, gender and sport. In the context of public and policy debates about the risks and social impacts of alcohol consumption, we expect to generate significant new knowledge outcomes. These include a world first research corpus of direct relevance for sports administrators and policy-makers, who are currently grappling with the costs and consequences of alcohol use in licensing and legislation, as well as in marketing, sponsorship and promotion of sport to women.	49,100.00	98,869.50	88,751.50	38,982.00	0.00	0.00	275,703.00
	National Interest Test Statement As women’s participation in sport grows, the impacts of associated drinking (by players and spectators) on social practices, wellbeing, marketing, and health promotion are predicted to be significant. Our research will contribute to public and policy debate about the impacts of alcohol consumption in the context of Australian sport. Data and publications generated should be of immediate and long-lasting benefit to industries, governments and communities managing the growing public significance of women's sport. Project findings will extend theoretical insight and provide policy advice and practical interventions that could improve overall societal wellbeing through better understanding the relationship between women, sport and alcohol; supporting stakeholders working to address a National Science and Research Priority - Improving prediction and management of an emerging local and regional health threat. Costs to our healthcare system may be minimised or avoided by policy decisions and targeted interventions informed by our project, leading to significant longer-term economic and social benefits.							
DP200101467 Hurd, Prof Catriona L	The aim is to discover if rising levels of oceanic carbon dioxide will offset negative effects of ocean warming on seaweeds, using targeted physiological experiments together with novel molecular diagnostics. Seaweeds create habitats and food for shellfish and fish, and play a crucial role in long term ‘blue carbon’ storage. They are predicted to benefit from future carbon dioxide enrichment, but to test this forecast requires a detailed understanding of the mechanisms used by seaweeds to acquire dissolved inorganic carbon. The expected outcome is robust predictions of how the primary productivity of coastal waters will respond to future high carbon dioxide conditions, enabling human adaptation to environmental change.	50,000.00	95,000.00	90,000.00	80,000.00	35,000.00	0.00	350,000.00
	National Interest Test Statement We will discover how temperate seaweed forests will respond in a future ocean that is warmer and suffused with carbon dioxide. This is highly significant because seaweed forests extend across the southern half of Australia’s coastline: they underpin tourism and aquaculture industries valued at over A$11bn/year as well as ecosystem services including climate regulation, nutrient cycling, nursery habitat for commercially important fish, and coastal protection from storms. It is crucial to understand how seaweed productivity might change to future-proof blue-economy food industries, including crayfish and abalone fisheries that rely on seaweeds as nurseries, food and shelter. Australia’s globally unique cool-water systems require tailored management strategies founded on the research-based knowledge of carbon uptake and productivity the project will provide.							

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DP200101635 Warr, Prof Coral	This project aims to shed light on how insect odorant receptors function by using comparative genomic studies between the genetic model insect Drosophila melanogaster and a pest species, the Australian sheep blowfly. This project expects to generate knowledge of how specific chemicals activate specific receptors in order to excite sensory neurons and drive behaviour, which is not well understood. Expected outcomes include increased understanding of olfaction in insects, increased national and international collaboration, and outstanding graduate student training. This research will be of significant future benefit in deriving methods to modify the behaviour of insects of agricultural or medical importance, for example the sheep blowfly.	92,289.00	190,960.50	196,732.50	98,061.00	0.00	0.00	578,043.00
	National Interest Test Statement Our research will increase the understanding of how insects locate their host plants or animals using chemical signals. It has long term applications in deriving methods to modify the behaviour of insects, and will be applicable to a range of insects of agricultural or medical importance. For example, the knowledge we obtain of key receptors for chemicals relevant to the Australian sheep blowfly's ecology may enable the design of compounds that shut down the ability of a sheep blowfly to detect sheep odours without interfering with mammalian neural processes. The Australian sheep blowfly is the subject of much investigation due to its impact on the meat and wool industries, and there is strong industry desire to transition to control practices that reduce environmental and animal welfare concerns. In addition, further increasing our understanding of insect odorant receptors will be of benefit to the efforts being made in a number of institutes around the world to utilise them to develop novel olfactory biosensor technologies.							
DP200101696 Hinder, Dr Mark R	This collaborative project aims to improve our understanding of how movements are rapidly cancelled, or reprogrammed, based on visual cues. Using innovative computational models, non-invasive brain stimulation and recordings of muscle activity, the project aims to elucidate how our brains anticipate the possibility of having to cancel planned actions, and how this changes as a function of healthy ageing. The outcomes are expected to assist in the design of neuromorphic technologies that mimic human brain function. The generated knowledge may also inform future research aimed at maintaining cognitive and motor function in the ageing workforce and treating conditions in which inhibitory control is compromised.	63,426.50	120,657.00	119,728.50	62,498.00	0.00	0.00	366,310.00
	National Interest Test Statement The combined effect of Australia's population growth and ageing demographics will result in the number of Australians > 65 years old increasing by 5.9 million by 2051 relative to 2012 numbers. Not only will this result in costs related to ageing rising exponentially but will also result in a significant older workforce. The current project will provide fundamental new knowledge about the mechanisms of inhibitory control, and how this facility degrades during later life. This knowledge may lead to future interventions aimed at maintaining efficient inhibitory control in later life, and thus assumes significant economic and social benefits.							
DP200101877 Stark, Dr Hannah L	This project aims to tell a global story about extinction as a human problem, by reconstructing the individual biographies of a selection of thylacine (Tasmanian tiger) specimens. Through transforming these specimens into grieveable lives the project expects to facilitate scholarly and public engagement with the cultural history of extinction, advancing the foundation for a sustainable and informed response that may help prevent further extinctions. In bringing together the zoo and the museum as key sites for the development of public environmental sentiment, this project has the potential to generate new and globally-relevant resources for engaging with conservation and extinction, through these institutions and beyond.	32,321.50	71,605.00	74,283.50	35,000.00	0.00	0.00	213,210.00
	National Interest Test Statement There exists a precious, irreplaceable and dispersed archive of extinct thylacine (Tasmanian tiger) remains, which is scattered through museum storage facilities around the world. This project will produce individual histories of a selection of these specimens in order to tell a global story about extinction. This will reveal the international trade of thylacine bodies, and the shifting relationships between collecting institutions such as zoos and museums through the 19th and 20th centuries in relation to contemporary museum practices and environmental politics. It will also render accessible a natural history collection that is too fragile for conventional forms of public display. This timely project will seek out new ways to memorialise species loss in order to change the way that we think and feel about extinction. It contributes to cultural understanding of the environmental impact of humans in Australia, a country with the worst mammal extinction rate in the world.							

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DP200101909 Cole, A/Prof Andrew A	The project aims to explore a unique niche in exoplanet detection: searches for cold planets down to Earth mass, including ice giants and rogue free-floating planets. Infrared cameras and adaptive optics on large telescopes will be used to make accurate measurements of cold planets in diverse galactic environments. These are significant because they are completely different from most known exoplanets, being far from their host stars and unique probes of planet formation theory. Expected outcomes are a greatly improved understanding of planet formation, and improved techniques for cold planet detection with gravitational microlensing. The project will strongly benefit the next generation space-based programs planned for the next decade. **National Interest Test Statement** This project benefits the national interest through its potential to contribute to answering some of the biggest questions possible: the formation of Earth-like planets, and the origin and prevalence of life itself. These questions lie at the heart of scientific curiosity and are of broad interest to the public. The results of astronomical research have dramatic impact on the public view of the nature of life and our place in the Universe. Fundamental basic research is essential to educate workers for a technically-based, information-driven economy, and to build the knowledge base of scientists across applied and commercial sectors. Exoplanet research is an area of strength for Australian astronomy; this project has tremendous synergy with recent major investments by the government in astronomy infrastructure. The discovery of exoplanets in diverse environments across the Milky Way is a unique opportunity to engage public interest in science, and will encourage students to study Science, Technology, Engineering and Mathematics subjects by raising the profile of Australian fundamental scientific research.	87,500.00	160,000.00	145,000.00	72,500.00	0.00	0.00	465,000.00
DP200102395 Bowman, Prof David M	Aims: This project aims to discriminate between competing explanations for vegetation patterns in the Tasmanian Wilderness World Heritage Area: (a) fire (the legacy of Aboriginal burning), or (b) soil. We will do this through a novel, transdisciplinary research program. Significance: The project expects to create new knowledge essential for achieving evidence-based fire management, as well as to advance a globally important ecological theory. Outcomes: Expected outcomes include significantly strengthened fire science and fire management capacity in Tasmania. Benefit: Benefits should include the protection of globally significant cultural, biological and landscape values that sustain the vibrant Tasmanian tourist economy. **National Interest Test Statement** The Tasmanian Wilderness World Heritage Area protects iconic landscapes which are of profound importance to Australia's cultural identity. It conserves globally unique biological systems and supports a thriving tourist industry. Over recent decades this region has become threatened by lightning-ignited wildfires that have proved extremely difficult and costly to control. The causes of and appropriate responses to fire have been publicly debated and investigated, including by Senate and Tasmanian Government inquiries. This research will contribute to fire management in this region by providing new evidence to inform an enduring debate about whether skillful Aboriginal burning or soil properties caused the vegetation mosaics present in the area today. Settling this debate will deliver economic, commercial, environmental and cultural benefits by allowing us to develop new approaches to managing flammable landscapes under a rapidly changing climate, both within and beyond western Tasmania.	59,500.00	127,500.00	101,000.00	33,000.00	0.00	0.00	321,000.00
DP200103193 Dickson, Prof Tracey C	Aims: We aim to develop new cell culture platforms to form defined networks of brain cells. These platforms will be used to determine the critical mechanisms underpinning central nervous system function. Significance: The devices developed will enable an unprecedented capacity to monitor changes throughout a network, with analysis at the level of the synapse, cell and circuit. Expected outcomes: We will advance knowledge regarding the function of the CNS and deliver complex human cellular systems, that have both discovery and commercial applications. Benefit: These platforms will have subsequent application revealing the mechanisms underlying numerous neurological diseases, with capacity to upscale for rapid drug screening.	80,330.00	162,921.00	192,451.50	109,860.50	0.00	0.00	545,563.00

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	National Interest Test Statement							
	The critical importance of understanding how the brain functions is evidenced by international investment in this area of research. For example, in the US, BRAIN (Brain Research through Advancing Innovative Neurotechnologies) has been supported with $1-3 billion, while in Europe the 'Human Brain Project' is supported with $1.5 billion. This proposal falls directly within the scope of these with its focus on new platform technology to underpin fundamental molecular studies of neuronal circuits. It is in the national interest of Australia to undertake internationally leading cross-disciplinary research in this area, a position confirmed in the Academy of Science coordinated Think Tank on "Inspiring smarter brain research in Australia". Being the first to develop this new platform technology, will allow Australian researchers to be at the forefront of determining the mechanisms underlying neurodegenerative diseases, and the development of new treatments. In addition, direct financial benefit could be obtained through the technology, for example, through licensing novel microchamber designs.							
	University of Tasmania	743,703.50	1,484,954.50	1,418,828.00	712,577.00	35,000.00	0.00	4,395,063.00
	Tasmania	743,703.50	1,484,954.50	1,418,828.00	712,577.00	35,000.00	0.00	4,395,063.00

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Victoria								
Deakin University								
DP200100391 Choi, Prof Jinho	The Internet of Things (IoT) supports the connectivity of almost everything including powerless simple devices (such as radio frequency identification (RFID) tags), making it an indispensable technology for future industry and business. This project is to develop systematic and cost-effective approaches by leveraging existing cellular networks for the connectivity of simple sensors/devices using mobile data collectors (such as smart phones) so that their information becomes available to IoT applications via cellular systems. For example, products' information stored in RFID tags or power-limited sensors' data can be provided to logistic or IoT applications, respectively, without building dedicated systems via existing cellular systems.	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00
	National Interest Test Statement Direct application of outcomes: The outcomes of this research can help extend the range of Internet of Things (IoT) support to power-limited or powerless devices and sensors. This has significant implications for IoT applications as the connectivity (of cellular IoT) can be extended to simple and cheap devices with passive radio frequency identification tags. These developments will promote Australia's in-depth expertise and intellectual property in the new area of extended IoT connectivity, bring Australia's IoT technology to the world-class level, and improve Australia's life and make business efficient by enabling smart cities and smart farms. Training of highly skilled personnel: This mobile data collector based backscatter communication system project will provide research training to prepare high-calibre postgraduates and honours project students. There will be a number of research graduate engineers in the areas of communications and IoT systems, both areas of existing and worsening skills shortages that are constraining the growth of the IoT and defence industry sector in Australia.							
DP200100571 Olsson, Prof Craig A	There is widespread interest in preconception determinants of child development but progress relies on multigenerational longitudinal datasets, which are rare internationally. This project takes advantage of a unique opportunity to follow third-generation offspring from one of Australia's oldest longitudinal studies of psychosocial development. The Australian Temperament Project has followed 2000+ young Australians (and their families) since 1983, and over 1000 offspring from pregnancy to 4 years since 2012. This project will expand offspring assessments to 6-years, marking the transition to school. Findings have the potential to reshape approaches promoting intergenerational wellbeing and breaking intergenerational cycles of disadvantage.	76,719.50	155,346.50	158,216.00	79,589.00	0.00	0.00	469,871.00
	National Interest Test Statement Findings from the Australian Temperament Project (ATP) have been informing national policy around prevention of mental disorder and promoting a healthy start to life for close to 40 years. Results have been published in over 180 peer-review articles, and have played a central role in raising awareness not only of the importance of early intervention, but also the maintenance of investment at every age and stage of development from infancy to young adulthood and parenthood. ATP Generation 3 data are now mapping transitions into parenthood, highlighting the importance of the preconception period for next generation outcomes, shaping training for Vic. Maternal Child Health Nurses and establishing new Comprehensive Monitoring Systems. Findings have been consistently translated for government in collaboration with key organisations such as ARACY and the Australian Institute for Family Studies, such as reports on early risks for dangerous driving (learner driver training); pathways from antisocial behaviour (juvenile justice); links between early alcohol consumption and risky drinking patterns (drug legislation).							

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DP200100575 Macreadie, A/Prof Peter I	Blue carbon is organic carbon stored within coastal vegetated ecosystems. This project will examine the composition, formation and dynamics of blue carbon in a range of coastal ecosystems. Combining advanced analytical chemistry with environmental microbiology, we will discover how blue carbon is stabilised and destabilised, a critical factor in nature-based climate change mitigation strategies. Further, we will gain a quantitative understanding of blue carbon contributions to carbon cycling, providing enhanced modeling and prediction of climate-cycle feedbacks in response to biotic and environmental change. This research will significantly benefit Australia's effective management of coastal vegetated ecosystems for maximum carbon offsets.	109,330.50	193,915.00	170,594.50	86,010.00	0.00	0.00	559,850.00
	National Interest Test Statement Australia's coastal vegetated ecosystems (seagrass meadows, mangrove forests, tidal marshes) hold one of the world's largest stores of 'blue carbon', which has sequestration value of billions of dollars. However, coastal development and climate change have the potential to dramatically weaken the stability of our blue carbon stocks by putting ancient 'stable' carbon at risk of microbial attack. This project will develop fundamental new knowledge that will inform how coastal ecosystems should be managed; ensuring that Australia's vast reservoirs of blue carbon achieve maximum carbon offset capacity, and providing new societal and financial impetus for protection and rehabilitation of coastal vegetated ecosystems. The completed project will produce significant new knowledge in preparing for, and responding to, climate change, which requires us to be able to understand and predict the degree to which the natural process of biosequestration will help offset anthropogenic emissions. This research is timely given that blue carbon ecosystems are declining globally.							
DP200100727 Barnett, Prof Matthew R	The strength limit of a metal is marked by rapid motion of crystalline defects. The associated speeds can locally approach that of sound. To probe the associated mechanisms clearly requires both spatial and temporal resolution. We propose to create a new bulk x-ray technique with an unprecedented combination of temporal and spatial resolution. We plan to exploit the technique to mediate a step change in modelling strength based on twinning. The formation of crystalline twins is known to dictate the strength of the light metal magnesium. A fuller understanding of the effect of twinning on strength in this metal will provide much needed confidence to implement it more widely in energy saving applications.	56,309.00	117,582.50	124,511.00	63,237.50	0.00	0.00	361,640.00
	National Interest Test Statement The new insight into crystal strengthening of metals developed in this study will open up new ways to explore the mechanisms governing material behaviour under load via computation simulation and x-ray imaging. New models describing the strength of metals in terms of their microstructure and chemistry will be developed to facilitate digital design of alloys, manufacturing processes and metal components. This will bolster Australia's expertise in automobile design and advanced manufacturing. This will enhance Australia's ability to carry out leading material science.							
DP200101468 Isakhan, A/Prof Benjamin	This project aims to investigate the complexities of local-state-global dynamics in the destruction and reconstruction of Syrian and Iraqi heritage. This project expects to generate conceptual and methodological innovation via an interdisciplinary approach that involves conducting and analysing surveys, interviews and archival research. Expected outcomes include unprecedented empirical insights into how the people of Syria and Iraq perceive their heritage, and the extent to which it aligns with the attitudes of key state and global actors. This should provide significant benefits, including shaping further intellectual inquiry, as well as the policies and responses of key state and global actors to heritage issues in the Middle East.	78,970.00	129,970.00	107,500.00	102,000.00	45,500.00	0.00	463,940.00
	National Interest Test Statement This project will have a range of benefits for Australia. Firstly, Australia has made a considerable investment in Syria and Iraq, from the Iraq war of 2003, through the fight against the Islamic State, to various ongoing military, humanitarian and peace-building initiatives. This project has the potential to further the goal of a peaceful Syria and Iraq, thereby stemming the global flow of refugees, advancing the fight against terrorism and mitigating attacks on Australia and its interests. Secondly, this project will enhance Australia's relationship with its foremost ally, the US, via collaboration with its leading institutions, as well as with key Middle East states and global actors such as UNESCO. Thirdly, this project will see Australia become a world leader in the protection of heritage sites in conflict, advancing Australia's foreign policy goals of promoting democracy, human rights and nonviolence. Finally, by demonstrating a commitment to Syrian and Iraqi heritage, Australia can enhance relations with Middle Eastern minorities at home, furthering its status as a peaceful multicultural nation.							

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DP200102176 Karantzas, A/Prof Gery	The project aims to conduct: 1) a developmental test (i.e., from childhood to adulthood), and 2) a dyadic longitudinal test of an integrative model of intimate partner violence (IPV). The project is significant as it addresses 4 key IPV research limitations. These are the lack of: 1) focus on relationship dynamics; 2) longitudinal research on couples; 3) developmental tests of IPV; 4) research on same-sex couples. Expected outcomes include a comprehensive suite of assessments to effectively detect and support couples at risk of IPV and self-help resources to combat IPV. Benefits include the development of an integrative framework to identify couples most at risk of IPV and guide the development of interventions and policy to reduce IPV.	86,629.00	165,798.50	171,509.00	92,339.50	0.00	0.00	516,276.00
	National Interest Test Statement Two million Australians experience intimate partner violence (IPV). The social and health impacts of IPV in Australia are estimated at $22 billion. The potential outcomes of this project are estimated to reduce the social and economic costs of IPV by over $10 billion over a life time. The project aims to achieve this through developing and testing a much-needed integrative framework for researchers, practitioners and policy-makers to understand the factors that incite as well as inhibit IPV. This in turn, can help to assist with the screening and the effective identification of couples who are most likely to be at risk of IPV. This information can then assist counsellors, caseworkers and policy-makers within the relationships and violence sectors on how to tailor their counselling and intervention programs as well as policy to help reduce cycles of IPV.							
DP200102299 Zaslavsky, Prof Arkady	Context-awareness in Internet of Things (IoT) applications has profound impact on smartness, relevance, adaptability, dependability, performance and flexibility of such applications. This project will address the significant knowledge gap by investigating, proposing and validating a novel adaptive context caching scheme for fast near real-time access in multiple concurrent context queries coming from multiple and diverse IoT applications. The outcome will be a critical component of the IoT context management platform called Context-as-a-Service which is currently under development. The expected benefits will be far ranging and applicable to many domains including intelligent transportation, industrial internet and smart cities..	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement Internet-of-Things is a disruptive technology which will impact the way data is sensed, collected, stored, processed, reasoned about and delivered to decision support systems. Context information plays a critical role in making Internet-of-Things applications agile, intelligent, relevant, dependable and accurate. The research outcomes will benefit Australian institutions and businesses involved in developing context-aware Internet-of-Things applications and systems, making Internet-of-Things applications more effective and efficient. This research will enable better intelligent transportation systems and smarter cities, where the outcomes of the project will be validated. This project will build world-leading Australian capability in an important technology area, and place Australia on the map of international research in Internet-of-Things knowledge field.							
DP200102763 Kirksey, Dr Eben	Justice is often framed as a human problem. How other species shape just or unjust futures is rarely considered. Biodiversity loss and modernisation programs can result in unequal suffering for Indigenous communities. Health inequalities, produced by microbial diseases, also disproportionately impact marginalsed peoples in developing countries. Collaborative ethnographic research in Indonesia will enable participants to reconceptualise justice and make policy reccomendations in three arenas: 1) the environment, 2) human rights, and 3) health. New knowledge in cultural theory and multispecies studies will be generated through collaborations with distinguished international scholars and indigenous intellectuals.	27,500.00	52,000.00	59,000.00	34,500.00	0.00	0.00	173,000.00
	National Interest Test Statement Australia’s regional security is dependent on mutually beneficial relationships with nearby countries. This project will fill a gap in knowledge about public health and environmental issues in Indonesia, one of our closest neighbors and key partner nations. Indonesia has one of the world's fastest growing economies and the environmental and health impacts of this growth is poorly understood. Some of Indonesia's most vulnerable, namely Indigenous peoples, face human rights abuses and exclusion from the benefits of development projects. By working with Indonesian scholars, and by fostering relationships with Australian and Indonesian officials, this project will identify specific legislative and administrative measures that could ameliorate injustices experienced by these groups. Australians will gain a deeper understanding of the barriers to achieving justice, allowing the Commonwealth to better target its foreign policies and aid programs to resolve social, medical, and environmental problems on Australia's doorstep.							

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	Deakin University	560,458.00	1,064,612.50	1,041,330.50	582,676.00	45,500.00	0.00	3,294,577.00
La Trobe University								
DP200100013 Dutton, A/Prof Jason L	Gold offers great potential in chemical catalysis and this project will use a fascinating new class of gold compounds discovered by the CIs, to develop novel catalysts. Using this chemistry a series of gold(III) compounds with fluoride ligands will be prepared. The catalytic properties of these molecules will then be explored, with a particular focus on adding value to arene hydrocarbons. The ultimate goal of the project is development of new catalysts for the formation of carbon-fluorine bonds and the selective fluorination of organic compounds. Fluorinated organic molecules are of critical importance in medicinal chemistry and new catalysts of this type offers the potential for better synthesis of medicines and diagnostic agents.	55,000.00	120,000.00	130,000.00	65,000.00	0.00	0.00	370,000.00
	National Interest Test Statement The introduction of fluorine atoms to organic molecules is of critical importance for the synthesis of new medicines, diagnostic agents and in the fine chemical industry. Despite the importance of this chemistry, procedures for the formation of C-F bonds are limited. Especially rare is the ability to use the most economical of raw materials to accomplish this; C-H containing compounds and simple fluoride. This project will use new gold-based catalysts to enable gentle and easy formation of C-F bonds directly from C-H bonds and fluoride without the generation of any chemical waste byproducts, by replacing chemical reagents with electrochemical techniques for key steps in the syntheses. These novel techniques will have significant impact in the economical production of new and existing pharmaceutical products and other fluorinated materials.							
DP200100194 Herries, Prof Andrew I	Our archaeological excavations and preliminary dating of Amanzi Springs (South Africa) to between 515,000 and 163,000 years ago shows that the site covers a critical time period that led to the origins of our species, Homo sapiens. Amanzi documents, in never before seen resolution, the technological leaps that our ancestors made during this transition. At ~400,000 years ago this includes the oldest evidence for woodworking and tool use and >163,000 years ago the oldest heat treatment of rock to make stone tools. The organic preservation at the site means that we can reconstruct changing environment, linked to sea level changes and spring activity, for this period in the evolution of our ancestors at a level of detail not previously possible	29,000.00	91,500.00	125,000.00	112,500.00	50,000.00	0.00	408,000.00
	National Interest Test Statement The discovery and dating of the world's oldest worked wood and tools (~400,000 years old) in direct association with stone tools is a find of massive international significance. Amanzi Springs in South Africa records the highest resolution sequence ever discovered for a critical time period (>515,000 to ~163,000 years) in human evolution and documents the technological transition that accompanies the evolution of the earliest representatives of our species. Moreover, our ability to reconstruct the changing environment through this transition at the site, as well as understanding changing spring activity due to sea level change, enables us to understand how our ancestors responded to climate and landscape change, allowing us to more effectively respond to the greatest threat of the modern age. The work is relevant to every human on the planet and is critical for helping us understand and highlight the shared ancestry of all Australians, no matter their more recent origins. This work will significantly highlight and promote Australia on the intentional stage through its collaborations and media coverage							
DP200100496 Callinan, Dr Sarah	This study will investigate how price influences beverage choice in high-risk drinkers. With already collected data from countries with similar policy environments, but differing tax structures, we compare amounts and patterns of use of different beverage types that are the cheapest alcohol in each country, and how these interplay with the distribution of high risk drinking occasions on and off licensed premises. These cross-national analyses will then inform analysis of price, high risk drinking and harms in Australia. The project will provide key points of evidence to policy makers aiming to most effectively target high risk drinking in Australia.	32,605.00	70,414.50	37,809.50	0.00	0.00	0.00	140,829.00

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	National Interest Test Statement							
	Heavy drinking is a major cause of a lot of harm in Australia – increases in alcohol consumption result in corresponding increases in assaults, fatal traffic crashes and homicides in the short run, and in cancer and other chronic disease in the longer run. There is a need for policy interventions that reduce consumption among heavy drinkers. This cost-effective study, using already collected data from Australia, New Zealand, England and Scotland, will identify the drinking and purchasing patterns specific to both heavy drinkers and those drinkers whose drinking results in the most harm, pointing to how policy interventions such as taxes, minimum price requirements and limits on times and places of beverage availability can best be structured to reduce harms from alcohol. This work is particularly timely in light of recent policy moves such as the introduction of a minimum unit price (a floor price per standard drink that alcohol must be sold at) in the Northern Territory, and restrictions on opening hours in New South Wales and Queensland.							
DP200100994 Hussain, Dr Mumtaz	This project aims to develop new powerful measure theoretic techniques in mathematics that will be used in establishing some indispensable results in analytical number theory (Diophantine approximation) and dynamical systems. The plan is to construct new techniques and to use them in situations where existing techniques are not applicable. As a consequence of the proposed frameworks, not only we aim to resolve a few long-standing problems such as the Generalised Baker-Schmidt Problem (1970) but also envisage that the proposed frameworks will have far-reaching applications beyond the confines of Diophantine approximation and dynamical systems, for example, geometric measure theory, geometric probability and stochastic geometry etc.	67,500.00	135,000.00	135,000.00	67,500.00	0.00	0.00	405,000.00
	National Interest Test Statement							
	This project aims to conduct fundamental research in number theory and dynamical systems that will add to the long history of significant contributions made by Australian researchers in these fields. The project investigators have an established research partnership and it will be further strengthened through pursuing the aims of this project. The proposal will help in supporting a research assistant and train several students on cutting-edge research. Progress on the proposed problems will solidify Australia's position as a world-leader in an important field of Diophantine approximation and in providing the high-level perspective needed to make advances in more applied areas, such as mathematical physics, dynamical systems and engineering.							
DP200101781 Jiang, Dr Heng	Drinking, smoking and gambling are common lifestyle risk behaviors, which constitute critical social and health challenges for Australia. This project is the first study to examine trends in household expenditure on alcohol, tobacco, gambling, and other goods and services over the past 30 years. More importantly, this project pioneers analysis of the associations between alcohol, tobacco and gambling expenditure and housing and socioeconomic inequalities over time. The research findings will provide key insights into the changing place of these three risk behaviors in Australian society and inform future public policies to reduce problem drinking, smoking and gambling and related harms.	45,581.50	94,597.50	94,597.50	45,581.50	0.00	0.00	280,358.00
	National Interest Test Statement							
	The proposed project will inform future social and public policy to reduce problem drinking, smoking and gambling and related harms. First, the proposed project will increase understanding at how drinking, smoking and gambling behaviors and expenditure have changed in subgroups over the last 30 years. Second, the proposed project will describe how reduced expenditure on alcohol, tobacco or gambling may reduce housing and socioeconomic inequalities. Third, the potential reasons for change trends in alcohol, tobacco and gambling expenditure will be examined in relation to spending on other goods and services. Lastly, the correlations between price and expenditure share for the three risk behaviors will be measured considering the effects of other goods and services. This project provides crucial information to inform future alcohol, tobacco and gambling price/tax policies by detailing how price and demand for each risky product affects demand for the others and for other goods and services in the vulnerable subgroups and in the whole population.							

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DP200102452 Whelan, Prof James M	Biomass accumulation in plants is the balance of CO2 fixed into carbohydrates through photosynthesis and carbohydrate burned (respired), ~ 50% of fixed CO2, to fuel growth. Plants possess energy conserving and non-conserving respiratory pathways. The alternative energy non-conserving pathway appears wasteful but is necessary for plant tolerance to adverse growth conditions. Our research has achieved modification of the alternative respiratory pathway that positively impacts plant growth. We will dissect the mechanism(s) of how the alternative respiratory pathway stimulates growth, from a molecular level to whole plant physiology, answering a long-standing question of the role of the alternative respiratory pathway in plant cell biology.	72,500.00	147,500.00	145,000.00	70,000.00	0.00	0.00	435,000.00
	National Interest Test Statement Plant growth and productivity are critical for producing food (grain crops, fruit and vegetables), fibre (e.g. cotton) and fuel (e.g. biodiesel). The Australian agriculture industry generates $60 billion per annum and directly employs 300,000 people with a total of 1.6 M people employed across the entire supply chain. The National Farmers Federation (NFF) has a target to expand Australian agriculture to a $100 Billion industry by 2030. This expansion will require research to drive innovation and generate novel solutions to challenges in plant productivity. This proposal will dissect the mechanistic basis of the improved growth that we have observed in alternative oxidase over-expressing lines to understand how fine-tuning plant respiration can lead to increased plant productivity. The new knowledge can then be applied to a range of crops to breed varieties with increased productivity.							
DP200102947 Hogan, A/Prof Conor F	Chemical analysis is a vital activity in our society, which is to a large extent confined to scientific laboratories and carried out with complex instrumentation. The breakthrough technology envisioned in this proposal will pave the way for simple, low-cost tests which can be used by non-scientists. The development of small, portable sensors for applications ranging from pollution monitoring to health testing, will enable ordinary people to gain knowledge about the concentrations of molecular compounds in their environments and in themselves. This will stimulate economic and social benefits related to environmental testing and early disease diagnosis and generate new commercial opportunities for the Australian biotechnology industry.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement The novel technology developed here contains breakthrough science in the form of new knowledge, new sensing materials and and new technologies that will open up a variety of new possibilities for the field of chemical analysis and bioanalysis. This new science will stimulate economic and social benefits and produce commercial opportunities for the Australian biotechnology industry. Other key outcomes of this proposal will be to further Australia's research capabilities and increase its international profile through publication in prestigious journals, conference presentations and intellectual property and through international collaborations with world leaders in the field. In addition, this collaborative arrangement and the cross disciplinary nature of the project will produce high quality Honours and PhD graduates with excellent multi-disciplinary training and diverse skill sets, well qualified for future employment in chemical and biotechnological industries, universities and research institutions.							
DP200103269 Ellinghaus, A/Prof Katherine	Indigenous peoples have always undertaken extensive travel and movement, but colonisation brought new reasons for travel and new Indigenous peoples from New Zealand and the Pacific to Australia. Historians have not yet fully grappled with these histories. These migrations and journeys always traversed Indigenous geographies. Bringing Indigenous perspectives and ethical methodologies to an analysis of mobilities, we aim to explore hidden histories of Aboriginal, Torres Strait Islander, Maori and Pacific Islander travel to and across Australia, and engage with Indigenous communities to understand meanings associated with travel and current implications for sovereignties and identities.	67,000.00	160,000.00	178,000.00	85,000.00	0.00	0.00	490,000.00
	National Interest Test Statement This research will contribute to Australia's national interest by providing extensive cultural benefit. Stories of Indigenous mobilities to and through Australia - the movement of Aboriginal, Torres Strait Islander, Maori and Pacific Islander people - reveal the agency and resilience of those living in new circumstances. It enriches contemporary Australian culture through stories of adaptation. It strengthens Indigenous wellbeing by valorising those who became mobile. Such histories can better inform all Australians by encouraging engagement with the breadth of Australian histories, including the role of Maori and Pacific Islander travel and migration, and stories of Aboriginal and Torres Strait Islander movement for labour or education, and promote respect for and learning from Indigenous perspectives.							

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DP200103393 Anderson, Prof Marilyn A	Extracellular vesicles (EVs) are small membrane bound sacs that carry information between cells in essentially all organisms. EVs are also produced by bacterial and fungal pathogens and have a crucial role in infection in mammals . We propose that fungal EVs are key players in the establishment of fungal diseases in plants. We have isolated EVs from the cereal pathogen Fusarium graminearum which decreases yield and quality of grain in major food crops such as wheat, barley and corn. This project will focus on the cargo that EVs transport through the fungal cell wall and into the plant host and will establish the role of this cargo in disease progression. Ultimately, this knowledge will be used to design new strategies for disease control.	75,000.00	145,000.00	140,000.00	70,000.00	0.00	0.00	430,000.00
	National Interest Test Statement Fungal disease in humans and agriculture is a growing problem that is spiralling out of control due to widespread resistance to the limited number of antifungal treatments available. Crop destroying fungi account for perennial yield losses of 20% worldwide and a further 10% loss post-harvest. The goal of this project is to understand how fungal pathogens transfer molecules required for infection to their host and to use this information to identify new targets for the development of antifungal treatments. We will use the devastating plant pathogen Fusarium graminearum as a system to study the coordinated release of molecules in “virulence bags” called extracellular vesicles. F. graminearum is the causative agent of Fusarium Head Blight (FHB) which affects all major cereals. The Grains Research and Development Corporation has identified FHB as one of the top five threats to Australian wheat production. Discoveries made in F. graminearum will be transferable to other fungal pathogens, providing broad application for this work.							
	La Trobe University	509,186.50	1,094,012.00	1,115,407.00	580,581.50	50,000.00	0.00	3,349,187.00
Monash University								
DP200100002 Davis, A/Prof Mark D	This project aims to investigate the sociological dimensions of antibiotics consumption by examining the views and experiences of clinicians, decision-makers, and members of the general population. The project expects to generate new knowledge about the social aspects of antibiotics use and consumer-provider interactions. Expected outcomes of this project include stronger consumer-provider collaborations about antibiotic use and a new evidence-base to guide policy decisions. This project should provide significant benefits for the national response to antimicrobial resistance, including enhanced public education and public policy.	72,408.00	145,345.50	149,517.50	76,580.00	0.00	0.00	443,851.00
	National Interest Test Statement The consumption of antibiotics is high in Australia and is thought to contribute to antimicrobial resistance. This project addresses antibiotics use for human and animal health in Australian community settings, to better understand how consumers think and feel about antibiotics and help prescribers more ably collaborate with them. The new insights provided by this research will inform decision-making and policy about the use of antibiotics and contribute to measures to help limit antibiotic resistance in Australia.							
DP200100017 Evans, A/Prof Joanne E	This interdisciplinary research project aims to explore how records co-creation can be conceptualised in child protection and information law and overseen dynamically through a new digitally enabled, child-centred and rights-based advocacy and regulatory framework, to play an integral role in ensuring that the systems to protect children from abuse and neglect do not themselves cause harm. This project seeks to develop participatory information governance as a new theoretical foundation for proactive recordkeeping and rights advocacy for childhood out-of-home Care. Improved transparency, accountability, efficiency and access to justice are anticipated benefits from this legal, recordkeeping and information infrastructure design research.	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00

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	National Interest Test Statement							
	This research aims to contribute to ensuring that Australians with out-of-home Care experiences have their rights in childhood recordkeeping recognised, represented and enacted upon. It will deliver economic and social benefits to the Australian community through ensuring that the governance and recordkeeping systems in the child protection sector are amongst the most innovative and productive in the world. It seeks to ensure that recordkeeping in this sector not only plays its part in keeping children and young people safe, but also in developing their sense of identity, connection to family and community, and ensure access to justice and redress for institutional harm. It will also be part of defining new frameworks for the management of data and information rights that better balance the need for personal agency and control in an increasingly data driven age.							
DP200100020 Grundy, Prof John C	This project aims to address critical problems with mobile applications that exhibit human values-based defects, by advancing our understanding, detection and fixing of such defects. Many mobile apps do not operate according to the essential values of their human users - e.g. inclusivity, accessibility, privacy, ethical behaviour, due care, emotions, etc - making them ineffective, underused, unfit for purpose or even dangerous. Expected outcomes include new theories, techniques and prototype tools for developers and end users to detect and help fix values-based defects in mobile apps. Benefits include better, safer mobile apps for people and organisations and improved app developer productivity and competitiveness.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement							
	Australians and Australian businesses are now critically dependent on mobile apps for transport, health, education, business management, social interaction and leisure applications. However, the effectiveness and safety of many current apps is compromised because they do not adequately take into account diverse users' human values. The expected outcomes from our project would empower developers, organisations and end users alike. Australian software development companies will benefit from the increased productivity of their developers in finding and correcting complex, values-oriented mobile app defects, resulting in cost savings, enhanced competitiveness and enhanced reputation. Australian companies will be able to deploy better mobile apps that better suit their needs and those of their staff and customers, resulting in enhanced productivity, cost savings, and reputation. Australian and international end users of these enhanced mobile apps will benefit from less frustrating, annoying, confusing and dangerous mobile apps, with better support for achieving their needs from these improved apps.							
DP200100025 Stuckey, Prof Peter S	Automation is a transformative technology for logistics -- using robots to manipulate inventory allows warehouses to be more efficient, and larger-scale, than ever before. But doing this in practice requires efficient, reliable methods for coordinating ever-larger fleets of robots. These problems are extremely difficult, and current approaches either scale poorly or give weak or no guarantees on solution quality. The project will develop transformative approaches to multi-agent pathfinding which can handle industrial size problems, and handle all of the complications that arise in practical applications. This will deliver improved cost-effectiveness and productivity to automated warehouse logistics and other agent coordination problems.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement							
	Leading retailer Amazon generates over 200 billion USD in revenue annually and its business is powered by advanced logistics and automation. In order for Australian businesses to be globally competitive, it is essential that they too have access to this transformative technology. At the heart of Amazon distribution centres are thousands of robots moving billions of items to be shipped. This creates a massive coordination problem that current techniques, including those used by Amazon, do not solve well. By developing fast, robust methods for solving coordination problems which can both scale reliably to large fleets, and account for physical constraints, this project will serve as a key enabler for improving efficiency in warehouse logistics. By focusing on flexible approaches, the project will also provide benefits in other areas where large-scale coordination problems arise, such as evacuation planning, search and rescue, and traffic control. This project will help position Australia as a leader in automation and develop exportable technology for a growing global industry.							

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DP200100036 Meyer, Prof Dr Bernd	This Project aims to investigate how evolution has shaped the self-organisation of robust communication networks that emerge in large animal collectives from the actions of individuals following only simple, local rules. It expects to generate new knowledge into the fundamental principles guiding the self-organisation of networks that can sustain a complex society. Empirical work with ant colonies will inform the construction of simulation models to push the investigation beyond experimental limits. The Project should significantly advance our understanding of how communication networks enable the development of large societies, and thus of how to better manage autonomous man-made networks, most importantly the Internet-of-Things. **National Interest Test Statement** We are at the onset of a worldwide paradigm shift that puts communication networks centre-stage in collective behaviour research. To keep Australia's world-class research community in collective behaviour at the forefront we must build expertise and capacity in network-based approaches, as this project does. The project's connections to international centres of excellence will bring cutting-edge knowledge and capabilities to Australia and further strengthen Australia’s international standing. We expect derived economic benefits. By 2020, the Internet-of-Things is predicted to connect 35 billion autonomous sensors, actuators, and devices across the globe, constituting > $400 billion economic value. Managing the growth of the IoT and its relatives, such as next-generation smart power grids, is essential for productivity and sustainability. Understanding how evolution has shaped autonomously growing networks for effective function will give us the basis to better manage man-made networks towards a productive future. At this vast scale, even small improvements will constitute a significant economic benefit.	97,612.50	192,288.50	200,830.50	106,154.50	0.00	0.00	596,886.00
DP200100040 Nicholson, Prof Ann E	This project aims to improve human causal and probabilistic reasoning about complex systems by taking a user-centric, multimodal, interactive approach. The project will explore new integrated visual and verbal ways of explaining a causal probabilistic model and its reasoning, to reduce known human reasoning difficulties, and investigate how to reduce cognitive load by prioritising the most useful user- and context-specific information. Expected outcomes include novel AI methods that empower users to drive the reasoning process and strengthen trust in the system’s reasoning. Performance will be assessed in medical and legal domains, with significant potential benefits to end users from better, more transparent reasoning and decision making. **National Interest Test Statement** Reasoning and decision making under uncertainty is an essential challenge in medicine, the law, and many other key domains. The best AI systems for helping humans meet this challenge are causal Bayesian networks, which can accurately model complex probabilistic systems. However, because people are notoriously deficient in probabilistic reasoning, they find hard to understand and trust these models and their reasoning. This project will explore new integrated visual and verbal ways of explaining these models and their reasoning, to reduce known human reasoning difficulties and fallacies. It will also investigate how to reduce human cognitive load by prioritising the most useful information for the user. Expected outcomes include novel AI enhancements that empower users to drive the reasoning process and strengthen trust in the system’s reasoning. The project will apply and evaluate these methods in two areas: medical and legal reasoning, where better and more transparent reasoning and decision making improve outcomes for end users, providing significant potential health, social and economic benefits.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
DP200100096 Hong, Dr Yi	Future wireless networks will support huge amounts of mobile data traffic and numbers of terminals. To provide satisfactory service to emerging mass transportation systems such as self-driving cars, high-speed trains, and drones, it will be critical to incorporate the ability for wireless networks to function in high-mobility environments. The project aims to devise novel modulation techniques to support high-mobility communications with superior performance. The theoretical advances will be demonstrated using software-defined radios. These outcomes will provide fundamental scientific basis for deployment of future air interfaces. The project will benefit Australia in gaining a leading position in global telecommunications development.	79,000.00	160,500.00	164,500.00	83,000.00	0.00	0.00	487,000.00

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	National Interest Test Statement							
	A vastly growing demand for mobile services in ground vehicles, subways, highways, and high-speed trains with a speed up to 500 km/h raises extreme challenges to 5G networks and beyond. We will develop novel modulation techniques with strong emphasis on interactions between theoretical advances and practical implementation. The outcomes will go beyond current modulation limitations to open up new opportunities for Australian industrial innovation in high-mobility wireless communication networks. Our innovations will present valuable opportunities to provide Australian young researchers with world-class training in bridging the gap between theory and practice in the area of physical layer technologies supporting high mobility wireless communications.							
DP200100105 Rendall, Dr Michelle	The project aims to study the skill composition of the Australian workforce. Changes in the macroeconomic and technology environments make it hard to predict skill shortage. The project expects to develop macroeconomic models quantifying skill-mismatch of university graduates, identify sources of mismatch, highlight gender and generational differences, and estimate associated costs to Australia. The expected outcomes are to help shape policy recommendations on the funding of tertiary education in a changing economic climate. This should provide significant benefits to Australians, as policies shaping the tertiary education system affect individual income and the aggregate economy by determining labour supply and taxpayers' financial burden.	19,761.50	43,337.50	48,416.00	24,840.00	0.00	0.00	136,355.00
	National Interest Test Statement							
	Fostering a workforce with relevant skills is crucial for economic growth and welfare. The project will make use of the newly available ATO Longitudinal Information Files administrative tax data released in 2018 by the Australian Taxation Office and the Higher Education Loan Program module from the Department of Education to better understand the skill formation of the Australian economy. In addition, focusing on gender differences should help reduce gender workplace inequality and a disproportionate gender employment gap in Science, Technology, Engineering and Mathematics occupations as highlighted by the Workplace Gender Equality Agency in their Higher Education Enrolments and Graduate Labour Market Statistics Report. The project outcome should enable Australian policy makers to design educational policies that will benefit the aggregate economy as well as both men and women while not place undue burden on taxpayers.							
DP200100179 Wong, Dr Yan T	The project aims to answer how billions of cells in the brain can work together to allow us to perceive the world. By using novel electrophysiological and engineering techniques, the project tests if a brain signal called the local field potential provides a way for different areas in the brain to communicate. The hypothesis is that the local field potential is used by cells to synchronise their activity to be most effective. This project would be a paradigm shift in how we currently understand how the brain works. Expected outcomes include answering long held questions about how we see and perceive the world. This should provide significant benefit to fields such as computer vision and the development of neural engineering devices.	69,500.00	141,000.00	143,000.00	71,500.00	0.00	0.00	425,000.00
	National Interest Test Statement							
	This research continues Australia’s tradition of being at the forefront of discoveries of the brain. Advances in our understanding of how the brain works will drive and inspire research in artificial intelligence computer technologies that will revolutionise how society interacts with machines. By providing a basis for how the human brain can perform tasks such as recognising a face in the blink of an eye, we will be able to replicate this in computer technology to allow computers to begin to make more complex and humanistic decisions. Furthermore, understanding how brain areas communicate has the potential to revolutionise neural prosthetics. This knowledge can form the basis of new brain-computer interface technologies, including "intelligent" artificial arms. This will have great economic impact in manufacturing and IT in Australia if we can be at the forefront of these technologies. In the long-term a greater understanding of the brain will allow us to uncover what makes us uniquely human and provide insights into questions such as how consciousness arises.							

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DP200100189 Andrejevic, Prof Mark B	This project would explore public attitudes toward the use of facial recognition technology in public and commercial spaces, schools, and workplaces with a national survey, focus group interviews, and four case studies. The project aims to generate new knowledge about public attitudes through a multi-method interdisciplinary approach that anticipates the future of the technology by studying its use in China. Expected outcomes include public reports on the survey and case studies, seven academic journal articles, and a book. The research would provide significant benefits by contributing new knowledge about how to implement the technology in accordance with Australian commitments to civil rights, ethics and democratic values.	49,105.00	97,545.00	73,440.00	55,000.00	30,000.00	0.00	305,090.00
	National Interest Test Statement Facial recognition technology will dramatically transform the way Australians experience public and commercial space by making it possible to uniquely identify and track individuals as they go about their daily lives. The technology promises significant benefits for national security, policing, and commerce. Realizing these benefits will entail ensuring that Australians understand and are comfortable with the emerging uses of the technology and the privacy issues it raises. This study would provide pioneering research on the future of facial recognition technology and the potential issues and concerns it raises for the public. The effective use of automated facial recognition as a technology for security and commerce requires both an understanding of public response to its use and an evidence-based conceptual approach to assessing its social impact. The proposed research would achieve both of these goals, placing Australia at the forefront of research into a technology that will soon integrate itself into everyday interactions and transactions.							
DP200100225 Bowman, Prof John L	This project aims to identify the extent of overlap between the genetic determinants of the gametophyte and sporophyte shoot meristems. The project expects to generate new knowledge of the evolution and development of land plants by applying comparative genomics and new technologies to a novel model genetic system. Expected outcomes include an elucidation of the genetic basis for one of the key morphological adaptations for life on land. The ability to manipulate the growth and development of plants via the activity of meristems based on fundamental principles has broad agricultural implications.	90,000.00	180,000.00	180,000.00	90,000.00	0.00	0.00	540,000.00
	National Interest Test Statement Nearly all of our food is ultimately derived from land plants and humans have long managed plant growth in cultivated crops. Land plant growth is mediated by meristems, groups of cells that produce new organs at the tips of shoots and roots. This project will generate new understanding of the fundamental principles by which land plant meristems operate, providing knowledge that can be applied to manipulate plant growth from fundamental principles. The application of knowledge gained has the potential to enhance targeted selection of new forms of crops for increased biomass, better drought resistance and regulated fruit and seed development, and will inspire the next generation of agricultural innovators.							
DP200100231 Davis, Prof Thomas P	This project aims to develop innovative scalable synthesis techniques to produce polymeric nanomaterials with controlled properties and characterise interactions between nanomaterials and cells under flow conditions. This project expects to generate new knowledge in priority research areas of nanotechnology, polymer chemistry and immunology. The outcome of this project is an original scalable and environmentally friendly technology, new knowledge of cell-nanomaterial interactions and new design principles for nanoparticles with potential future applications in drug delivery, immunology and nanomedicine. This project should provide significant benefits to polymer, nanomaterial and pharmaceutical research and industry in Australia.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
	National Interest Test Statement The innovative manufacturing techniques developed in this project is friendly to both industrial manufacturing (large scale) and the environment (this technique does not employ organic solvents that are harmful to the environment). Therefore, the development of this technique will benefit not only the Australian economy (polymer and nanomaterial industry) but also its environment. The knowledge of nano-bio interaction obtained in Aim 2 will be useful not only to the international research community in nanobiotechnology but also to the public understanding of nanomaterial toxicity in the vascular network, which will benefit the Australian society. The outcome of Aim 3 will potentially lead to the future development of novel drug delivery nanocarriers for cancers and cardiovascular diseases that will be beneficial for Australian health and economy.							

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DP200100234 Coxon, Dr James P	This project aims to examine how genetic variation in humans affects the capacity of exercise to augment neural plasticity and learning. This project expects to generate new knowledge through an innovative approach combining genetics, exercise physiology, and cognitive neuroscience. It is expected the outcomes will have implications for human learning, workplace productivity, and training protocols for rehabilitation and sport. Exercise is a cheap way to enhance neural plasticity and improve behavioural performance, which is of benefit to employers, our economy, and individuals. A possible future application of this research could be the personalised prescription of exercise for brain health based on an individual's genetics.	79,845.50	194,816.50	191,904.50	76,933.50	0.00	0.00	543,500.00
	National Interest Test Statement Exercise is essential for a healthy and productive life. Today there are 11 million Australian adults (70%) who do not meet physical activity guidelines and who should be moving more in their daily life. Lack of exercise may affect an individual's ability to learn new procedures, be productive, and may have long-term consequences for how well their brain functions as they age. This physical inactivity problem has led to substantial economic burden, costing the Australian economy billions of dollars lost due to reduced productivity of employees at work. This project will generate new knowledge as to how exercise affects the brain, and determine the type and timing of exercise required to improve cognition. These findings will have implications for Australian workplace productivity, training protocols in in the workplace, rehabilitation, and sport, and will be relevant for the articulation of public health messages aimed at the prevention of cognitive-motor decline in the ageing Australian population.							
DP200100256 Thomson, Prof Robert	This project aims to advance knowledge of how internationalisation affects the quality of democratic representation in established democracies such as Australia, the US and the UK. It expects to generate new insights into how internationalisation expands or limits the scope for democratic accountability, responsiveness and responsibility. It plans to develop and test new theories with comparative analyses that focus on economic, social and environmental policies. Expected outcomes include improved measures of internationalisation, and insights into the opportunities and challenges it poses for democratic representation. The project should provide significant benefits by countering misconceptions in current academic and public debates.	40,299.00	72,771.00	56,032.00	23,560.00	0.00	0.00	192,662.00
	National Interest Test Statement The research is of immediate relevance to Australia as an established democracy that is deeply engaged in international cooperation. It will provide new evidence to inform current debates on how political and economic internationalisation affects the quality of democracy. This debate is polarised in Australia, as it is in other established democracies. This is illustrated by competing claims regarding Australia's international climate commitments and regarding foreign direct investment from China. The research includes analyses of how democracies' cooperation with non-democracies affects the quality of representation in those democracies. This is highly relevant to Australia given the importance of its relationships with non-democracies in the region. The research examines democratic performance in terms of accountability, responsiveness and responsibility. It includes performance with respect to economic, social and environmental welfare. The research takes a comparative perspective that examines these processes in Australia and its key international partners, including the US and the UK.							
DP200100324 Lane, Dr Ruth	Australia is experiencing an urban waste crisis. Long-term solutions require new strategies to reduce waste generation. To be effective, these will need to engage and actively involve households. This project examines the capacity for experimentation and innovation in households necessary to transition to low waste cities. It integrates studies of demographic profiles of household waste generation, household low waste experiments and policy rationales and co-design to propose realistic pathways for decreasing waste generation. The research outcomes are critical for understanding and supporting pathways to low waste cities. The knowledge developed will support urban sustainability transitions in Australia and internationally.	61,237.00	143,530.00	108,623.50	26,330.50	0.00	0.00	339,721.00

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	National Interest Test Statement							
	Australia is facing a waste crisis and transitioning to low-waste cities is now imperative. This project provides the knowledge to achieve societal and policy transition with national environmental and social benefits. The findings will support the development of “resilient urban, rural and regional infrastructure (Science and Research Priority 8.2) by developing new practical pathways for household waste reduction and recycling, and “options for responding and adapting to the impacts of environmental change on biological systems, urban and rural communities and industry” (8.3). The project addresses the critical practical research challenges of “Consumption Patterns, Population Issues and the Environment” (PRC 960702) by mapping waste profiles, assessing household innovation capacities and working with key stakeholders to enhance “Environmental Policy, Legislation and Standards”, 960799 and “Waste Management Services” 900401. Through international collaboration and networking it will generate new understanding of the role of households and potential for household innovation in sustainability transitions.							
DP200100347 Lazarou, Dr Michael	This project aims to investigate how autophagosomes are built during autophagy by using advanced multi-modal imaging and unique gene-edited human cell lines. This project expects to generate new knowledge on how a family of evolutionary conserved proteins regulate autophagosome formation during starvation and stress conditions. Expected outcomes include the development of frontier imaging technologies that can be subsequently utilised for the advancement of any field of cell biology. This should provide significant benefits by placing Australia at the forefront of cell biology technologies and increasing our understanding of how plant and human cells can protect themselves during starvation and stress.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
	National Interest Test Statement							
	Autophagy is a garbage disposal pathway used by cells to recycle material for energy during starvation, or to remove damaged cellular components and invading bacteria. It is therefore a fundamental pathway for life. Autophagy plays important roles in both plants and animals; autophagy protects cattle against salmonellosis which is a type of bacterial infection. Pacific oysters use autophagy to defend against infection by Vibrio aestuarianus, a bacterium that was responsible for economically significant mortality outbreaks in Australia's aquaculture industry in 2010. Autophagy in wheat and barley crops determines their yield, drought resistance, and responses to environmental stress. This application will utilise gene editing and advanced imaging technologies to understand how autophagy is regulated in human cells. Given the evolutionary conservation of autophagy, this project will also increase our understanding of how plants and animals protect themselves during starvation and stress, thereby having a positive impact on the environment and economy.							
DP200100475 Johnston, Dr Angus P	Nanotechnology has the potential to transform the way we treat many diseases. This project will investigate a new type of nanoparticle, the caveosphere, and tests its effectiveness as a peptide delivery system. Caveospheres can protect delicate cargo from degradation, target cargo to specific cells that induce the maximum therapeutic response, and can be synthesised in large-scale, cost-effective batch fermentation. This study will: 1: Engineer biological function into caveospheres 2: Investigate the cellular behavior of the engineered caveospheres 3: Determine the therapeutic activity of caveospheres in vitro It will develop a fundamental understanding of nanoparticles trafficking in cells, to make improved nanoparticle delivery systems.	82,500.00	166,500.00	170,500.00	86,500.00	0.00	0.00	506,000.00
	National Interest Test Statement							
	Caveospheres are a sophisticated, yet easy to synthesise delivery system that has the potential to revolutionise the way therapeutic peptides are delivered. This proposal will engineer nanoparticles to improve the delivery of peptides and proteins to cells. It will provide fundamental insights into how nanoparticles can be engineered to control the delivery of peptides and will expand Australia’s knowledge base in nanotechnology through the training of interdisciplinary researchers. The project will develop intellectual property that will benefit the emerging Biotec and MedTec industries in Australia and provide significant economic, commercial and healthcare impact.							
DP200100500 Wang, Prof Huanting	This project aims to develop multifunctional composite electrodes for electrochemical synthesis of ammonia from water, nitrogen gas and renewable energy under ambient conditions. Hydrophobic subnanometre water channels will be integrated with an electrocatalyst to control supply of water as vapour, thereby effectively minimising hydrogen evolution reaction and enabling high-efficiency ammonia synthesis. Expected outcomes include enhanced capacity in developing electrochemical reaction systems, and new fundamental knowledge of electrocatalyst design and reaction engineering. This should provide significant economic and environmental benefits by developing a sustainable manufacturing technology to transform the century-old ammonia industry.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00

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	National Interest Test Statement							
	Ammonia is crucial for agricultural industry as a key fertiliser feedstock. Australia has one of the largest ammonia plants in the world. The current ammonia synthesis using a century-old technology is energy-intensive and emits vast amounts of carbon dioxide. This project aims to develop a sustainable ammonia synthesis technology by replacing fossil fuels used in current ammonia production with only water, nitrogen gas (from air) and renewable energy. This project expects to place Australia at the forefront of research in advanced catalysis and renewable energy utilisation. The project has the potential to bring important economic and environmental benefits by transforming existing ammonia industry and reducing its carbon footprint. In addition, ammonia has also been considered as a promising energy carrier to store renewable solar and wind energy and to power fuel cell vehicles. Clean production of ammonia will create a unique opportunity for Australian energy and manufacturing industries.							
DP200100524 Millie, A/Prof Julian P	This project aims to investigate state support for Islamic practices in two large, Muslim-majority nation states, Turkey and Indonesia. In these countries, massively-funded bureaucracies allocate state resources for pious practices that until recently were considered outside the national interest. Combining the skills of anthropologists of Islam as well as a public economist, this project will ask which Muslim actors and practices receive and are denied these budgetary allocations. An outcome of the project will be to establish the role in governance of these compacts between Muslims and governments. The benefit is to gauge the prospects for moderate Islam in the two countries that are known as the foremost incubators of progressive Islam.	18,000.00	59,000.00	62,507.50	21,507.50	0.00	0.00	161,015.00
	National Interest Test Statement							
	The project will contribute to Australia's and the international community's capacity to understand, interpret and engage with its regional and global environment through a greater understanding of Islamic practice and politics. The project's researchers are experts in the study of Turkish and Indonesian Islam, and are fluent speakers of the languages of these countries. By using these skills and the research tools proposed here, the project's researchers will provide more accurate, up to date knowledge on the relationships between the state and Muslims in both countries. Understanding how the organs of state manage religion and state-civil society relationships in the regions of Southeast Asia and the Middle East is of direct relevance to Australia's capacity to engage with the cultures and societies with which it has close relations. The outcomes of the project will provide much needed knowledge on Islamic public spheres in Turkey and Indonesia, whose current importance as models for liberal Islam is increasingly important.							
DP200100624 Cheng, Prof Wenlong	Conventional plasmonic sensors and devices are rigid, planar, and not stretchable. This project aims to apply plasmene materials developed at Monash's Nanobionics lab to design highly stretchable plasmonic devices (artificial plasmonic skins). Systematic experimental and theoretical studies will be undertaken to understand how the plasmonic skins respond to strains and how they can be used for fabricating novel stretchable devices. Such studies will generate important new knowledge of fabrication, characterisation, and modelling of stretchable plasmene, hence, contributing to further Australian standing in the field of nanotechnology and plasmonics. It may also incubate patentable technologies, bringing potential economic gains.	80,000.00	155,000.00	150,000.00	75,000.00	0.00	0.00	460,000.00
	National Interest Test Statement							
	As Australian traditional industries such as Automobile phase out and mining boom stops, we urgently call for creating new innovative industries to be competitive globally. The proposed soft plasmonics project sits at the cutting-edge of nanotechnology research, contributing to positioning Australia at the forefront of soft sensor space. It can potentially incubate new industrial opportunities, contributing to future industrial growth in wearable electronics, healthcare, automation and artificial intelligence. This project may help elevate innovation levels of current high-tech industries to remain competitive to sustain future Australian economy growth. In the long-run, it will bring economic gains to Australian and create new jobs.							

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DP200100642 Selomulya, Prof Cordelia	The Australian dairy industry plays a significant part in the nation's economy, with almost $3 billion in export revenue in 2016-2017. Powdered dairy products extend shelf life and ease of transport, with >20% annual growth in premium products, such as milk protein concentrates and infant formula powders. This project aims to support the development of value-added dairy powders by investigating the impact of a novel high pressure processing technology in enhancing the properties of dairy powders and/or introducing new functionality. Successful outcomes will help expand the offering of high value dairy ingredients and thus increase the global competitiveness of Australian dairy manufacturing.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
	National Interest Test Statement The proposed project meets the Science and Research Priority of enhancing food production, and will address the practical challenges faced by Australian dairy manufacturers in dealing with new formulations, optimising spray drying operations, and investigating the potential application of a new technology in high pressure jet processing to enhance the properties of dairy powders. Australian dairy manufacturers have an unprecedented opportunity to target the premium Asian market with value-added offerings. The Chinese market presents a significant opportunity, with the demand for infant formula alone expected to grow by 10–12% by 2020. Sports nutrition is another burgeoning area, with the global market estimate at US$17.5 billions by 2021. The main dairy ingredients used in sports nutrition are whey and milk proteins, with protein powders being the largest product category. The proposed project will contribute to the knowledge required to develop new dairy powders with enhanced functionality (including shelf stability and better protection of active ingredients) crucial for the export market.							
DP200100658 Arunachalam, A/Prof Dharmalingam	This project aims to investigate the prevalence, experience and variations of ethnic and religious mixed marriage in Australia, which will guide policies that facilitate social integration and cohesion. The implications of a lack of integration have been demonstrated by recent events in Europe and US, which reflect strong anti-immigration tendencies. This project expects to generate new sociological knowledge of ethnic/religious mixed-marriage, new understanding in social integration and enhanced research capacity in the area of migration and integration. This research should provide significant benefits, such as enhanced cultural understanding and appropriate policies that foster social integration of cultural groups.	66,966.00	129,394.00	106,597.00	44,169.00	0.00	0.00	347,126.00
	National Interest Test Statement Successful integration of ethnic and religious minorities is a challenge encountered by governments around the world. Yet, policies are either unproven or have been shown to be ineffective. If Australia does not develop appropriate evidence-based policies and programs, we are likely to encounter growing incidences of inter-group violence, stigmatisation and weakening of social cohesion. This project's focus on cultural and religious boundaries will provide key insights into social cohesion, thus informing governments' need to manage diversity and maintain cohesive societies, expanding the field of family and cultural sociology. Specifically, this project will generate new sociological knowledge and advance much-needed understanding of the processes and factors relevant to social integration in Australia. The findings will be communicated to State and Local Government, as well as community stakeholders to inform policies, events and activities that promote social integration and cohesion.							
DP200100659 O'Bryan, Prof Moira K	This project aims to investigate the function of cysteine rich secretory protein (CRISP) family members in fertility. It is expected to generate new knowledge on the role CRISP1 and 4 play in sperm competition in vivo, and thus, evolutionary processes; to define the role seminal plasma CRISPs play in fertility; and identify the mechanism underpinning their biological activities. This will be achieved using a range of innovative, state-of-the-art approaches. Expected outcomes and benefits include an enhanced knowledge of the mechanisms underpinning fertility and infertility, enhanced collaboration and research knowhow, and an evidence base for future applied projects aimed enhancing fertility in agricultural species.	115,374.00	220,411.00	209,715.50	104,678.50	0.00	0.00	650,179.00

* Note - Indicative funding for approved projects will be made available through a funding variation under section 54 of the ARC Act

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	National Interest Test Statement							
	This project will make multiple significant contributions to the future prosperity and standing of Australia. It will add to our knowledge of the processes of male fertility and, by extension, consolidate Australia's already excellent standing in reproductive biology. It will enhance intra-country and international collaborations, and in doing so, enhance the impact of precious ARC funding. It will generate a knowledge base for applied research wherein these proteins may be used to enhance sperm function and stability in assisted reproductive technologies, including the artificial insemination of agricultural species. It will provide a mechanistic understanding of a body of agricultural observations – and thus, a means to optimise breeding strategies to improve fertility. This project will also provide an outstanding, industry relevant, training and mentoring opportunity for at least one post-doctoral fellow and one PhD student.							
DP200100704 Hourigan, Prof Kerry	This project aims to investigate the mechanisms affecting the rolling motions of spheres and cylinders. This international project expects to generate new knowledge of the effect of surface roughness, cavitation and compressibility using novel experimental and computational methods. Expected outcomes of this project include the discovery of the explicit role of surface roughness in allowing bodies to roll, the means of modifying these motions, the wake mechanisms leading to body vibration, and the mixing induced by rolling bodies. This will provide significant benefits to the understanding of the motion of particles and bodies in a range of situations such as particle reactors and sedimentation processes.	45,000.00	90,000.00	90,000.00	45,000.00	0.00	0.00	270,000.00
	National Interest Test Statement							
	The motion of particles near walls occurs in a range of industrial and environmental processes, such as particle reactors and sedimentation. Central to this understanding is finding out precisely what determines how fast a particle will roll on a wall, what vibrations can occur, and the amount of mixing induced by the particle's wake. This study has the potential to improve the control of such particle interactions and improve the performance and efficiency of these processes in Australian industry.							
DP200100709 Smith, A/Prof Craig A	This project aims to enhance our understanding of gonadal sex determination (testis versus ovary development), using innovative genetic approaches that exploit the avian embryo as a model system. The project aims to define the key molecular events regulating gonadal sex determination in birds. It intends to enhance knowledge in the area of cell biology, embryology, and sex determination specifically. Importantly, it will have application to the poultry industry. Currently, half of all hatchlings (the undesired sex) are culled. The proposed project intends to illuminate those genetic pathways that can be targeted to produce single-sex lines of birds, a major goal of the multi-billion dollar Australian and global poultry industries.	90,000.00	185,000.00	179,000.00	84,000.00	0.00	0.00	538,000.00
	National Interest Test Statement							
	This project will contribute to Australia's national interest in three areas: (1) Enhancing knowledge of basic cell biology and organ development. It will yield new information that has the potential to be used in the areas of biology such as stem cell research,tissue engineering and regeneration. (2) Enhancing economic and commercial effciency, by reducing costs for the poultry industry, and providing societal benefits in the area of animal welfare. The multi-million dollar poultry industry currently seeks methods of manipulating sex. At present, half of all chicken hatchlings are culled (only are females needed by the egg industry, for example). This is a major economic and animal welfare issue. The project will identify genetic mechanisms that can be targeted to alter sex determination in chickens, to ultimately produce single sex lines of birds. The work will addresses a strategic objective; managing food assets. The work will potentially be patentable, an economic gain for Australia. (3) Training highly skilled scientists, upon our research capacity, future discoveries, and prosperity are based.							
DP200100731 Viterbo, Prof Emanuele	The project aims to investigate the application of error-control coding theory in blockchains, focusing on reducing the storage, computation, and communication overheads, as well as increasing the throughput of blockchain networks. The ambition is to develop coding theory in a completely new territory: decentralised, untrusted, and peer-to-peer networks. The intended outcome is to greatly extend the current state of the art of the theory of error-control codes, previously investigated only in the context of centralised architectures, where a server coordinates every task. Practically, the project should provide significant benefits in terms of cost-effectiveness of blockchains, increase in their processing speed, and security enhancement.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00

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	National Interest Test Statement							
	Since the introduction of Bitcoin in 2008, the blockchain technology has generated a tremendous amount of interest not only from the industry and the research community but also from governments. The technology has a potential to transform various industry sectors, including financial services, logistics, healthcare, energy distribution, IoT, and government services, such as registries and identity, grants and social security, quota management, and taxation (source CSIRO's Data61). Last year, the Australian government signed a landmark AUD $1 billion deal with IBM to accelerate the applications of blockchain, across different agencies of the government. CSIRO's Data61 has also formed a consortium to build Australian National Blockchain, the country's first cross-industry, large-scale, digital platform to enable Australian businesses to collaborate using blockchain-based smart legal contracts. Our innovations will provide solutions to the blockchain limitations in scalability and cost efficiency, and give Australian young researchers world-class training, bridging the gap between theory and practice.							
DP200100757 Razi, Dr Adeel	This project aims to understand dynamics of how several brain regions work together to process information. This project will generate new knowledge in brain sciences by using state of the art computational modelling and neuroimaging methods like functional and diffusion magnetic resonance imaging and electromagnetic measurements. This project will develop technologies to compute multiscale, multimodal and directed connectivity in the brain. Expected outcomes of this project will enhance our understanding of the brain's functional organization and dynamics. The benefits of this project will include breakthroughs in development of new neuro-technologies like brain-machine interfaces and neuroscience inspired artificial intelligence.	78,284.50	158,766.50	167,154.00	86,672.00	0.00	0.00	490,877.00
	National Interest Test Statement							
	Despite Australia's neuroimaging being recognised as world class there is a relative paucity of computational neuroscience research relative to the experimental neuroscience. This project will bring the Australian neuroimaging research to the forefront of the rapidly developing computationally extensive approaches to understand brain mechanisms. We propose that this project will substantially add to understand how various brain regions work together by providing a mechanistic approach to study brain's functional integration. This will result in breakthroughs in neuroscience inspired artificial intelligence and development of new technologies like cognitive robots. This project will further Australia's leadership in brain inspired data science by tackling fundamental knowledge gaps in our understanding of dynamic information processing in the brain.							
DP200100796 Scanlon, Prof Martin J	We will develop new synthetic strategies to support the development of small molecule chemical probes that bind with high affinity and specificity to a target protein. Such chemical probes are invaluable in elucidating the role of specific proteins in biological pathways. Our novel strategy aims to be rapid, efficient in its use of materials and widely applicable to a range of different protein targets. The core of our approach involves using biophysical binding assays to characterise compounds that are produced on small scale using parallel chemistry. This approach will enable better chemical probes to be developed more rapidly at lower cost than is currently possible.	125,000.00	235,000.00	210,000.00	100,000.00	0.00	0.00	670,000.00
	National Interest Test Statement							
	The current project will develop new synthetic strategies for the development of potent and specific small molecules that act as probes of biological activity. This will provide opportunities to better understand the mechanism of biological processes. In the search for useful chemical probes of biological function, it is often relatively straightforward to identify small molecules that bind weakly to a target of interest. Such molecules typically have low affinity for the target, do not bind with enough selectivity to be useful as chemical probes and are of little intrinsic value. The current project will provide a systematic approach to the translation of such low affinity compounds into potent, selective and highly valuable chemical probes of biological activity.							
DP200100830 Wickes, A/Prof Rebecca W	This project aims to identify the temporal and spatial elements that influence the crime prevention actions of private citizens. Taking an interdisciplinary approach and applying a cutting edge methodology, it will be the first study to consider the capacity and availability of capable guardians and their intersection with the environmental contexts they frequent. The project intends to generate new knowledge on the resources needed to ensure individuals can effectively respond to problems when and where they occur. Given the enormous costs of crime to society, the expected outcomes of this project will lead to the development of economically efficient and practical community crime prevention programs that benefit the wider community.	57,305.50	140,355.50	125,547.50	42,497.50	0.00	0.00	365,706.00

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	National Interest Test Statement							
	Crime prevention is a key priority for government and local communities. Successful community based crime prevention interventions depend on private citizens to effectively respond to crime and disorder in ways that benefit the broader community. Yet research on the factors that influence the crime prevention actions of the ordinary citizen is limited and studies have not considered how the dynamics of time and place encourage individuals' responses to crime. Using advanced methodologies, this project aims to identify the spatial and temporal influences of crime prevention actions for ordinary citizens. It is anticipated the findings from this research will provide an evidence base for the development of citizen focussed crime prevention strategies that reduce crime, enhance public safety and strengthen community cohesion. It is expected that this research will benefit a range of government and non-government actors concerned with developing best practice solutions to crime prevention and the creation of safe and inclusive communities.							
DP200100892 Dowling, A/Prof Damian K	This project aims to determine the frequency and mechanisms by which male-harming mutations (those with negative effects limited to males) accrue within the mitochondrial DNA. Theory predicts maternal inheritance of mitochondrial DNA will lead to accumulation of these mutations, but the real-world implications of this theory are unknown. Leveraging an innovative approach, this project expects to generate new knowledge into the causes of sex differences in physiology and health. Expected outcomes include insights that advance understanding of fundamental biological processes, and training of students. Expected benefits include strengthening of Australia's research capacity, by setting the research agenda in this rapidly developing field.	65,500.00	152,500.00	153,000.00	66,000.00	0.00	0.00	437,000.00
	National Interest Test Statement							
	This Discovery Project is in the national interest because it will result in research breakthroughs that advance our understanding in fields of basic science – evolutionary biology, genetics and mitochondrial biology – in which Australia is a world leader. Specifically, this research will answer questions we currently have no satisfactory answers for, namely how and why do our energy-producing genes (those of the mitochondria) accumulate mutations that confer harm to males, with no effects in females. Answering these questions will reshape our understanding of the mitochondria, and their role as mediators of sex differences in health and function. The insights generated should also ultimately provide insights of medical significance. The project represents excellent value for money – it will produce numerous high profile outcomes that capture international scientific attention, at modest cost, overseen by a Chief Investigator with an outstanding record for research innovation. Finally, the project will provide a world-class platform to help train the next generation of Australian scientific innovators.							
DP200100941 Seear, A/Prof Kate	This project aims to address the legal and policy dimensions of hepatitis C discrimination. Hepatitis C is a major public health challenge linked to profound discrimination, including in law and policy. Treatments introduced in 2016 improved cure rates; optimism about disease elimination is high, but questions remain about discrimination faced by those who are cured. This interdisciplinary project's goal is to generate new knowledge about hepatitis C discrimination in a post-cure context, and identify opportunities for legal and policy reform. Expected outcomes of the project include better legal, social and policy outcomes for Australians cured of hepatitis C, significantly benefiting these individuals directly and society more broadly.	88,000.00	189,000.00	192,143.00	91,143.00	0.00	0.00	560,286.00
	National Interest Test Statement							
	Around 182,000 Australians live with hepatitis C, with 10,000 new infections being notified each year. People living with hepatitis C are subject to discrimination and are profoundly stigmatised and marginalised, mainly because of the association between the virus and injecting drug use. The Australian government has invested around $3 billion in new, highly effective drugs and has an ambitious goal to eliminate hepatitis C by 2030. Medical treatment alone, however, will not solve the multiple social, political and structural issues that confront those with a hepatitis C diagnosis. Many Australian laws and policies devised in a pre-cure world negatively affect people with a history of hepatitis C. This project aims to review those laws and policies, investigating and mapping the legal, policy and service reforms needed in a post-hepatitis C world. Through engagement with both key stakeholders and people with a history of hepatitis C, we aim to propose changes that have the potential to reduce discrimination and improve the legal, social and policy outcomes of affected people.							
DP200100952 Currie, Prof Graham V	Historically new transport technologies have significantly changed urban form in Australian cities with important business, economic, congestion, social and environmental impacts. Autonomous cars are said to revolutionise tomorrows transport but no research has yet considered long term impacts on land use and city structure. This project explores how land use and travel will change adopting innovative land use and transport models. Outcomes will better prepare Australia for an autonomous travel future.	32,433.00	66,207.00	67,548.00	33,774.00	0.00	0.00	199,962.00

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	National Interest Test Statement							
	Autonomous vehicles are a major world trend which will significantly impact Australian communities. Current research is focused on autonomous vehicle technology and short-term benefits (reduced crashes, congestion relief). This project explores long-term disruptive effects with a focus on land use and travel impacts to ensure wider social, economic and environmental impacts are better managed. Findings from this project will help Australian cities prepare for the long-term disruptions of autonomous vehicles.							
DP200101270 Whittaker, Prof Andrea M	This anthropological study aims to investigate the global networks and emerging markets for assisted reproduction in Southern Africa. It will focus upon the mobilities of patients to South Africa for assisted reproduction and mobility of ova providers, gametes, embryos and medical staff across Africa and to and from Australia. This ethnographic study includes an analysis of the development of the industry, surveys of the numbers of international patients travelling to clinics in South Africa and interviews with staff, patients, gamete donors, and facilitating agencies. This study is anticipated to provide theoretical insights on the social impacts of reproductive travel across national borders for improved public policy responses.	101,764.50	194,088.00	184,641.50	92,318.00	0.00	0.00	572,812.00
	National Interest Test Statement							
	South Africa is an emerging hub for international assisted reproduction both for Australians travelling to South Africa and South Africans travelling to provide services in Australia. This project will have social benefits to Australia in providing better understanding of the social impacts in Southern Africa and Australia of the international reproductive travel industry for intended parents. It will enhance Australia's international reputation for scholarship in the social sciences, in particular our reputation for leading innovative theory associated with reproductive technologies. The project will build a dynamic collaboration between leading Australian and international researchers and institutions as well as provide research training opportunities in Australia. Translation of the findings will inform the formulation and design of national/international policies and practices and will inform public debate over cross border reproductive travel.							
DP200101272 Kellermann, Dr Vanessa M	This project aims to understand how insects will adapt to climate change by examining a largely overlooked but economically important group of species: Australian native bees. Native bees are important pollinators of both crops and native plants, but their sensitivity to changes in climate are unknown. Expected outcomes include new knowledge of the resilience of native bees to climate change, and new effective tools for predicting climate change resilience that can be applied to many species. The intended benefits include increasing our understanding of the potential for native bees to act as future pollinators in Australia's natural and agro-ecosystems, and guide policy and management decisions to better protect and conserve our bee fauna.	57,500.00	127,500.00	123,500.00	53,500.00	0.00	0.00	362,000.00
	National Interest Test Statement							
	Bees are among the most important pollinators of crops and native plants and play a key role in human food security and ecosystem health. Bees contribute to 75% of the world's crops and the value of bee pollination services is estimated at US$235-577 billion annually. In Australia, the introduced honey bee is an important crop pollinator, but new evidence shows that our native bees (2000+ species) are also high-value pollinators. With honeybee populations declining in many parts of the world, native bees are likely to play an increasingly important role in crop pollination in the future. Yet, there remains a pressing knowledge gap: we do not understand the resilience of native bees to changes in climate. This project will examine the potential for native bees to adapt to climate change and in doing so will help secure the future of native bees as Australian pollinators by guiding policy							
DP200101345 Fuhrer, Prof Michael S	This project aims to build and characterise a family of novel electronic materials: layers of atomically thin semiconductors stacked with a twist, to realise new electronic phases and new low-energy electronic devices. The project adopts an interdisciplinary approach combining advanced experimental and theoretical techniques. The expected outcomes will be a detailed understanding of the electronic and optical properties of twisted semiconductor superlattices, such that they can be produced with desired properties on demand. The benefits of the project will be new materials for electronics and optoelectronics applications, new links to international organisations, and training of students and postdocs for careers in nanoelectronics.	94,750.00	248,000.00	262,750.00	109,500.00	0.00	0.00	715,000.00

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	Information technology (IT) currently consumes 8% of global electrical energy, and is expected to grow significantly as silicon-based computer processors run out of room for efficiency improvement (the end of Moore's Law) in the next few years. The IT industry has identified a need for a low-energy transistor technology to replace silicon CMOS. The electrically controlled electronic phase transitions envisioned in this proposal offer a potential avenue to low-energy transistors, and this proposal will develop the foundational intellectual property for such a technology. Such a low-energy electronics technology would have the direct impact of revolutionising the >$400B semiconductor industry, as well as sustainably continuing the IT revolution, and its numerous societal benefits, into the future. Additionally the project will train two PhD students and two postdoctoral researchers in forefront nanoelectronics concepts that will be essential in tomorrow's electronics technologies.							
DP200101414 Martin, Prof Gael M	This project proposes a new paradigm for prediction. Using state-of-the-art computational methods, the project aims to produce accurate, fit for purpose, predictions which, by design, reduce the loss incurred when the prediction is inaccurate. Theoretical validation of the new predictive method, without reliance on knowledge of the correct statistical model, is an expected outcome, as is an extensive numerical assessment of its performance in empirical settings. The new paradigm should produce significant benefits for all fields in which the consequences of predictive inaccuracy are severe. Problems that lead to substantial economic, financial or environmental loss if predictions are incorrect will be given particular attention.	65,000.00	131,500.00	131,500.00	65,000.00	0.00	0.00	393,000.00
	National Interest Test Statement							
	Predicting the future value of any quantity of interest, be it economic, financial, or arising from the physical world, carries with it the risk of error: the predicted value is likely to differ from the value that eventuates. The impact of prediction error varies according to context. For example, under-predicting a large fall in the value of a financial portfolio may have severe consequences (including insolvency), whilst failing to predict demand for electricity that exceeds capacity is consequential, given the economic and societal impact of black-outs. This project proposes a completely new approach, in which predictions are expressly designed to reduce the problem-specific `loss' that can result from prediction error. Hence, financial predictions that minimize the probability of financial loss by accurately forecasting large price falls; predictions of energy demand that, by design, minimize the chance of black-outs by accurately forecasting peak demand, are now the goal. Benefits are anticipated in all spheres in which the consequences of prediction error are significant.							
DP200101434 True, Prof Jacqui	This project aims to understand the impact of sexual and gender-based violence on the dynamics of conflict. With an innovative mixed method design it will study all reported incidences of sexual and gender-based violence in 41 conflict-affected countries between 1998 and 2018. It will generate new knowledge establishing how and when crimes of sexual and gender-based violence affect the onset and intensity of conflict. The expected outcomes of this project include the identification of the most high-risk situations, the phases of violence, and the improvement of risk assessments for such violence. The project will significantly benefit the prevention of sexual and gender-based violence in conflict-affected situations globally.	52,860.00	81,839.00	124,347.50	95,368.50	0.00	0.00	354,415.00
	National Interest Test Statement							
	Australia has been a consistent global advocate of the Women, Peace and Security (WPS) agenda. Through its foreign policy and aid program, Australia has given priority to integrating a gender perspective into global peace and security efforts, across all elements of the WPS agenda – conflict prevention, women's participation and protection, relief and recovery. Since Australia's term on the Security Council (2012-2014) the Department of Foreign Affairs and Trade (DFAT) has continued its international engagement on WPS. The Australian Government supports United Nations (UN) agencies and non-government organizations responsible for WPS, including in the protection, assistance, and prevention of sexual violence in conflict and humanitarian situations, including UNHCR, UNFPA, UNICEF, and International Committee of the Red Cross. This research project directly engages with the protection and reporting functions these organizations. The findings will inform how to maximise Australia's future financial and political commitments to these organizations to improve the prevention of conflict-related sexual violence.							

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DP200101448 Lupton, Prof David W	Conjugate acceptors are common chemicals that are readily available from petrochemical and biomass feedstocks. While they are used extensively to build functional materials, including polymers and medicines, the reactions that they can engage in are largely limited to those exploiting their natural reactivity. In this project, catalysis will be used to allow these ubiquitous building blocks to react in entirely new ways. In doing so new chemical reactions will be discovered that convert simple building blocks into sophisticated fine chemicals. The potential utility of the products is diverse and will enable future applications in fields focused on the preparation of functional materials.	80,500.00	163,500.00	168,500.00	85,500.00	0.00	0.00	498,000.00
	National Interest Test Statement Simple chemical building blocks are used to build the fine chemicals, medicines, and advanced materials that define the quality of life within Australia. Their preparation is often achieved using novel chemical reactions. The chemical reactions of greatest value are cheap, environmentally benign, and produce materials not previously accessible. In this project we examine the conversion of one family of very simple chemical building blocks to materials with highly defined structure, shape and reactivity. Our approaches exploit catalysis, a process which allows the assembly of new products without the creation of significant waste, thereby increasing potential economic and environmental value. To address the challenges of tomorrow, including the manufacture of high value advanced materials, Australia requires new technologies, such as those introduced herein. Beyond the value of the discoveries, this proposal will play a significant role in creating human capital ready to tackle the problems of future chemical manufacturing in Australia.							
DP200101491 MacFarlane, Prof Douglas R	The goal of this project is to develop sustainable methods to produce nitrates from air and water, using renewable electricity. This new electrochemical technology will be based on the design of new electrolytes and catalysts supported by advanced theoretical concepts to provide high rate of production and selectivity. This is expected to generate new fundamental knowledge in materials and catalysis science. As traditional production of nitrates for industry and agriculture generates significant greenhouse gas emissions, the core anticipated outcome of this project is a new, sustainable era of nitrogen chemistry. This is also expected to benefit farmers by providing a process for the generation of sustainable fertilisers on a local basis.	100,000.00	232,500.00	267,500.00	235,000.00	100,000.00	0.00	935,000.00
	National Interest Test Statement This project will contribute to Australia's national interest in several contexts as follows: (i) Environmental: by providing a sustainable approach to nitrate and fertiliser production thereby lowering Australia's greenhouse gas emissions (CO2 and N2O) (ii) Commercial: by providing a fertiliser production technology that can be implemented at an "on-demand", local, distributed level (i.e. individual farms, communities and individual industries), the fertiliser supply chain will be altered considerably. This will benefit individual farmers, lowering the cost of supply considerably. It will also open up new manufacturing industry opportunities in the construction and supply of the devices. (iii) Economic: As an entirely renewable energy based process that could draw on Australia's very considerable global potential as a renewable energy generator, this process will create new export opportunities in the form of sustainable fertilisers.							
DP200101562 Nash, Prof Jordan	The Standard Model of Particle Physics describes the fundamental particles of which matter in the Universe is composed, and the interactions which bind these particles. It is one of the most precisely measured and validated theories which science has produced, and there has as yet been no measurement of fundamental particle interactions which is in conflict with its predictions. This project involving a large international team and highly sophisticated technology will search for evidence of physics beyond the Standard Model by looking for conversion of muons to electrons a reaction which the model prohibits. Observation of this process would be evidence of new particles and interactions, and would revolutionise our understanding of nature.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00

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	National Interest Test Statement							
	This research will search for evidence of new fundamental constituents of the universe. The quest to understand the basic building blocks of matter, and the forces which hold them together remains has long driven advances in science research. Pursuing these difficult measurements requires developing and applying scientific techniques which push the limits of technological capability and exposes our researchers to cutting edge methods. The large international collaborations involved in this research will give Australian scientists opportunities to interact, create partnerships, and develop new research tools and analysis with leading scientists around the world. The experiment should improve the sensitivity for observation of new physics signals by a factor of 100 which will be a world leading measurement in this area. This research will enable Australian researchers to take part in seeking to answer one of the most profound scientific questions, an activity of cultural and scientific importance. The technology required for the measurements will train researchers in techniques valuable for employers.							
DP200101664 Pas (née Izgorodina), A/Prof Ekaterina I	The project aims to address a growing problem of increasing energy consumption by storing intermittent energy from the sun in affordable and efficient flow batteries. The project expects to generate new knowledge in the areas of materials science and battery research by using innovative theoretical chemistry approaches to studying electrochemical properties of nitroxide radicals in ionic media. The project aims to develop radical organic flow batteries by utilising ionic liquids to stabilise radicals. Intended outcomes of the project include improved efficiency of flow batteries that can store energy from widely used solar panels. This should provide significant benefits to Australia's effort to switch to renewable energy technologies.	76,000.00	154,500.00	154,500.00	76,000.00	0.00	0.00	461,000.00
	National Interest Test Statement							
	The project is expected to generate economic and environmental benefits to the Australian Community. The development of affordable, efficient and environmentally friendly radical organic flow batteries will revolutionise the way flow batteries will be designed in the future. These batteries do not rely on availability of natural resources such as precious metals, are non-corrosive and utilise recyclable electrolyte materials, thus significantly reducing their production cost compared to alternatives currently available on the market. Due to their unique properties, radical flow batteries can be easily scaled to provide electricity to residential households as well as large manufacturing enterprises and hospitals. Most popular renewable energy technology – a solar panel – generates electricity while the sun shines. The use of radical flow batteries will ensure that Australians have uninterrupted access to electricity at any time of the day. The project is expected to fast track Australia's effort to switch to renewable energy technologies and generate socioeconomic benefits to the Australian community.							
DP200101680 McGeoch, Prof Melodie A	This project aims to understand how common species change across regions and how this affects the functions that biodiversity provides across natural and built landscapes. Using a novel, information-rich approach and metric, the project aims to combine simulation experiments, and empirical data using organisms with low (plants) and high mobility (birds). Expected outcomes include new theory and improved biodiversity models, policy and management-relevant insights, new institutional collaborations, and student training. The research aims to provide significant benefits for understanding and monitoring the dynamics of common species, including problem species and common native species in rapid decline.	64,125.00	132,470.00	132,470.00	64,125.00	0.00	0.00	393,190.00
	National Interest Test Statement							
	This research aims to contribute to Australia's National interest by the knowledge and capacity it will deliver to understand rapidly changing common species populations. Expanding and declining common species have implications for both the environment and society in natural, rural and built areas. The project aims to better understand and predict the consequences of dramatic declines in common species. Such declines are currently happening across Australia from mangroves in the tropics to populations in the sub-Antarctic. By focusing on common species, the research aims to further understand the consequences of expanding populations, including invasions and population outbreaks, such as species that become super-abundant in urban environments. Unexpected gains and losses in common species will feature strongly in Australia's environmental future. We aim to shed light on the consequences of these changes for the services that biodiversity delivers. This information is needed to inform action to sustain quality of life for current and future generations of Australians.							

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DP200101878 Simonov, Dr Alexandr N	The project will design a new solar-powered system for electrosynthesis of ammonia to replace the current energy intensive, non-sustainable process that generates 1.5% of global CO2 emissions. An innovative new system will be developed by combining cutting edge electrochemical, spectroscopic and theoretical methods. Expected key outcomes include novel concepts in the design of advanced materials, and an efficient process for the green ammonia synthesis. Given the strategic importance of ammonia as a future energy carrier for the export of Australian renewables and as a major source of fertilisers, this project should provide significant national economic and ecological benefits and is expected to have a broad reaching global impact.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
	National Interest Test Statement Key outcome of this project will be an efficient, cost-effective and reliable technology for the conversion of renewable electricity, water and air (nitrogen) into ammonia. This will directly contribute to Australia's national interest in three strategically important areas: (1) Energy. Ammonia is a hydrogen fuel carrier that can be exported to Japan, South Korea and other countries actively implementing green energy technologies, but lacking renewables. This will support the export of abundant but underused Australian renewables and will add new income item to the national budget. (2) Food Industry. Ammonia is a basis for all fertilisers and is produced in Australia on a multi-tonne scale. Implementing a new renewable technology that can be used on-demand on a small business scale will lower the cost of fertilisers for local farmers. Eventually, all ammonia in Australia will be produced via renewable route, as it is cheaper and more flexible than the current technology. (3) Environment. The developed technology will decrease greenhouse gas emissions in Australia associated with fertiliser production.							
DP200101953 Heryanto, Prof Ariel	The project aims to investigate the dynamics of Indonesia's politics today as an extended battle to remember or forget violent events, including those which took place around Indonesia's decolonisation in the 1940s. It will offer new insights into ethical and political issues of how that past has significant bearing upon key political debates in contemporary Indonesia. In addition to conventional archives, the project will examine popular culture (cinema, radio, fiction, newspaper) as an innovative research field in its own right. The project aims to deliver richly-nuanced insights about Indonesia and its longstanding connections with Australia beyond the pursuit of material interests.	25,047.50	67,047.50	90,000.00	48,000.00	0.00	0.00	230,095.00
	National Interest Test Statement This research potentially brings public awareness of Australia's historic contribution to the making of a new world order after World War II. In 1945 Indonesia declared its independence. Australia became Indonesia's strongest supporter, betraying its White Australia policy. Academic-cum-diplomat William McMahon Ball was the first foreign diplomat to visit Indonesia, to convey in-person Australia's support for Indonesian independence. Indonesia gained the full transfer of sovereignty in 1949, partly thanks to Australia, who acted as Indonesia's representative in the UN sponsored negotiations. Until recently, that history has been largely erased from public memory in both countries. In addition to bringing the critical nuances of that past event to today's public fora, this project aims to search for a resolution to the current debates in The Netherlands and Indonesia on alleged crimes of humanity during the Indonesian revolution. This research would enable Australia to have the opportunity to assist Indonesia and The Netherlands by providing a third and neutral space to discuss this sensitive issue.							
DP200101965 Thomas, Prof Merlin C	Reactive intermediates generated during our metabolism contribute to ageing. Glyoxalase-1 is a key defence enzyme against these toxic intermediates and therefore ageing itself. This project aims to investigate novel pathways how the expression and activity of glyoxalase-1 are regulated. This interdisciplinary project expects to generate new understanding by combining relevant cell and animal models, protein chemistry, epigenetics and structural biology. It is expected that this work will improve understanding of this fundamental biological defence. This will allow us to identify the potential means to enhance the capacity of glyoxalase-1 to the future benefit of biological ageing.	100,500.00	199,000.00	202,000.00	103,500.00	0.00	0.00	605,000.00

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	National Interest Test Statement							
	Although we all get older every day, organismal decline can be modulated to support healthy ageing. Glyoxalase-1 is a fundamental regulator of biological ageing. However, there are currently no means to increase and/or preserve its activity. In this interdisciplinary project, we address this problem through exploring, modelling and modulating the molecular regulation of human glyoxalase-1. This project will extend discoveries made by CI-Thomas to establish smart 'proof of principal' technologies to slow ageing and models in which to effectively explore them. This discovery represents a transformative advancement of our knowledge in this important field. Better understanding of this pathway will advance the commercial potential of this discovery and assist in attracting investment. We anticipate that our discoveries will also be broadly applicable to other important biological questions and lead to the development of innovative strategies of commercial and societal importance. This project will also train staff and students and expand capacity in this important area of biology.							
DP200102016 Duke, Dr Daniel J	This project aims to deliver a novel simulation framework to accurately predict the behaviour of metered dose inhaler sprays using advanced numerical methods for flash-evaporating turbulent flows developed by the investigators. The project expects to generate new knowledge of the complex physics which occur in these devices through a first of its kind combination of unsteady non-equilibrium thermodynamics, turbulence and spray models. Expected outcomes of this project include a novel ability to predict and optimise the performance of inhalers to suit environmentally-friendly replacement propellants. This will significantly benefit the pharmaceutical sector as it will accelerate the design of next-generation inhalers and propellants.	30,000.00	65,000.00	62,500.00	27,500.00	0.00	0.00	185,000.00
	National Interest Test Statement							
	The research will deliver an accurate and efficient computational model which will unlock the development of novel hydrofluoroalkane (HFA) free pressurised metered dose inhaler products. The planned global phase-down of HFA consumption will have a detrimental effect on the cost and availability of inhalers for Australians. At present, there are no viable replacements for HFAs in inhalers. This project will deliver the knowledge and tools necessary to search for and identify potential next-generation inhaler designs and propellant formulations. This may then lead to the future development of new low-cost, environmentally-friendly inhaler products. The focus of this project is the delivery of the fundamental engineering knowledge necessary to do so. Australians will benefit from this research through both environmental benefit and reduced over the counter cost for future inhaler products. The Australian pharmaceutical sector will also benefit as the research will position Australia as a leader in HFA-free aerosol technology.							
DP200102093 Janovjak, Dr Harald L	This project aims to develop synthetic biology methods to study brain function by utilising engineered plant receptors. This project will expand our ability to manipulate nerve cell function with high specificity and without side effects in freely behaving animals. Plant receptors will be developed into molecular tools in an iterative process that improves key properties using rational protein design. Expected outcomes include innovative and broadly-applicable neuroscience methods and an understanding of receptors involved in plant growth and defense. Benefits of this project include an enhanced capacity to generate knowledge, multidisciplinary training opportunities and patentable synthetic biology technologies.	73,802.00	207,072.00	225,290.00	92,020.00	0.00	0.00	598,184.00
	National Interest Test Statement							
	The national benefits of this project include: 1. Generation of new molecular technologies for studying and engineering living cells; these technologies will be patentable inventions and have global applicability; 2. A deeper understanding of proteins that are involved in the defence and growth of plants, including of plants that are important to Australian agriculture; 3. A basis for international partnerships based on the future global interest in the use of new Australian technologies; 4. A unique opportunity to educate a next generation of broadly-trained and open-minded scientists in the rapidly growing and multidispliplinary field of synthetic biology.							
DP200102151 Danaher, Prof Peter J	This project aims to apply and adapt the latest machine learning techniques to enable companies to utilise their existing customer data to reveal purchase motivations, product preferences, and responsiveness to marketing communications for each single customer. A widespread practice in marketing is to partition customers into broad groups, but customers expect products and services that are tailored to their individual needs. This presents extreme challenges due to the size and complexity of customer databases. The expected outcomes will enable Australian companies to attract and retain more customers, and make more efficient use of their marketing budget. Benefits include equipping companies to better compete domestically and globally.	68,129.00	130,064.00	61,935.00	0.00	0.00	0.00	260,128.00

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	National Interest Test Statement							
	Australian companies such as Telstra, Qantas, Myer and Coles all maintain large customer databases. However, the size and complexity of these databases means that existing use of this information is often limited to broad groups of customers, whereas today's customers expect individually customised service and product offerings. By reanalysing such large customer databases with the latest computational and mathematical methods we aim to reveal previously elusive insights into customer purchase motivations, product preferences and responsiveness to marketing communications and loyalty program rewards. The new methods will be sufficiently flexible to apply to a broad range of Australian companies, such as the retail sector, which is struggling due to the widespread adoption of internet shopping, and an influx of global competitors, such as Amazon and eBay.							
DP200102165 Weinberg, Prof Roberto F	This project aims to determine how active volcanic continental margins, such as the Ring of Fire, evolves and control the origin of new continental crust. This project expects to generate new knowledge regarding how continents form in such margins using new findings that suggest they undergo cyclical heating and magmatism. The intended outcome is a finely resolved thermal-magmatic temporal history of an ideal example of such a margin. This should provide significant benefits, such as an understanding of how new continental crust forms, and increased predictability of when in the evolution of continental margins significant copper and gold deposits form.	39,000.00	81,000.00	84,000.00	42,000.00	0.00	0.00	246,000.00
	National Interest Test Statement							
	Continental crust forms as a result of plate tectonics at plate margins along volcanic arcs, such as the Pacific Ring of Fire. The eastern third of Australia formed in this way, and this project seeks to determine the processes that control how these regions form and how they control the origin of resources. The geology of eastern Australia is a result of the superposition of several volcanic arcs developed over hundreds of millions of years. These are no longer active and their upper parts have been eroded exposing rocks that were once deeper in the crust, including mineral resources such as copper and gold. Knowledge of when in the magmatic cycle ore deposits form enhances the chances of success for the mineral exploration industry. More generally, increased understanding the chemical and structural nature of these old arcs increases our general ability to use the resources provided by the eastern part of Australian continental crust.							
DP200102187 Neumann, Dr Brent	This Project aims to investigate the role of structural and functional cellular components known as microtubules in nervous system regeneration. This Project aims to use innovative approaches in confocal and electron microscopy, genetics, and cell biology, with the expectation of generating new knowledge into nervous system repair. Expected outcomes of this Project include a comprehensive description of how microtubules are rearranged following nervous system injury and the importance of microtubule modifying proteins in promoting regeneration. This should provide significant benefits in our understanding of the cellular mechanisms behind nervous system repair, and offer new approaches for promoting regeneration after injury.	85,000.00	172,500.00	175,000.00	87,500.00	0.00	0.00	520,000.00
	National Interest Test Statement							
	The proposed research will combine the training of new staff with the use of core Monash University facilities to generate high-impact publications that will significantly strengthen Australia’s research in neuroscience and enhance the international profile of this nation’s research. This research will provide new fundamental knowledge about the nervous system. Ultimately, this information may lead to benefits for the large proportion of society affected by nervous system injury, and neurodegeneration, helping to ease the large burden placed on the healthcare system. Thus, the outcomes of this project may eventually contribute to improvements in health and quality of life.							
DP200102214 Monro, Dr Keyne	This project aims to understand how gene interactions impact evolution in our warming marine environments. The role of gene interactions is controversial because they are assumed to have little effect on genetic variation for fitness in natural populations. Yet new data show that this effect can be substantial and is enhanced by heat stress, explaining most of the genetic variation available for evolution under stressful conditions. The project aims to use quantitative genetics, genomics, and theory to determine the evolutionary impacts on marine populations facing rapid ocean warming in southeast Australia. The outcomes could change how we view gene interactions, and help us to better predict biological responses to environmental change.	68,933.50	134,578.00	121,603.50	55,959.00	0.00	0.00	381,074.00

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	National Interest Test Statement							
	Understanding the evolutionary dynamics of vulnerable populations facing rapid environmental change is critical for managing our natural biodiversity into the future. This project will identify the extent to which gene interactions underlying ecologically-important traits, like survival and reproduction, impact the evolution, adaptation and extinction risk of marine populations in our rapidly warming seas. The project outcomes will benefit the Australian community by improving our understanding of, and ability to predict, how organisms respond to environmental change. Doing so will contribute cutting-edge knowledge, training, and genetic resources in a research area of national priority, and could deliver vital information about the biological impacts of climate change to researchers, managers, policy-makers, and other stakeholders.							
DP200102224 Warren, Dr Narelle L	This project aims to examine the social and cultural dimensions of dementia by using a comparative ethnographic approach to examine the experiences of people living with dementia in Australia, Malaysia and India. The project expects to generate new anthropological knowledge about structural inequalities by examining how dementia is responded to in diverse geographic, cultural and social settings. Expected outcomes of this project include the creation of a new evidence-base on dementia and the production of briefing documents to guide global health frameworks. The project should provide significant benefits for people living with dementia by providing locally-relevant strategies to respond to dementia and resultant disability.	64,130.00	163,327.00	189,980.00	90,783.00	0.00	0.00	508,220.00
	National Interest Test Statement							
	The project will expand Australia's knowledge base about how social, cultural, economic, political and environmental contexts shape people's experiences and decisions about dementia-related disability for diverse communities in Australia and in our closest neighbours. It will provide a solid research base to inform policy development on the delivery of social support services, including under My Aged Care and in light of the Aged Care Royal Commission, and will contribute to communication strategies for governmental and non-governmental agencies working with people across socio-cultural backgrounds.							
DP200102295 Johnston, Prof David W	The project aims to describe the extent of socioeconomic inequity in Australian mental healthcare use, identify the causal pathways that drive inequities, and conduct economic evaluations of programs aimed at increasing healthcare access. Microeconometric methods will be used to analyse large, longitudinal datasets that have not previously been used for this purpose. The project expects to provide a greater understanding of the barriers that people face in accessing treatment and how to overcome them. Such understanding is currently missing from academic literatures and policy inquiries. Ultimately, the research should aid in the design of cost-effective policies that improve health outcomes and that reduce inequities in treatment access.	93,839.50	181,706.00	163,078.00	75,211.50	0.00	0.00	513,835.00
	National Interest Test Statement							
	Resources for mental healthcare are distributed inequitably in Australia; across households and across neighbourhoods. The rate of disorders and need for care are highest among low income, non-employed Australians living in low socioeconomic status neighbourhoods, yet their rate of access to and treatment from healthcare professionals is relatively low. Better models of healthcare that improve outcomes, and reduce disparities for low socioeconomic status groups are required. The aim of this project is to provide the economic evidence base required to ensure these important system changes are appropriately targeted and cost effective. The project will produce nine large economic studies that explore the socioeconomic determinants of mental disorders and healthcare, and the economic effectiveness of existing Australian programs and policies. Ultimately, the research should aid in the design of policies that improve outcomes, including for our most vulnerable populations, increase efficiency, and provide greater value for government expenditure.							
DP200102329 McGregor, Dr Shayne	Anthropogenic sea level rise is expected to inundate low-lying islands and coastlines around the world, with multiple model projections suggesting that changes in wind patterns will lead to larger than average sea level rise along Australia's east coast and in neighbouring small island nations. Confidence in projections of this spatial sea level rise variability is low, however, due to a strong mismatch between patterns of observed and model-projected sea level rise in recent decades. This work will use a newly developed climate model hierarchy and innovative experimental design to determine the cause of this discrepancy and will produce more credible regional sea level rise projections by clarifying and reducing projection uncertainty.	65,000.00	135,000.00	140,000.00	70,000.00	0.00	0.00	410,000.00

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	National Interest Test Statement							
	Anthropogenic global sea level rise (SLR) has already led to the inundation of low-lying islands and coastlines around the world, and the rate of SLR is expected to accelerate in the future. Projected regional differences in SLR, related to changes in surface winds, suggest that coastal impacts for parts of Australia may be felt decades earlier than expected by considering the global mean rate alone. Thus, making credible predictions critical for the management of future coastal risks. At present, however, there is little confidence in regional SLR projections from climate models due to large discrepancies between observations and models. This project will enhance our understanding of what causes surface wind changes and the associated regional SLR differences, and provide more accurate measures of regional SLR uncertainty. These components will be combined to: i) increase the credibility of regional SLR projections; ii) aid the detection and attribution of anthropogenically forced regional SLR; and iii) provide information critical for coastal climate change adaptation.							
DP200102405 Turner, Prof Stephen J	Adaptive immune cell activation results in the acquisition and long term maintenance of specific cellular function that enables efficient immune control of infections. Using advanced cellular and genomic approaches, combined with high-resolution microscopy and cutting edge computational biology, this proposal aims to address major gaps in our knowledge about how alterations in genomic 3D architecture and targeted biochemical modifications impact cell specific gene nuclear positioning and how this regulates changes in gene expression associated with immune cell activation. An outcome will be identification of novel molecular mechanisms that will have broad applicability across cellular biology, and provide novel targets for drug development.	115,000.00	222,500.00	237,500.00	130,000.00	0.00	0.00	705,000.00
	National Interest Test Statement							
	Changes in the 3D organisation of the genome have recently been revealed to influence cellular processes, including those of the immune system. However, we lack a detailed mechanistic picture of these events. This project addresses this fundamental gap in knowledge in biology. Specifically, the changes in genome structure upon exposure to a virus that lead to the activation of immune cells will be explored by leveraging Australia's leading-edge infrastructure in high-resolution microscopy, high-performance computing and genomics. The tangible benefits and implications of this work are diverse and numerous: most notably, identification of the novel molecular mechanisms that regulate our immune responses will create opportunities for other researchers and industry to develop new classes of drugs to target them.							
DP200102477 Karel , Dr Julie	This project aims to develop new multiferroic materials for high performance computing and data storage technologies. Semiconductor industry leaders have identified the development of these materials, operating a room temperature, as a key challenge in enabling future high speed, high performance logic and memory devices. The intended outcomes of this work are (i) the delivery of new multiferroic materials by magnetic doping of a semiconductor, strained to a ferroelectric state and (ii) the demonstration of a new paradigm in materials design to realise such materials. The key benefit of this work is the enabling of next generation computing and memory devices exhibiting higher speeds, reduced sizes and lower power consumption.	15,000.00	67,500.00	102,500.00	50,000.00	0.00	0.00	235,000.00
	National Interest Test Statement							
	This project aims to develop new materials for emerging high speed, low power computing and data storage technologies. The impact of this work is both economic and environmental. Higher speed computing and data storage will enhance productivity across all sectors - government, private industry and education. Low power devices will translate to cost savings through reduced electricity consumption across the same segments of the economy and a reduction in the negative impacts of climate change.							
DP200102522 Hall, Dr Matthew D	This project aims to examine how differences in the thermal performance of hosts and pathogens can influence the capacity of a species to respond to warming temperatures. This project expects to generate new knowledge in the area of global change biology by integrating approaches from the fields of evolutionary genetics, sexual selection, and epidemiology. Expected outcomes include improved knowledge and techniques that can be used to forecast the growth or decline of host and pathogen populations under different scenarios of warming. This should provide significant benefits, such as helping to identify local wildlife or agricultural populations that are most at risk under the duel threat of parasitism and global change.	76,000.00	149,500.00	139,000.00	65,500.00	0.00	0.00	430,000.00

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	National Interest Test Statement							
	Global change is predicted to result in both rapidly changing environments and dramatic increases in disease outbreaks. Yet our ability to identify populations at most risk from the nexus of global change and parasitism is limited. This project aims to explore how tropical and temperature populations in Australia might respond to the dual threat of parasitism and changing temperatures. It is expected to train a new generation of researchers in interdisciplinary approaches linking evolution, ecology, and epidemiology. The expected benefit is an improved capacity to predict extinction risks in a changing world and a proof of concept that ecosystem management could be enhanced by considering the joint thermal ecology of hosts and pathogens.							
DP200102547 Campbell, A/Prof Arthur D	The aims of this proposal are to better understand the role of networks in different activities such as social media, education, crime and environment-friendly behaviour. The project expects to help inform the design and practice of policies for education and environmental authorities, police and media markets. Social networks are pervasive in Australia. The project tackles issues of criminal gangs in Australian cities, the political system and environment-friendly behaviours. This project is at the frontier of work in the economics of networks, with expected outcomes to include new models and methods to better understand the impact of social networks. Benefits include clear policy recommendations to improve welfare in Australian society.	41,816.50	88,926.00	99,547.00	52,437.50	0.00	0.00	282,727.00
	National Interest Test Statement							
	Good economic policy is fundamental to future Australian prosperity. We believe that this research project will help create relevant policies to address crime, education and the political system in Australia. We first focus on how individuals form beliefs about political opinions and how this impacts the political process in Australia. This project will help us understand why people may form extreme political opinions and will also provide insight into the increasing polarisation of political opinions in Australia. We then address the issues of education and crime in networks. Should policy target ‘key players’ in criminal networks to reduce crime or should we change the social norm in schools to enhance education in Australia? Finally, we tackle the issue of environmental behaviour, social norms and access to recycling facilities, which is particularly relevant for Australia since recycling is often not viable in towns and settlements located a great distance from the major population centres. This project will provide insights on adequate policies that increase recycling behaviour.							
DP200102614 Voelcker, Prof Nicolas H	The project aims to address key questions about the development and integration of advanced materials and functional molecules into cutting-edge analytical tools for screening emerging environmental pollutants. This is expected to generate fundamental and applied knowledge in analytical chemistry, using an interdisciplinary approach to engineer materials with precisely tailored properties for ultra-sensitive and selective detection of extremely persistent toxicants in water. Anticipated outcomes are optical materials and functional molecules, integrated into lab-on-a-chip platforms with advanced features for real-life environmental applications – with significant benefits for addressing major environmental and health treats to our society.	85,000.00	170,000.00	170,000.00	85,000.00	0.00	0.00	510,000.00
	National Interest Test Statement							
	We will produce significant advances in micro and nanotechnology to develop advanced analytical tools capable of screening highly persistent emerging contaminants that seriously threaten the environment and sustainable economic development. The project will span disciplinary boundaries to engineer cutting-edge sensing technologies for integrated, label-free detection, quantification, and molecular fingerprinting of PFASs. The resulting knowledge and technological advances will give environmental researchers advanced tools for generating new insights into the fate and impact of PFAS contaminants in the environment and in populations, ultimately having a disruptive effect on standardised analytical protocols to monitor pollutants in water sources. The project will deliver economic, commercial, and environmental benefits through research excellence, engaging with industry and the broad community, and creating social impact by increasing the society’s awareness of environmental pollution problems associated with our life style. We expect to license the outcomes for translation to produce a marketable technology.							

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DP200102737 Wilce, A/Prof Jacqueline A	This project investigates the way in which protein molecules interact effectively with RNA molecules and also aims to enhance the CRISPR-Cas13a system for RNA detection. Innovative approaches will be used to test the role of a particular protein motif, called the RGG/RG motif, in remodelling RNA structure and enhancing the Cas13a protein. This knowledge is expected to shift our understanding of protein-RNA interactions that are fundamental to almost every aspect of cell biology. The project is intended to benefit Australia through contributing to fundamental knowledge in the field, facilitating the development of new CRISPR-Cas biotechnologies for RNA detection and through the training of young researchers in frontier technologies.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
	National Interest Test Statement This project will firstly contribute to Australia's national interest through advancing knowledge in the field of biological molecular sciences. Proteins and RNA are the machines that carry out the majority of functions in our cells. Our work examines a novel aspect of protein-RNA interactions and will raise the profile of Australia in this scientific field. Our work will also be enabling of novel biotechnologies. The CRISPR-Cas13a technology, that allows specific RNA to be detected (for example the RNA from a particular virus), will be enhanced by our research. The outcomes are expected to be patentable and to benefit Australia commercially in the biotechnology field. Thirdly, this project will involve the training of upcoming young scientists in a cutting-edge field and in the use of frontier technologies. This will also be of benefit to Australia for the establishment of future scientists and entrepreneurs in a growing scientific field.							
DP200102754 Sgro, Prof Carla M	This project aims to develop a framework for accurately predicting species responses to global change. Many environmental factors will change, and species will evolve, but in a sex-specific manner. Yet understanding of how the sexes vary in their ability to evolve and adapt to such complex environmental change is lacking. This project aims to integrate environmental data with the sex-specific evolutionary potential of organisms in response to multiple stressors in a spatially explicit context. The intended outcome is a powerful and general tool for predicting the impact of environmental change on the distribution and abundance of organisms. The benefits include improved conservation outcomes and better pest/disease vector control.	67,237.50	139,819.00	144,081.50	71,500.00	0.00	0.00	422,638.00
	National Interest Test Statement Predicting species vulnerability to climate change is a major research priority for Australia. It requires understanding how the sexes vary in their ability to adapt to the environmental shifts projected under change. This understanding is largely absent, severely limiting our ability to make informed decisions in the key areas of climate change policy, particularly biodiversity conservation, disease and pest management and food security. The proposed research will address this knowledge gap, and in so doing provide quality training to young Australians, equipping them to play a central role in solving the problems key to Australia's future.							
DP200102769 Anderson, Prof Heather M	The project aims to contribute to Australian and international efforts on emission control by advancing the methods for quantifying the relationships between energy production, emission and climate, and assessing the real and financial risks associated with changing the ways in which economies produce and use energy. The project is interdisciplinary and expects to develop new knowledge in the areas of energy and climate econometrics. The anticipated outcomes of this project are new methods for modelling variables with complex trends, and an innovative data-driven approach for learning from policy experiences of other countries. This should provide significant benefits by enabling evidence-based policy making in the era of climate change.	84,284.50	170,766.50	175,154.00	88,672.00	0.00	0.00	518,877.00
	National Interest Test Statement Electricity production in Australia generates more metric tons of CO2 emissions per capita per year than any other developed OECD country, and in 2015, the Australian Government nominated environmental change and energy as two of nine national research priorities. This project adds the expertise of social scientists and time series analysts to societal efforts to ensure sustainable economic growth with a stable energy supply that has lower carbon emissions. The project develops a scientific methodology that uses relevant quantitative information to identify the advanced economies that are similar to Australia, and then combines the experiences of this group of countries to provide an objective prediction of the likely consequences of Australia adopting specific renewable energy policies. The proposed work will lead to improved precision in the measurement and prediction of environmental conditions, electricity generation and their co-movement, thereby facilitating the development of policies that can meet Australia's climate change goals whilst ensuring stable energy markets.							

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DP200102776 La Gruta, Prof Nicole L	CD8+ T cells are immune cells that are critical for the adaptive immune response, which is central to immune function in vertebrates. CD8+ T cells mediate their effector functions only after activation, which occurs via T cell receptor (TCR) recognition of foreign antigens. Here, unique reagents and sophisticated technologies will be used to define precisely how the nature of TCR-antigen recognition impacts on T cell activation and effector function. This work builds on an earlier identification of an entirely novel mode of TCR-antigen recognition, and its success will establish novel paradigms in T cell biology and represent a key advance in knowledge in the life sciences.	95,000.00	195,000.00	200,000.00	100,000.00	0.00	0.00	590,000.00
	National Interest Test Statement Recognition of foreign antigens by the T cell receptor (TCR), expressed on the surface of T cells, is the defining and most critical event in T cell activation, ultimately resulting in T cell-mediated viral clearance. In the short term, this work will advance our fundamental understanding of how the nature of the TCR recognition event impacts on CD8+ T cell activation and effector function. Therefore, this work will, through the continued publication of high impact research articles and international presentations i) increase Australia's international reputation for research excellence, ii) attract outstanding students to Australian research, and iii) attract funding from external industry sources and granting bodies. In the longer term, the advances in our fundamental understanding of T cell activation from this study will inform immunotherapies for cancer, autoimmunity, and viral infection that, now more than ever, rely on modulation of T cell function. In summary, this work is expected to make a sustained impact on Australia's research standing, and health and commercial outcomes.							
DP200102829 Whittaker, Dr Michael R	This Project aims to provide new rules for the design of novel polymer materials with antibacterial properties by employing mechanism-based mathematical modelling. This Project expects to generate new understanding of those mechanisms which underpin the antibacterial activity of these materials, how bacteria respond to these through metabolic changes and emergence of resistance.These rules will govern material design to yield new antibacterial materials with improved properties. Expected outcomes of this project may be a novel mechanism-based mathematical model that will enable the next-generation of antibacterial materials. This outcome will help address the increasing economic and social burden of antibiotic drug resistance in Australia.	70,000.00	145,000.00	145,000.00	70,000.00	0.00	0.00	430,000.00
	National Interest Test Statement The development of new antibacterial synthetic materials is of considerable importance to the advanced manufacturing sector, where new products with a high added value are constantly sought. The project will provide a new platform technology for potential end use in the veterinary/medical and agricultural sectors. It will see Australian-trained researchers equipped with cross-disciplinary skills that are truly unique and maintain Australia's reputation as a leading country for innovation and polymer materials research.							
DP200102858 Croft, Prof Elizabeth A	This research aims to advance emerging human-robot interaction (HRI) methods, creating novel and innovative, human-in-the-loop communication, collaboration, and teaching methods. The project expects to support the creation of new applications for the growing wave of assistive robotic platforms emerging in the market and de-risk the integration of collaborative robotics into industrial production. Expected outcomes include methods and tools developed to allow smart leveraging of the different capacities of humans and robots. This should provide significant benefits allowing manufacturers to capitalize on the high skill level of Australian workers and bring more complex high-value manufactured products to market.	70,000.00	125,000.00	110,000.00	55,000.00	0.00	0.00	360,000.00
	National Interest Test Statement Embracing and integrating robotics technology is of tremendous importance to Australian industries, which lag behind their international competitors in implementation of robotics-based production, and must advance the use of smart automation while upskilling their workforce. A Boston Consulting Group study estimates that integration of industrial robotics can improve manufacturing output per worker by anywhere from 10 to 30 percent. Utility, acceptance and success of collaborative robotics requires simple to use and effective methods for creating and communicating a shared understanding of collaborative tasks. The expected outcomes of our human-robot interaction tools, frameworks and methods will advance the implementation of human-robot teams. This will allow effective leveraging of the different capacities of humans and robots, resulting in a higher productivity and skill level workforce.							

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DP200102876 Holman Jones, Prof Stacy	This project aims to address increasing discrimination and violence against Australian women by researching how theatre can be used as a socially-engaged laboratory for understanding and improving their lives. The project seeks to generate new knowledge about how women theatre makers craft creative and effective responses to gender-based inequality and oppression. Expected outcomes include a comprehensive feminist analysis and innovative written, digital and performance-based documentation of women's contributions to Australian theatre history and their efforts to address social inequities. It seeks to benefit Australian society by exploring how theatre gives women useful tools for countering inequality and oppression in their own lives.	37,500.00	77,775.50	87,339.00	47,063.50	0.00	0.00	249,678.00
	National Interest Test Statement Gender-based discrimination, harassment and violence continue to affect Australian women. The theatre stage is an ideal laboratory for developing responses to these and other social inequalities. Women theatre makers play a key role in developing creative and effective actions to address gender-based inequality and oppression. This project will document their contributions to theatre, particularly the methods they use to represent women's lives in all their complexity and material reality. The project will deliver useful tools for addressing inequality and oppression in women's own lives, reducing inequality in the Australian community. In addition, the project will develop the evidence-base for creative industry responses to real-world social problems.							
DP200102954 Jakob, Prof Christian	This project aims to uncover the key links in Australia's weather-climate connection by identifying the role weather features play in influencing the slowly varying climate and how changes in one might affect changes in the other. Better describing the two-way connection between weather and climate through an innovative combination of research techniques usually applied to only one of weather or climate will allow for a more insightful assessment of climate model quality. This assessment will support the identification of the most reliable climate models and, by using them, reduce uncertainties in future predictions. Improved predictions of climate in turn will enable better decision making in all sectors of society.	75,000.00	150,000.00	155,000.00	80,000.00	0.00	0.00	460,000.00
	National Interest Test Statement Australia's climate is one of the most variable on Earth and it is changing. To human endeavours, changes in climate express themselves as changes in the weather and it is the consequences of the changing weather that society as a whole has to adapt to. It is therefore of critical importance to understand and predict our changing climate in the context of changing weather. The increased understanding of the weather-climate connection in Australian climate change resulting from this research will have direct practical implications for many sectors of our economy as well as the public. By applying the newly gained understanding from our research in evaluating the ability of the world's climate models to simulate Australia's weather-climate connection, we will provide guidance to their use in downstream applications, such as downscaling, and decision making at all levels of government and industry and in doing so, will contribute to reducing uncertainties in our knowledge of our future weather.							
DP200102985 Nie, Prof Jian-Feng	This project aims to reveal the origin of a new phenomenon that we recently discovered: intrinsically brittle magnesium becomes super-formable at room temperature when its grain size is reduced to about one micron. It will use state-of-the-art atomic-scale characterization and computation to determine the mechanisms underlying the phenomenon, and to explore some as yet uncharted dilute alloy composition territories for unprecedented formability. Expected outcomes are likely to form the scientific basis and a new pathway for designing and developing a new generation of wrought magnesium alloys.	72,500.00	147,500.00	150,000.00	75,000.00	0.00	0.00	445,000.00
	National Interest Test Statement Lightweight magnesium has tremendous potential for energy efficient and environmentally friendly applications. However, it is intrinsically difficult to form at room temperature, preventing its products from lower-cost manufacturing. This project will address this issue by identifying the metallurgical factors that can lead to super-formability at room temperature and without alloying at traditional levels. The outcomes should be a major step in the design and development of a new generation of wrought magnesium alloys that will help the Australian magnesium industry to expand its international market share. The findings will also make major contributions to physical metallurgy of magnesium alloys in the understanding of inter-granular deformation modes and dynamic recrystallization and their effects on super-formability of magnesium alloys.							

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DP200103070 Etheridge, Prof Joanne	This project aims to develop new electron microscopy techniques that will unambiguously determine the elusive structures of photoactive perovskite compounds under static and operational conditions, while correlating crystal structure with solar cell device performance. Photoactive perovskites are promising photovoltaic materials, however, many are sensitive to air and irradiation. This has impeded a huge international research effort to determine their structure reliably at the atomic scale. With these new techniques applied to leading compounds and devices, it is expected this project will reveal the structural effects controlling electrical properties and device performance and so enable the design of superior perovskite photovoltaics. **National Interest Test Statement** Solar cells offer a promising method of generating electricity sustainably. Australia has led the world in the development of silicon-based solar cells, consistently achieving record power conversion efficiencies. Australia has the potential to do the same for upcoming technologies, such as ‘perovskite’ solar cells. These are relatively easy to synthesise, thereby keeping manufacturing costs down. Furthermore, they can be deposited on other layers in tandem with conventional silicon or other solar cell technologies for improved solar cell efficiencies. This project aims to develop new microscopy techniques to examine the structure of perovskite solar cells at the level of atoms, so that the electrical properties of these materials can be understood and engineered for maximum solar cell efficiency and minimum fabrication cost. These new techniques will enable and support research programs across Australia, in other materials, as well as solar cells, and will be available to support nascent perovskite solar cell industries, as they arise.	95,000.00	230,000.00	230,000.00	95,000.00	0.00	0.00	650,000.00
DP200103074 Greening, A/Prof Christopher A	This project aims to determine the molecular and cellular basis of atmospheric trace gas oxidation by bacteria. Bacteria have a remarkable ability to adapt to resource limitation and environmental change by entering dormant states. Our research has shown they survive in this state by using atmospheric hydrogen and carbon monoxide as energy sources. This interdisciplinary project will determine how bacteria achieve this by elucidating the regulation, mechanism, and integration of the three uncharacterised enzymes that mediate this process. Outcomes and benefits include understanding of the processes that facilitate bacterial persistence, regulate atmospheric composition, and in turn support resilience of natural ecosystems. **National Interest Test Statement** This project will improve understanding of how Australian environments will adapt to the impacts of global change. We will determine the mechanisms underlying a key interaction between the soil biosphere and atmosphere that supports human activity. The consumption of atmospheric trace gases allows soil microorganisms to maintain diversity and productivity in the face of environmental degradation. This process is particularly important for Australian agriculture, which is reliant on vulnerable drylands. This process also regulates the composition of the atmosphere, including reducing levels of the major urban pollutant carbon monoxide. By resolving the mechanistic basis of this process, we will able to better understand the resilience of Australian biodiversity to environmental change and improve modelling of the biogeochemical cycles that control atmospheric composition. The project also has potential economic significance given it will characterise two new hydrogen biocatalysts with remarkable oxygen-tolerance; these have utility in the development of fuel cells for Australia's developing hydrogen economy.	74,304.00	164,804.00	174,000.00	83,500.00	0.00	0.00	496,608.00
DP200103219 Currie, Prof Peter D	This application aims to investigates the basis of the fin-to-limb transition, an event that set the stage for the entire tetrapod radiation. This project expects to generate new knowledge concerning the natural history of vertebrates using a multidisciplinary approach that combines paleontology and embryology of unique Australian fauna. While the skeletal changes associated with the move from water to land have been investigated, little is known about the origin of tetrapod limb muscles. This proposal has as an expected outcome, a determination of how limb muscles arose during evolution. This knowledge should provide significant benefits by transforming our understanding of the origins of the tetrapod body plan and our own natural history.	76,000.00	142,500.00	133,000.00	66,500.00	0.00	0.00	418,000.00

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	National Interest Test Statement							
	Evolution is the guiding theory of biology, and yet how it acts to generate distinct morphological innovations remains poorly understood.This proposal tackles one of the fundamental transitions in vertebrate evolution, how limbs evolved from paired fins. This knowledge will provide insight into how evolution acted to produce diversity over 600+ million years, encompassing a period of our own natural history. A further tangible benefit is the development of the elephant shark system, a uniquely Australian "living fossil", as a critical tool for studying early vertebrate evolution. Using this species as well as developing the epaulette shark, another Australian species makes use of Australia natural biodiversity to advance human knowledge and advances Australia standing in International research collaborations. This is also evident in the specific fossil taxa utlised in the proposal which are sourced from unique Australian geographies and present with preservation profiles unique to the GoGo formation of the Kimberly. Thus, this proposal showcases the unique nature of Australian fauna both extant and extinct.							
DP200103293 Pocock, A/Prof Roger D	This project aims to investigate how stem cells are controlled during animal development, by exploring how a specific protein, essential for embryonic development, controls cell fate decisions during the early stages of life. This project expects to generate new knowledge in stem cell biology, embryonic development, and general mechanisms controlling cell fates, using innovative approaches in gene editing and high-throughput imaging. Expected outcomes of this project include enhanced capacity for fundamental stem cell biology in Australia. This should provide significant benefits, such as training of young Australian researchers in frontier technologies, and new knowledge in fundamental aspects of life, including embryonic development.	65,000.00	126,500.00	124,000.00	62,500.00	0.00	0.00	378,000.00
	National Interest Test Statement							
	How genes control the development of an embryo is not fully understood. This project expects to expand knowledge of how developmental decisions at this early stage of life are controlled, and may identify therapeutic targets for future study. Additionally, this work will train young Australian researchers in cutting-edge techniques and will expand this countries expertise in this vital area of genetic research.							
DP200103308 Yuan, Dr Xingliang	This project aims to design an encrypted, distributed, and queryable data store. Distributed data stores are used for a broad spectrum of applications. While creating unprecedented opportunities, long-standing data security and privacy concerns are yet to be tackled. This project expects to propose a new architecture for encrypted data stores, and devise practical query processing functions over encrypted and distributed data records. The intended outcome should bring users confidence for the secure adoption of cloud data storage services and significantly benefit enterprises that demand guaranteed protection on their proprietary data.	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00
	National Interest Test Statement							
	The technologies proposed in this project should mitigate intentional and unintentional data breaches, and provide defence-in-depth data protection for enterprises, organisations, as well as governments. Expected outcomes should also enable Australia to create new cybersecurity-centric sectors, and further promote disruptive technologies such as the Internet of Things, cloud computing, and machine learning in a secure and trustworthy fashion. Apart from economic benefits, the results should ease privacy concerns in society and significantly benefit financial and eHealth services that demand privacy-assured data processing. It will be of widespread interest throughout several communities, including security, databases, distributed systems, and beyond.							
DP200103360 Hutchins, Prof Brett	This pioneering project aims to investigate the range of environmental and sustainability messages communicated by sport media, and how these messages negotiate the dilemma of promoting environmental awareness through events and activities that also generate adverse ecological impacts. By engaging sport media professionals, environmental claims-makers, policy-makers and journalists, this project seeks to deliver valuable knowledge that informs industry decision-making, policy formulation and environmental awareness. The intended societal benefit is a new understanding of how environmental issues are communicated through popular media to large-scale publics, including how tensions in the communication of environmental change are negotiated.	40,551.00	90,684.50	102,625.50	52,492.00	0.00	0.00	286,353.00

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	National Interest Test Statement							
	Sport media is unique in its cross-demographic reach, and is increasingly engaged to communicate environmental issues, such as climate change and sustainability. This is true both of sporting event impacts on the environment, but also in the potential of mass market penetration of sport to communicate environmental messages of stewardship. Understanding the extent to which sport media transforms environmental discourse is important because such discourse influences the decision-making and policies of key actors in social, political and economic systems. This project will provide the first evidence base for how sport media informs Australian practices, policies and environmental discourse. This will reveal how media, commercial and environmental agendas intersect and are understood by Australian media sport professionals, environmental claims-makers and policymakers. Ultimately, the project will lead to new knowledge to underpin environmental policy in sport media organisations.							
DP200103364 Wyres , Dr Kelly L	This project aims to explore metabolic diversity of Klebsiella pneumoniae, a bacterium relevant to the agricultural, veterinary, medical and biotechnology industries. It is expected to reveal significant insights into the biology of this diverse organism via an innovative combination of DNA sequence analyses and metabolic modelling. Expected outcomes include 4500 novel metabolic models and a novel population metabolic framework. This should provide major benefits for understanding bacterial ecology and evolution, and for future studies seeking to optimise industrial processes or prevent disease. It will also directly contribute to building Australia's capacity in computational biology- a key driver of biotechnology innovation.	84,102.00	178,489.00	173,559.00	79,172.00	0.00	0.00	515,322.00
	National Interest Test Statement							
	This proposal is in Australia's national interests because; (i) it will build national research capacity in the growing field of computational biology, producing graduates skilled in computer programming and big data analysis; (ii) it will generate knowledge and resources that will vastly improve our understanding of a bacterium relevant to the Australian agricultural, veterinary and medical industries. This bacterium, Klebsiella pneumoniae, is an important cause of animal and human disease, potentially transmitted via the food chain, infecting thousands of Australians each year with significant morbidity and economic cost. The knowledge generated herein will improve our understanding of K. pneumoniae, and potentially provide a mechanism to identify paths by which the bacteria spreads in the environment and food chain. The results will inform future efforts to design novel therapeutics, control strategies and policies. Hence this work is relevant to the national Science and Research Priorities for health and food.							
DP200103408 Hutt, Dr Karla	This study aims to address a problem of national significance; determining the impact of commonly used environmental toxicants (pesticides) on the fertility and health of female animals, both agricultural and native. This project expects to generate new knowledge in the fields of ovarian biology, female fertility and toxicology by using a combination of mouse and marsupial animal models. The expected outcomes include the establishment of interdisciplinary collaborations and provision of world-class training for staff and students in the field of reproductive biology. This project should provide significant benefits, such as improved chemical management in livestock production and the development of marsupial conservation action plans.	77,545.50	187,524.50	216,710.00	106,731.00	0.00	0.00	588,511.00
	National Interest Test Statement							
	A major neglected environmental issue is contamination from synthetic chemicals. Thousands of tonnes of these chemicals are used in our environment every year. We will develop tractable laboratory-based multigenerational mouse and native marsupial models as a platform to study how these environmental toxicants affect the health and fertility of female animals and their offspring. Specifically, this work will identify how exposure to the widely used pesticide atrazine impacts the ovary and fertility across generations. It is anticipated that the outcomes will be used to update guidelines for appropriate pesticide use in agriculture and the environment, which may improve livestock production and reduce chemical impacts on native species. Improving livestock production has economic benefits. Reducing chemical impacts on native species has environmental benefits.							

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DP200103462 Berry, Dr Richard	The conversion of external stimuli to the interior of a cell is a fundamental process that underpins many unique facets of biology, including cellular movement, nerve transmission, response to hormones and immune recognition. However, the basic mechanism by which such signals are transmitted across cellular membranes is poorly understood. This proposal will seek to bridge this gap in our knowledge by imaging a multi-component “decision-making” machine that controls whether or not the immune system becomes activated. Accordingly, this proposal will provide far-reaching insights into molecular events that are of central importance to the initiation of immunity, and thus will ultimately benefit society via improvements in health.	124,572.50	243,449.00	237,753.00	118,876.50	0.00	0.00	724,651.00
	National Interest Test Statement This proposal will explore the use of novel tools and approaches to study the structure and function of multi-component membrane-embedded receptor. These include sophisticated protein engineering & expression systems, and structural/imaging methodologies (e.g. cryogenic electron microscopy and fluorescent based single molecule imaging). While many institutes around Australia are currently investing heavily in these methodologies, Australia currently lacks the necessary expertise to fully capitalise on these emerging technologies. Thus, this proposal will allow us to build Australia’s research capacity within this area via the training of a new generation of scientists with specialised skills. This will have direct implications for the biotechnology industry, because membrane embedded receptors encompass ~30-40% of the genome and over 70% of drug targets.							
DP200103463 Loveland, Prof Kate L	Aims: This project will study a key molecular switch called IPO5, a protein that is required for cells and organs to form and function normally, and it will reveal how it works. Significance: These experiments will provide the first complete description of how this molecular switch controls the behaviour of a cell across its lifespan. IPO5 is highly conserved, so these studies will be relevant to a wide range of animals. Expected Outcomes: This knowledge will reveal how IPO5 controls formation of sperm by revealing what other proteins it binds to and how this affects cell signaling and responses to the environment. Benefits: This will provide information about potential interventions to control fertility or to repair abnormal cells.	85,000.00	170,000.00	170,000.00	85,000.00	0.00	0.00	510,000.00
	National Interest Test Statement We will be able to predict how changing the levels of the IPO5 protein inside an individual cell will control what that cell does next: does it die? does it change into a different kind of cell? Controlling cell fate and fertility are central to management of diseases and both human and animal welfare. By studying how a protein that is central to both of these, the outcomes from this project will help us learn how the environment affects fertility and health, for the benefit of agriculture and biomedicine. This information can be applied to design interventions that will reduce and enhance fertility, and it can be applied to reduce the incidence of diseases caused by malfunction of the immune system or inappropriate growth of cancer cells. Our highly experienced and internationally recognized team of experts will train students and postdoctoral researchers, increasing the workforce of highly skilled individuals with advanced capacity in the international leading research methods in which the investigator team excels: Proteomics, cell and molecular biology, bioinformatics and reproductive biology.							
DP200103469 Joyce, Dr Richard J	Populist political movements pose a threat to international law because they oppose supranational authority. And yet, populism and international law are grounded in a common source – national sovereignty. The relationship between them is poorly understood. This project will undertake new interdisciplinary research in law and political philosophy to provide a new account of that relationship, and to establish new ways of thinking about how to advance the project of international law in ways which are both commensurate to global challenges and consistent with democracy and political freedom. This account will contribute to wider debates about the future of the international legal and political order in times of uncertainty and crisis.	32,000.00	68,250.00	70,250.00	34,000.00	0.00	0.00	204,500.00
	National Interest Test Statement This project will contribute to Australia's national interest through economic, strategic and social benefits to the Australian community. It will provide new insights into one of Australia's major strategic challenges by articulating the nature of the threat to the international legal order posed by populist political movements in Australia's two longest-standing and important strategic allies, the United States of America and the United Kingdom, and those states' rejection or abandonment of international key institutions and treaties. As a middle power which is both committed to, and relies on, a rules-based international order, the Australian community (academic, policy and general) must have the benefit of research into how that system can be maintained and improved in the face of threats to its operation. This is relevant to all policy areas which are influenced by international cooperation, including security, migration, the environment and trade.							

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DP200103509 Fornito, Prof Alexander	The human brain is an extraordinarily complex network of interconnected cells. This project aims to use mathematical modelling and brain imaging to uncover key principles of network wiring in the human brain. Using an interdisciplinary approach that combines elements of neuroscience, genetics, physics, and psychology, the project will result in a new, rigorous framework for testing competing theories of brain development, the identification of key wiring principles for developing brains, and an understanding of how these principles shape behaviour. This work will shed new light on the developmental processes that underlie human behaviour and disease.	85,402.00	168,975.00	169,378.50	85,805.50	0.00	0.00	509,561.00
	National Interest Test Statement The brain is arguably the most complex system known to man, but the mechanisms that give rise to this complexity remain unclear. We will develop a mathematical framework for testing different explanatory models of brain complexity, thereby identifying the wiring principles that govern brain organisation. This framework will have significant implications for understanding human psychology, health, and brain disorders. Over the longer term, the development of precise, mathematical models of wiring principles for brain networks can be used to inform the design of artificial intelligence algorithms and computer chip design.							
DP200103557 Chadha, Dr Monima	This project aims to provide a comprehensive philosophical and cognitive model of the sense of self. The project combines Abhidharma-Buddhist philosophy and cognitive sciences to propose a new model of subjectivity and agency, without postulating the existence of subjects or agents. The expected outcome is a new understanding of the mind as the locus of agency and moral responsibility. In addition, this projects opens up new opportunities for enhanced cross-cultural capacity and cross-institutional collaboration. The anticipated benefit is cross-cultural research training and providing a new theoretical foundation for the widespread practice of mindfulness meditation.	33,797.00	82,264.50	93,269.50	44,802.00	0.00	0.00	254,133.00
	National Interest Test Statement The project will lead to a better understanding of mindfulness meditation, which is very popular in Australian homes and workplaces but whose actual efficacy for mental well-being is still debated. It will also educate Australians about the Buddhist origins of mindfulness. This has the capacity to facilitate cross-cultural understanding and lead to social benefits in areas such as interfaith dialogue and general strengthening of cultural ties between Australia and one of our most important global cultural and trade partners, India.The project advances the understanding of mind and consciousness without a self and has the potential to transform debates and investigations of the sense of self, which will benefit philosophical, cognitive and psychological communities in Australia. It will also enhance Australia's cross-cultural research training, and our international reputation for inclusive and cutting-edge research.							
DP200103589 Abud, A/Prof Helen E	This project will define the key signals that promote cell division in the stem cells which produce the inner epithelial lining of the gut. This fundamental knowledge is of significance as it will provide information about how key signals are delivered to promote repair of injury to this key cell layer. The gut is a vital organ conserved across species that is prone to injury as it is exposed to a very harsh environment of bacteria and the products of food digestion. The outcomes of this project will provide an understanding of development and regeneration of the epithelial lining and key signals that may augment repair. The future benefits include improved health outcomes for animals and humans and potential economic benefits.	85,000.00	170,000.00	170,000.00	85,000.00	0.00	0.00	510,000.00
	National Interest Test Statement This research project has benefit to Australia as it will provide knowledge about how stem cells in the gut maintain the integrity of the cell layer that prevents bacteria and the by-products of food entering the body but also acts to absorb nutrients. This project will support the training of students and early career researchers and generate knowledge of importance to scientists worldwide and of interest to the Australian community. The future applications of this work could potentially lead to strategies to improve the health of animals and humans and could give insights into products that may contribute to commercial applications.							

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DP200103637 Kile, Prof Benjamin T	The human body is powered by mitochondria, microscopic components of living cells that make the energy they need to function. Mitochondrial damage is linked to a wide spectrum of human diseases, from devastating syndromic illnesses to neurodegeneration and autoimmunity. This project is focused on 1) how stresses such as cancer therapy or infection cause mitochondrial damage, and 2) understanding the biological processes that are triggered inside the cell as it tries to recover. It will give a much greater understanding of mitochondrial damage at the microscopic level, and has the potential to unlock new avenues of investigation into the causes of inflammatory and immune disorders.	90,000.00	177,000.00	175,000.00	88,000.00	0.00	0.00	530,000.00
	National Interest Test Statement Progress in the fight against disease varies wildly depending on the condition. For example, in blood cancers, extraordinary advances are being made. New drugs are being approved every year. In contrast, in neurodegenerative conditions like motor neuron disease, we have nothing. No treatments, not even an understanding of what the causes are. This project addresses a fundamental question in cell biology: how cells respond to damage, and how this influences their survival and subsequent function. The system we are studying is implicated in many diseases, potentially linking the innate immune system with conditions as diverse as Parkinson's and arthritis. In addition to generating the first clear picture of this basic biological process, this project will further the development of Australia's leading-edge nanoscopic imaging research technology, linking the national research community with the global revolution in this field.							
	Monash University	5,866,625.00	12,180,187.00	12,229,739.00	6,046,177.00	130,000.00	0.00	36,452,728.00
RMIT University								
DP200100005 Tari, Prof Zahir	Almost all chip vendors are producing new hardware accelerators by combining several units into a single main-board, and therefore making the execution of parallel and distributed run-time primitives not efficient/scalable. This project aims to develop innovative ways to building incremental and iterative computations over massive data sets in a cluster of heterogeneous systems. This will provide a significant reduction of performance bottlenecks when running heavily distributed data-driven applications. Expected outcomes will include resource management algorithms that optimise performance at large scale. The project will benefit many areas, including running stateful iterative stream-based data-analysis applications in data centres.	62,500.00	125,000.00	125,000.00	62,500.00	0.00	0.00	375,000.00
	National Interest Test Statement This project will develop new technological solutions that will help build smarter and more sustainable IT infrastructure, such as data centres, by substantially reducing their energy consumption. The outcomes will benefit Australian governments and businesses who rely on this infrastructure by significantly reducing computational costs and enabling reliable processing of high volumes of data in real-time. The proposed innovative solutions will provide a competitive edge to Australian industries by improving the way large-scale computer systems deliver reliable, real-time services.							
DP200100126 Sriram, Prof Sharath	We constantly seek faster, lighter, and energy-efficient devices. This project will create a new class of electronic devices, re-inventing vacuum tubes that enabled electronics almost a century ago, and scaling them down to the nanoscale realm. The devices are termed vacuum channel transistors, and transistors are the critical functional element of all electronics. At the extremely small size scales for nanoelectronics, the charge carriers travel very short distances. This avoids collisions enabling extremely high-speed transport. Such a virtual vacuum environment can potentially enable electronics thousands of times faster than the current silicon-based technology, providing a solution to the challenges faced by the semiconductor industry.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00

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	National Interest Test Statement							
	Current electronics is based on silicon, a material that has reached its limits in speed and efficiency. This project will demonstrate an alternative technology removing reliance on silicon. It intends to create a nanoscale electronic device that can be thousands of times faster than silicon-based electronics. The result will be an electronic technology that can be faster, potentially energy-efficient, and lower cost to manufacture. Design and creation of this technology will generate significant Australian intellectual property, research training for students and early-career researchers, and communicate outcomes to the broader community. This can position Australia as a key player in the multi-billion dollar electronics industry, complementing investments in quantum technologies, attracting local investment for joint technology development and research translation. Research training and outreach will provide social and cultural benefits, with an emphasis to be placed on diversity of project personnel.							
DP200100204 Lee, Prof Adam F	This project aims to develop and implement new strategies to create, visualise, and apply multifunctional catalysts in which the location of (and communication between) active sites is precisely controlled to unlock ultraselective cascade reactions. Catalysis is a key enabling technology contributing to 35 % of the global economy, with new catalysts underpinning socioeconomic advancement through fuels, chemicals, and pharmaceuticals production, and environmental depollution. This interdisciplinary project expects to discover next-generation nanoengineered catalysts, and to develop innovative energy- and resource-efficient chemical processes, which should offer significant benefits to Australian science, industry, and the environment.	93,750.00	163,750.00	140,000.00	70,000.00	0.00	0.00	467,500.00
	National Interest Test Statement							
	This project will underpin the sustainable manufacturing of low carbon fuels and high value chemicals from underexploited waste resources, with the potential to enhance Australian energy security, and to strengthen and diversify the Australian agricultural and chemical manufacturing sectors through new investment opportunities and associated job and wealth creation. Cleaner routes to the production of renewable transport fuels and high value chemicals, including renewable and biodegradable polymers and plastics, from industrial, municipal, and agricultural waste, will reduce water and energy consumption and help to protect and clean-up rural and urban environments, and to mitigate marine microplastic pollution.							
DP200100313 Wilson, Prof Karen	This project aims to develop next-generation solid acid catalysts for energy- and atom-efficient transformations of waste biomass and carbon dioxide to sustainable chemicals and fuels. Catalysis is a transformative technology, key to both life and lifestyle, contributing to 90% of chemical manufacturing processes and >20% of all industrial products, and will be a key enabler for the emerging Australian bioeconomy. The expected development of new high performance catalysts for the production of renewable transportation fuels and sustainable chemical feedstocks will underpin commercially viable low carbon technologies using waste resources, and should provide significant benefits to Australian science, industry, and the environment.	90,000.00	175,000.00	165,000.00	80,000.00	0.00	0.00	510,000.00
	National Interest Test Statement							
	Catalysis is a key enabling technology, contributing $15 trillion to the global economy, and underpinning sustainable approaches to the food-energy-water nexus, environmental remediation, and mitigating climate change. The proposed research will provide new cheaper, energy efficient routes to renewable transportation fuels, sustainable chemicals, and high performance materials. The research will be of benefit to the Australian agricultural sector and emerging bioeconomy, stimulating new jobs and commercial opportunities, aligning with National Food Waste and Forest Industry strategies, and contributing to the resilience of Australia’s liquid fuel supply chains. This research will also broadly benefit the environment through the establishment of cleaner routes for chemical manufacture, which will reduce emissions of toxic waste water, atmospheric pollutants and carbon dioxide, directly impacting on quality of life.							

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DP200100549 Nazem, A/Prof Majidreza	This project aims to conduct a fundamental study of a challenging class of geotechnical problems in which soil undergoes large strains and rapid deformations. The main goal of this project is to discover the fundamental principles governing soil behaviour at large and fast deformation rates. The expected outcomes are an innovative testing device for site investigation purposes, and robust solution and computational procedures for analysing a wide range of problems in soil dynamics. This should benefit government and engineers by providing safer and more cost-effective strategies for the design, construction, and maintenance of Australia's infrastructure.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
	National Interest Test Statement Australia’s infrastructure plays a major role in the functioning of its economy, its national welfare, and its development. The importance of infrastructure has been emphasised in the 2018-2019 Australian budget, with the allocation of $75 billion for investment over the next decade. Considering this huge investment, even small percentage savings resulting from scientific research will lead to positive absolute returns. The outcomes from this project will provide significant economic, social and environmental benefits for Australia, as summarised below: • Development of models and methods that will be made available to researchers and engineers, leading to safer and more economic design of infrastructure and soil related problems, with highly potential military applications. • The availability of robust software that can tackle a wide range of infrastructural problems. • Attracting international interest by the development and calibration of a new testing device, and the development of advanced computational methods, thus enhancing Australia’s excellent international reputation in geotechnical engineering.							
DP200100612 Gelmi, Dr Amy	This Project aims to determine how human stem cells differentiate into different cell types in response to electrical and mechanical stimulation on a conductive biomaterial platform, and to use this knowledge to develop a custom built bioreactor. It expects to generate new insight into the mechanisms that control stem cell fate using innovative single cell measurements, and will deliver a bioreactor capable of using these mechanisms for large scale stem cell differentiation. The expected outcomes are a significant advancement in knowledge in the field of tissue engineering and more efficient methodology for patient-derived stem cell therapy. This will provide new pathways to improving stem cell therapy for tissue engineering applications.	68,500.00	134,500.00	132,000.00	66,000.00	0.00	0.00	401,000.00
	National Interest Test Statement This Project will develop a method of improving the efficacy of culturing patient derived stem cells for a targeted cell phenotype, and will have long term impact on the use of stem cell therapy for tissue engineering in biomedical engineering and regenerative medicine. The Project has great potential to benefit stem cell research and clinical trials in Australia; the societal benefit of stem cell therapy for tissue engineering lies in the improvement of quality of life for a wide range of Australians. Using the patient's own stem cells to produce new tissue to repair or replace damage caused by non-fatal medical situations, such as bone cancer or a heart attack. In addition, the global market for regenerative medicines market is expanding rapidly, and this Project demonstrates Australia's ability to contribute to the international biomedical engineering market.							
DP200100631 Wu, Prof Yufei	This project aims to develop a novel structural system leading to more economical concrete bridge construction by utilising a customised structural fuse. A significant margin of safety is required in structural design to account for accidental over-loading and to reduce the risk of structural collapse. Such a margin leads to more material usage. Incorporation of a fuse into the structure that is triggered upon over-loading will cause a safer failure mode and prohibit further increase of loading, both of which result in a reduced structure without undermining safety. The project is expected to advance structural theory, and also provide significant benefits to the construction industry via cost reduction and more eco-friendly constructions.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00

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	National Interest Test Statement The project will develop a new 'fused' bridge structure that will lead to not only safer bridge structures but also more economical construction. Additionally, incorporation of the new fuse in a structure will allow more durable and high-strength advanced composite materials to be utilised more efficiently and effectively, and in a safer manner. The use of non-corrosive composite materials will further facilitate the direct use of an emerging sustainable construction material, namely seawater and sea-sand concrete, without desalination. These benefits will lead to short-term construction cost saving and significant reduction in long-term maintenance and repair costs of bridge structures. As a result, contribution will be made to cutting the carbon footprint generated by the construction industry, thus assisting Australia in meeting its emission reduction target by 2050 as required by the Climate Change Act 2017. The technology developed from this project will lead to advances in structural design philosophy and construction practices for the construction industry.							
DP200101197 Yu, Prof Xinghuo	This project aims to create a breakthrough switching dynamics approach and new technology to speed up finding optimal solutions. It will develop a distributed switching dynamics based optimisation scheme for global optimisation problems in industrial big-data environments where timely decision making is required. It will result in a practical technology for industry optimisation problems such as economic energy dispatch in smart grids and optimal charging and discharging tasks in a large network of electric vehicles, helping Australian power industry improve efficiency and security, as well as training the next generation scientists and engineers for Australia in this emerging field.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
	National Interest Test Statement This project will pioneer a cutting-edge switching dynamics approach to address the global optimisation problems in industrial big-data environments which are fast changing and uncertain. It will result in a flexible distributed global optimisation technology scalable to any size of optimisation problems to help timely decision-making. This will help reduce costs of Australia's industrial sectors such as energy by optimising operations and improving reliability. It will also produce the next generation scientists and engineers specialising in this technology who will lead the important applications to industry and society.							
DP200101199 Yu, Prof Xinghuo	This project aims to develop a breakthrough methodology and new technology to analyse and integrate large-scale network systems, such as power grids, that involve large networks of components with switching connections. The project expects to create a new theoretical framework to tackle the challenges arising from switching topology resulted from switching connections, and methods to understand their behaviours and design intervention strategies to achieve optimal outcomes. The expected outcome is a practical technology for industry applications, such as smart power grids. This should increase the reliability and resilience of the electricity networks against faults and cyber attacks.	80,000.00	165,000.00	170,000.00	85,000.00	0.00	0.00	500,000.00
	National Interest Test Statement This project will pioneer a cutting-edge technology for the analysis and synthesis of complex network systems with switching topology, such as smart grids, to achieve optimal performance. It will result in a methodology to understand and control of these systems helping develop smart strategies to enhance resilience against faults and cyber attacks and deliver efficiency. This will help increase the competitiveness of Australia's industrial sectors such as energy. It will also produce the next generation scientists and engineers specialising in this technology who will lead the important applications in Australia.							
DP200101248 Baratchi, Dr Sara	This project aims to study the effect of the stiffening of ageing arteries in endothelial cells. It explores the changes that occur in endothelial cells using a unique microfluidic technology with tuneable wall stiffness to mimic the biophysical and biochemical properties of ageing arteries. The expected outcome is the identification of the cellular mechanisms that control endothelial responses to arterial stiffening. This should provide the fundamental knowledge required to assist in the development of new therapies to tackle age-related conditions such as cardiovascular disease and dementia.	75,000.00	165,000.00	165,000.00	75,000.00	0.00	0.00	480,000.00

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	National Interest Test Statement							
	Arterial stiffening of ageing adults is a major contributor to cardiovascular diseases and dementia, affecting thousands of Australians and costing Australia's healthcare system millions of dollars annually. Treatment of such diseases requires a much better understanding of the fundamental biology of arterial stiffening, which in turn requires new, advanced experimental tools to mimic the conditions occurring in stiffened vessels. In this project, we will produce a bio-mimetic model of a blood vessel with tunable stiffness, to explore the response of the endothelial cells to arterial stiffening at the cellular and molecular level. The knowledge generated will underpin efforts to develop new treatments to tackle age-related diseases such as heart attacks, stroke and dementia.							
DP200101441 Zhang, A/Prof Xiuzhen	The project aims to detect fake news early to minimise the negative impact of false information. This project expects to devise novel solutions to address technical challenges for detection of fake news with scarce signals. Expected outcomes of this project include a suite of data mining and machine learning models for identification of fake news from the social media stream, prediction of user propagation of false information as well as recommendation of truthful news to counteract adversarial fake news. This project should generate technologies that enhance the integrity of the online echo system and benefit media providers and online population within Australia and across the world.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
	National Interest Test Statement							
	Australia has become a digital society, and the public always seek for news from social media platforms. Statistics show that in 2018 about 88% of the Australian population were active internet users and 79% were social media users. The wide spread of fake news becomes one of the biggest threats to the order of the Australian and international societies. We will devise computational approaches to early detection of fake news as well as recommendation of truthful news to counteract fake news. Our work directly falls within the strategic area of "Cybersecurity" with the goal of enhancing the integrity and credibility of online information. The technology produced in this project has wide social and cultural benefits to the Australian community, and will directly benefit Australian government agencies and companies that provide social media surveillance services for law-enforcement and other applications.							
DP200101808 Potts, Prof Jason D	This project aims to analyse the impact of cryptocurrency technology on taxation and the provision of public goods in Australia. The project will identify the historical relationship between money technologies and public finance, examine the impact of cryptocurrencies in relation to the modern state, and investigate the potential of utilising cryptocurrencies in the provision of public goods. The outcomes of the research will expand theoretical and practical understanding of public finance in a world of cryptocurrencies. The project findings will provide guidance to Australian and international policymakers to prepare for potential disruptions to taxation and public goods provision.	61,586.00	133,017.50	150,184.00	78,752.50	0.00	0.00	423,540.00
	National Interest Test Statement							
	Cryptocurrencies are likely to disrupt the relationship between money, taxation and public goods provision. The project seeks to understand how cryptocurrencies will affect government service provision. Through historical and theoretical analysis, this project will contribute to an understanding of how policy responds to cryptocurrencies as they evolve. The project will benefit Australian policy-making practices by guiding parliament, government and regulators on responses to cryptocurrencies, including new approaches to fund public goods.							
DP200102152 Menicucci, Dr Nicolas C	This project aims to investigate the effects of a fundamental minimum length on the nature of gravity and on how accurately we can make measurements in our world. The key challenge is to combine our best theories of fundamental physics to model what happens at ultra-short distances. This project will generate new knowledge at this interface by using a novel approach inspired by information theory. The expected outcomes are new connections between fundamental limitations on measurements, the nature of gravitation, and ultra-small-scale quantum physics. The benefit of this work is breaking the logjam in answering the most important open question in all of physics: how to unite quantum theory and gravitation.	78,000.00	156,000.00	160,000.00	82,000.00	0.00	0.00	476,000.00

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	National Interest Test Statement							
	Breakthroughs in our understanding of the laws of nature have historically revolutionised our technological capabilities and our understanding of the universe. The greatest opportunity for another such revolution at the current frontier of fundamental physics is the challenge to unify quantum theory and general relativity. Therefore, this effort is of broad interest to scientists and the general public in Australia and around the world. This project will leverage Australia's research strengths in quantum theory, and in particular, in the field of quantum information theory, to tackle this important challenge. Along the way, this work will elevate Australia's global scientific profile by strengthening the links between high-performing Australian universities and the powerhouses of leading research in Canada and elsewhere around the globe. The students involved in this project will take part in cutting-edge scientific research and interact with leading international scholars. This rigorous training will prepare them for future careers in quantum science and information technology.							
DP200102190 Xie, Prof Yi-Min (Mike)	This project aims to establish a new approach to designing and fabricating complex connections in spatial structures by taking advantage of latest technologies in topological optimisation and additive manufacturing. The project intends to develop new optimisation algorithms considering special constraints of additive manufacturing and to determine a cost-effective process for fabricating large metal connections. Expected outcomes of the project include a new methodology and an advanced digital design tool, validated by experiments, for designing and fabricating efficient structural components. This should provide significant benefits to the construction industry in terms of performance enhancement, weight reduction and waste minimisation.	59,050.00	124,640.00	130,217.00	64,627.00	0.00	0.00	378,534.00
	National Interest Test Statement							
	The new design and fabrication technology established from the project will significantly enhance the performance and reduce the weight and cost of complex structural connections. This will make Australian designers and manufacturers more competitive globally, resulting in new jobs and export opportunities in construction, manufacturing and engineering industries. The research will take advantage of latest technologies in topological optimisation and additive manufacturing, which will enable us to create innovative and efficient structural components that would be impossible to realise using traditional methods. The advanced structural optimisation software developed from the project will be licensed to various design firms around the world, which will bring direct economic benefit as well as new opportunities for Australian researchers and designers to collaborate with their international peers. The project will also provide an excellent opportunity for mentoring and training early-career researchers and postgraduate students in a national Science and Research Priority area, namely Advanced Manufacturing.							
DP200102612 Mueller, Prof Florian	From the beach to the pool, aquatic play is key to Australians' quality of life and advances physical, mental and social wellbeing. This project harnesses our increasing use of interactive technology (such as wearables) to develop the world's first design theory on interactive aquatic play. The project creates and evaluates three inspirational aquatic play prototypes, advancing confidence in water skills, self-expression through movement and employment of safe practices to enrich Australian's physical engagement with water. Digital media developers, government interventions and wellbeing groups can use the derived design knowledge to leverage digital technology and aquatic interactivity to foster Australians' physical engagement with water.	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00
	National Interest Test Statement							
	Drawing on Australia's strong affinity with water while harnessing Australians' increasing use of interactive technology, this research provides the world's first design understanding for interactive aquatic play in order to foster Australians' physical engagement with water. This understanding will: help developers create play and sports equipment for self-expression through movement to promote physical activity in and around water, supporting the digital media and sports industry; aid researchers in evaluating technology-augmented water-based exercise programs in uses such as rehabilitation; and guide community groups, government organizations and wellbeing advocates in utilizing digital technology to create compelling interventions to advance confidence in water skills and employ safe practices around water. This research provides the first design understanding of how to harness Australians' increasing use of digital technology to support physical engagement with water so that more Australians profit from the physical, mental and social wellbeing benefits associated with water-based activity.							

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DP200102666 Ma, Prof Dr Qian	This project aims to research and develop a novel methodology for the design and 3D printing of micro-architectured intricate metal lattice structures that can markedly expand the boundaries of both metal property space and structural forms. This will be achieved by harnessing the synergies across topology design, manufacturing optimisation, and in-situ microstructure control. The expected outcomes are a novel milestone methodology that will benefit Australia by enabling a new wave of innovation in materials design and 3D printing, and a new class of lightweight intricate metal lattice structures that potentially offer exceptional mechanical and/or biological properties for near-term commercial applications.	73,000.00	150,000.00	155,000.00	78,000.00	0.00	0.00	456,000.00
	National Interest Test Statement Advanced manufacturing is an Australian Science and Research Priority. This project will contribute to the practical research challenge “specialised, high value-add areas such as high-performance materials, composites, alloys …” by researching and developing a new design methodology for 3D printing of advanced metal lattice structures that perform to their maximum efficiency in terms of strength, flexibility and durability. These lightweight materials are ideally suited for niche applications in the energy, defence, aerospace, and biomedical industries. The project will generate valuable IP, which has the potential to lead to new commercial products through existing and new partnerships with small to medium Australian enterprises. Examples of specific near-term applications include advanced titanium lattice structures that are light, rigid, strong and corrosion-resistant to meet the requirements of high-performance defence vehicles, and novel bone-compatible titanium lattice implants, which are important to the national interest as one in every 200 Australians undergoes a bone replacement surgery each year.							
DP200103501 Bekessy, Prof Sarah A	This project addresses the profound challenge of reconciling development and biodiversity conservation by developing an alternative to the pervasive, yet unsuccessful, biodiversity offsetting approach. It will generate new knowledge in the areas of novel ecosystem function, land use optimisation and conservation attitudes. Key project outcomes will be a new framework for biodiversity onsetting, tested against environmental and social feasibility metrics, and new biodiversity evaluation methods for novel habitats. The project will provide environmental and economic benefits by reversing the ongoing decline in biodiversity from habitat loss and driving innovation in environmentally destructive industries that are vulnerable to climate change.	78,403.00	155,143.50	158,124.50	81,384.00	0.00	0.00	473,055.00
	National Interest Test Statement By requiring proponents to demonstrate how they will retain, protect, restore and improve biodiversity on their site, onsetting will drive creative thinking and much-needed innovation within industry. Furthermore, onsetting should help to drive development away from remnant vegetation and into already highly modified areas where onsite gains are feasible. Industry should benefit through the delivery of greater certainty; offsets, in contrast, are highly contentious and have led to major project delays. Two case studies will demonstrate the broader benefits to society, including housing developments that are more liveable and resilient to climate change and agriculture that will support more biodiversity which underpins ongoing food security.							
	RMIT University	1,224,789.00	2,457,051.00	2,460,525.50	1,228,263.50	0.00	0.00	7,370,629.00
Swinburne University of Technology								
DP200100419 Farmer, Prof Jane C	This research will use data from online communities to identify roles they do, and could play, in rural resilience. It uses social media analytics and spatial methodology to taxonomise and map service topics and social resilience from online communities. Governments call for rural service innovation. To date, robust evidence about online versus local services needed, is lacking. This is partly due to lack of data about diverse consumers' priorities and gaps. Social media could offer latent insights, but ethical methodology producing useful de-identified policy insights has been lacking. This study exemplifies applying social media data analytics at scale to address policy problems and will produce up-to-date co-designed data use guidelines.	45,572.50	121,283.00	153,324.00	77,613.50	0.00	0.00	397,793.00

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	National Interest Test Statement							
	The study provides social benefits as it informs investment in online communities by governments, NGOs and service providers through establishing evidence about whether, when and how these online services enable rural resilience, a national social challenge. The study engages rural people in a case study of social data science that can inspire entrepreneurial ideas about deploying data science to grow rural economies. It thus addresses a gap in rural data literacy cited by CSIRO as hindering growth of rural jobs involving data and technology. The project will advance Australian social media analytics capability by demonstrating how they can be used for social good and to support the design of up-to-date ethical data use guidelines. The project offers economic benefits by informing design of more targeted and thus efficient rural services. Social innovation and rural policy development is currently hindered by gaps in data about citizens' priorities and their experiences of service gaps, filled by this study.							
DP200100442 Todd, Prof Billy D	We will investigate the molecular level design of friction modifiers for a new generation of industrial lubricants. The goal is to dramatically reduce friction between moving mechanical parts, hence increasing energy efficiency in machines and reducing global greenhouse gas emissions. We will design and test these new friction modifiers by a combination of theoretical and computational methods based in statistical mechanics and nonequilibrium molecular dynamics and directly compare results with experimental measurements. Our investigations will pave the way to develop new cost-effective friction modifiers without the need for traditional and costly trial and error laboratory based experimentation.	70,000.00	140,000.00	135,000.00	65,000.00	0.00	0.00	410,000.00
	National Interest Test Statement							
	This project aims to develop new and powerful predictive technologies to improve machine lubrication and minimise energy losses to the environment due to frictional heating. The work, based on designing at the molecular level a new generation of friction modifiers for lubrication, will help to significantly lower greenhouse gas emissions whilst simultaneously improving the efficiency of industrial machinery and vehicle transportation. By doing this, the technologies developed from this project can benefit the economy by significantly reducing the cost of operating industrial and transport machinery in a way which can substantially reduce carbon dioxide emissions.							
DP200100886 Xiang, Prof Yang	Smartphones have become increasingly ubiquitous in people's everyday life. However, it was reported that one in every five Android applications were actually malware, considering that Android has taken 88% market share of mobile phones. As an effective technique, machine learning has been widely adopted to detect Android malware. However, recent work suggests that deliberately-crafted malware makes machine learning ineffective. In this project, we propose to develop a series of new techniques, such as 1) Android contextual analysis, 2) wrapper-based hill climbing algorithm, and 3) ensemble learning, to solve this problem. The outcomes will help Australia gain cutting edge technologies in adversarial machine learning and mobile security.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
	National Interest Test Statement							
	Australia is a remarkably cyber-dependent country, where securing cyberspace is a national priority. The capability that will be gained through this project is essential to our national cybersecurity and stability. The techniques developed in this project will safeguard Australian infrastructure for information communication, particularly the mobile operating system 'Android' that many Australians use every day, by enhancing the currently vulnerable classification based on machine learning. Billions of dollars have been spent to recover from the damage caused by mobile malware due to the ubiquitous use of mobile devices. This project has the potential to stop the adversarial problem in mobile malware detection, and prevent large financial losses in people, companies, organisations, and governments.							
DP200101394 Barraket, Prof Josephine	This project aims to clarify the institutional and cross-sectoral conditions needed for successful implementation of emerging social procurement policy reforms; these seek through public spending to increase employment and business opportunities for people experiencing social exclusion. Via a mixed-methods comparative study in the leading jurisdictions of Victoria and Scotland, the project will extend scholarly knowledge of implementing policy reforms that rely on government and non-government actors working together in new ways, and practical understanding of what is needed to realise social procurement policy goals. This will contribute to effective public expenditure and ultimately help redress the societal consequences of exclusion.	47,966.00	97,663.50	103,263.50	70,602.50	17,036.50	0.00	336,532.00

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	National Interest Test Statement							
	Since 2015, Australian governments have committed billions to improving employment and business opportunities for marginalised people through social procurement, with a limited blueprint for implementing this significant policy reform. This project will generate essential knowledge to support effective implementation - and, thus, effective outcomes - of this major public reform agenda. It will improve practical understanding of how social procurement commitments can be embedded by governments, corporations and social purpose businesses by shedding light on the factors for successful implementation. In so doing, this study will contribute to increasing employment and business activity of those who experience significant barriers to economic participation. It will thus increase our national productivity and reduce the public costs - currently $10B p.a. in welfare spending and at least $40 billion in unrealised productivity - of un(der)employment. The project will also yield insights relevant to implementing other policy reforms that involve active participation of organisations from across sectors.							
DP200102102 Cooke, Asst Prof Jeffrey	This Project aims to progress a novel collaboration of worldwide facilities operating at all-wavelengths to discover and rapidly follow up the fastest bursts in the Universe (those lasting only milliseconds to hours). This Project aims to increase the program's scientific output that searches an unexplored time regime and aims to uncover new phenomena and physics. The challenges of 'real-time' identification of the fast-fading events, including supercomputer data processing and sophisticated data visualisation and sonification techniques, offer an ideal platform to test and accelerate Big Data analyses in science, medicine, and industry, and increase public STEM participation, including the blind and visually-impaired community.	80,000.00	155,000.00	150,000.00	75,000.00	0.00	0.00	460,000.00
	National Interest Test Statement							
	The Project will continue a newly established successful program to search an unexplored time regime that aims to significantly advance knowledge regarding the physics and nature of the fastest explosions in the Universe. The Project, led by Australia, leverages an immense worldwide collaboration of cross-discipline and sub-discipline communities, top-tier universities, along with over 50 astronomical facilities toward a common scientific goal, with the aim to place Australia as the world leader in this burgeoning research area. The nature of the Project provides an ideal platform for 'real-time' testing and advancement of data science techniques that have direct applications in the medical field, industry, and all science research programs that transfer and process Big Data and that require fast and multi-parametric data analysis. The Project aims to advance our web-based tools and citizen science program, that will enable young scientists, the general public, and the blind and visually-impaired communities to participate in scientific research and discovery and to improve their STEM career employability.							
DP200102243 Deller, A/Prof Adam T	This project aims to capitalise on the dawn of the era of gravitational wave astronomy by studying the radio afterglows that result from gravitational wave merger events in minute detail. By comparing ultra-high resolution images to sophisticated computational models, we anticipate recovering information about the merger events that cannot be obtained from the gravitational wave data alone. In doing so, we expect new insights into not just of the extreme and unique physics in the aftermath of a violent neutron star merger, but also about the fundamental nature of the Universe, namely the speed at which it is expanding. This knowledge will provide significant benefits to astronomers studying the Universe at all wavelengths.	62,500.00	131,000.00	135,000.00	66,500.00	0.00	0.00	395,000.00
	National Interest Test Statement							
	The proposed research has the potential to answer one of the most fundamental questions known to humankind: what is the nature of the Universe? By revealing how fast the Universe is currently expanding, this project has the potential to inspire a generation of students to study in STEM, a highly desirable outcome given the future needs of Australia's workforce. The results of our project are perfectly suited to emerging visualisation technologies such as virtual reality and augmented reality, which can used to connect more effectively with the Australian public and potential students. Moreover, our data will also provide an excellent testbed for the development of scientific visualisation on these platforms, which could then be applied to other data-intensive science and industrial fields. Finally, by highlighting the excellence of Australia's research facilities in astrophysics, we can raise the profile of Australia as a destination for doctoral and postdoctoral astrophysics research and attract and retain the best and brightest researchers (domestic and international) to Australian institutions.							

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DP200102491 He, Dr Qiang	This project aims to deliver a framework and a suite of approaches for cost-effective app service management in the edge computing (EC) environment facilitated by the 5G mobile network. Edge computing offers great promises for rapidly advancing mobile and IoT apps in many active domains in Australia, e.g., self-driving cars, medical services, etc. Using a variety of optimization techniques and game theory, this project attacks the new challenges in the deployment, delivery and adaptation of app services in the EC environment. The outcomes of this project will significantly promote new mobile and IoT apps over Australia's 5G mobile network by allowing app vendors to manage their services cost-effectively with ease in the EC environment.	50,000.00	115,000.00	130,000.00	65,000.00	0.00	0.00	360,000.00
	National Interest Test Statement With the world's first 5G precinct in Gold Coast, Australia is one of the few countries around the world that are leading in the rollout of 5G mobile network. This makes Australia a land of opportunities for advances in conventional and new mobile and IoT apps, e.g., self-driving cars, healthcare, etc. From the app vendor's perspective, the major obstacle to their services in the edge computing (EC) environment facilitated by 5G is how to manage their applications in a cost-effective manner. As a result, this project will produce a new and highly-accessible framework with integrated approaches to assist app vendors in deploying, delivering and adapting their applications in the edge computing environment over the 5G mobile network. The success of this project will significantly promote Australia's 5G market and attract both domestic and international app vendors. It will also tackle specific issues that challenge Australia's cybersecurity - one of the main national priorities - in the EC environment, providing fault-tolerant technologies for applications over the 5G mobile network.							
DP200102611 Sellis, Prof Timoleon	This project aims to build a next-generation intelligent exploration framework over massive geo-located data, varying from points-of-interest to areas-of-interest data, in order to dramatically enhance user experiences when interacting with various forms of geo-located data over maps. Expected outcomes include novel exploration models, efficient and scalable algorithms for retrieving and visualizing the exploration results, online updating of personal preferences during the life cycle of exploration, as well as a prototype system to evaluate and demonstrate practical value of the research. It will complement existing map services and significantly benefit many location-aware services, e.g., logistics, health services and urban planning.	80,000.00	160,000.00	160,000.00	80,000.00	0.00	0.00	480,000.00
	National Interest Test Statement Data exploration is an iterative and interactive process, where users may have different degrees of knowledge on the data, query expertise and/or intention clarity, and they are called to navigate through massive amounts of data that are available nowadays. The outcomes of this project will provide individuals, businesses and governmental agencies with the abilities to unleash the key values in the overwhelming volume and variety of geo-spatial data, ranging from points of interest data to area of interests data, while offering them personalized, interpretable and interactive data exploration experiences that have not been supported by any existing map services. The ultimate goal of this project is to boost the national pool of research expertise in the new but vital field of data exploration while maintaining Australia's international leadership role in the field of big spatial data management. Many application fields ranging from retail and urban planning to logistics and health services planning may greatly benefit from the outputs of this project.							
DP200102671 Manasseh, Prof Richard	This project aims to predict natural bubble sounds. These audio signals contain data on the bubble size, which controls oxygen absorption, and thus product quality, in minerals, food, pharmaceuticals and water industries. Bubbles also control ocean carbon-dioxide absorption. Such gas absorption is almost impossible to monitor with laboratory sensors. In the ocean, sensors are quickly blocked by algae. In industry, liquids are opaque or too hot. However, the easily-measured sounds get through. Experiments and computer simulations would allow the sound volume as well as frequencies emitted by bubbles to be predicted. This would enable valuable data to be interpreted from complex sounds, transforming industrial and environmental measurements.	95,000.00	180,000.00	167,500.00	82,500.00	0.00	0.00	525,000.00

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	National Interest Test Statement							
	The formation of bubbles makes sounds familiar to everyone, from that of a drip of water to the roar of ocean surf. But these sounds also contain data on bubble sizes - valuable data because the bubble size controls the rate with which oxygen or other gases are absorbed by water or other liquids. Bubble size matters in oxygenation-critical Australian industries whenever air is pumped into liquid, such as processed-food and pharmaceuticals manufacturing, and rare-earth metals refining and recycling. Bubbles due to breaking ocean waves dissolve a very large fraction of global carbon emissions in the ocean, but this fraction is poorly-known, adding to uncertainty in climate-change models. At present, measuring bubble size is virtually impossible in most practical environmental and industrial situations. Expected project outcomes would allow instruments to monitor these processes, permitting their ultimate control. Australian instrument manufacturers would gain a potential new product and Australian minerals, food, pharmaceutical and environmental-monitoring industries would be the first to benefit.							
DP200102955 Pedell, A/Prof Sonja	This project aims to bring together design innovation with software engineering ensuring software is engaging, utilising methods and processes from design. Engaging software is important if it is to be taken up by the intended users. The outcome of the proposal will be new methods such as emotional goal models guiding key stages of the software engineering lifecycle, especially requirements elicitation, software design, implementation and evaluation, with a focus on assessing adoption over time. The benefit of the research is intended to be threefold: increased digital inclusion by more Australians engaging with the digital economy; better acceptance of developed software by consumers; and new methods for Australian software developers.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement							
	There are four intended impacts. (i) More Australians to participate in the digital economy, thereby increasing digital inclusion. (ii) Better economic outcomes for Australian software developers who will have innovative methods to make their software successful by engaging positively with the emotions of their customers. (iii) Happier consumers who will interact with the digital world more productively through technology adoption. (iv) shared methods between multidisciplinary teams of designers and software developers.							
DP200103700 Liu, Prof Chengfei	The availability of big attributed graph data brings great opportunities for realizing big values of data. Making sense of such big attributed graph data finds many applications, including health, science, engineering, business, environment, etc. A cohesive subgraph, one of key components that captures the latent properties in a graph, is essential to graph analysis. This project aims to invent effective models of cohesive subgraphs and efficient algorithms for searching and monitoring cohesive subgraphs in big and dynamic attributed graphs from both structure and attribute perspectives. The methods, techniques, and prototype systems developed in this project can be deployed to facilitate the smart use of big graph data across the nation.	73,000.00	148,000.00	152,000.00	77,000.00	0.00	0.00	450,000.00
	National Interest Test Statement							
	With the rapid development of information technology, huge volumes of digital data are accumulated with entities involving complex relationships, such as Facebook, Twitter, Reddit, Amazon, Bitcoin OTC, and Wikipedia. This results in a huge repository of big and dynamic attributed graph data. Efficiently finding attributed cohesive subgraphs from these graphs is essential for providing insights and values of big graph data, e.g., finding the right groups for marketing, research or business collaboration, detecting potential criminal groups. This project will contribute to big data analytics of important information from large and dynamic attributed graphs. We will develop a complete framework for modelling, searching, and monitoring attributed cohesive subgraphs. The techniques, algorithms, and prototype systems developed in this project can be deployed to facilitate the smart use of big graph data. The success of this project will bring considerable economic and social benefits to Australia in many advanced real applications across the nation, including business, society, government, education, research.							
	Swinburne University of Technology	739,038.50	1,517,946.50	1,556,087.50	794,216.00	17,036.50	0.00	4,624,325.00

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The University of Melbourne								
DP200100110 Jameson, A/Prof Guy N	This project aims to understand the mechanism and function of the protein nanocage, ferritin, which stores iron in the body ready for use on demand. Iron is an essential element, vital for wellbeing. To understand iron we need to understand ferritin. Despite being widely studied, how ferritin actually works remains unclear. This project aims to use an interdisciplinary approach combining protein biochemistry, spectroscopy, genetics and whole organism studies. It will develop new techniques to enable the physiological role of iron to be explored. Outcomes of this innovative platform are anticipated to include in-depth understanding of how ferritin functions to unravel its fundamental role in iron storage and release ready for re-use.	85,000.00	160,000.00	150,000.00	75,000.00	0.00	0.00	470,000.00
	National Interest Test Statement Correct iron homeostasis is vital for health and well-being. This project will generate a complete and accurate model of iron flux into and out of the iron storage protein ferritin in a whole organism. This information is the basis for developing a complete understanding of iron physiology. The knowledge gained may, in the longer term, identify new strategies to alleviate iron deficiency or toxicity in a targeted way. To achieve this aim, new tools and technologies will be developed to allow us to examine iron function within ferritin and a new generation of multidisciplinary talent will be trained ensuring that Australian researchers remain leaders in the field of iron metabolism.							
DP200100178 Donnelly, Prof Paul S	This project aims to make fundamental advances in inorganic chemistry, coordination chemistry and bioinorganic chemistry by preparing new metal-containing molecules based on specifically designed tetrapyrrole ligands. Innovative synthetic methods will be developed to enable systematic chemical modifications to explore the chemical and biological properties of the metal complexes. The potential of the new molecules to be of use as tracers for molecular imaging will be investigated. An expected outcome of this research will be an increased understanding of how chemical properties dictate the biological activity of metal complexes informing the potential long-term translation of this chemistry to to new molecular diagnostics and therapeutics.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
	National Interest Test Statement This research aims to make fundamental advances in the chemical sciences by making new designer molecules. High quality research will underpin internationally competitive discoveries at the forefront of bioinorganic chemistry. The new molecules and knowledge developed will have the long-term potential to improve modern society through technological breakthroughs in molecular agents capable of providing improved diagnosis and therapy. An excellent multi-disciplinary research environment will provide high quality training to the next generation of Science Technology Engineering and Maths (STEM) specialist scientists that are necessary to drive Australia'a emerging biotechnology and biomedical sectors.							
DP200100219 Zyphur, A/Prof Michael J	This project aims to vastly improve the data-analytic capabilities of social and health researchers, while increasing knowledge about emotion dynamics and their link to employee turnover. By drawing on and advancing methods from ecology and applied physics, this project plans to investigate the role that individual emotions play in employee turnover with new quantitative methods for characterising and testing causality in complex dynamic systems. The expected outcomes include an improved capacity for researchers, managers, and policy makers to understand complex organisational, economic, and health systems. This will provide immediate societal benefits by informing the development and deployment of targeted interventions in such systems.	71,791.50	141,869.50	142,383.50	72,305.50	0.00	0.00	428,350.00

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	National Interest Test Statement							
	This project will contribute to Australia's national interest by improving the ability of researchers and policy makers to understand complex socio-economic and health systems at multiple levels of analysis. By providing new knowledge about how individual emotions change over time, and how this relates to employee turnover, organisational researchers and managers will better understand how to predict employee turnover. Specifically, methods will be developed and exemplified that allow identifying employees approaching a 'critical transition' that precedes turnover. More generally, by developing new quantitative methods for characterising and testing causality in complex systems at multiple levels of analysis, researchers and policy makers from many areas will be better able to understand how to use policy tools to influence important organisational, economic, and public health outcomes that otherwise may appear to function in unpredictable ways. This will enhance Australia's national research capacity while simultaneously developing lasting international collaborations that are multidisciplinary in nature.							
DP200100344 Griffith, Dr Oliver W	The project aims to understand the role of inflammatory signalling in marsupial pregnancy. This project is expected to explain why inflammation, a processes normally confined to injury and infection, is a part of reproduction in live-bearing mammals. Outcomes of this project include robust measures of the capacity for, impact of, and evolution of, inflammatory signalling in marsupial pregnancy. The project will provide new knowledge about the unique biology of Australia's marsupial fauna.This project will provide significant benefits, including enhanced capacity for reproduction research in Australia, new international collaborations between Melbourne and Yale, and a new explanation for the puzzling role of inflammation in pregnancy.	125,000.00	255,000.00	255,000.00	125,000.00	0.00	0.00	760,000.00
	National Interest Test Statement							
	This project will test whether inflammatory signalling was co-opted to regulate key physiologies of reproduction and may have been the first mechanism for maternal-fetal communication in mammals. This is in the national interest because it will re-frame our understanding of mammalian implantation using unique Australian fauna. This knowledge will support new research that may be useful in supporting increasing implantation rate in both agricultural and medical settings and will provide critical data on marsupial reproduction to support the conservation efforts of Australia's threatened marsupial fauna. The research will increase Australia's strength in reproductive biology, by training new comparative reproductive biologists through Postdoctoral, PhD, and Master's programs, will develop new research capacity in the field of reproductive biology by developing new experimental models, will build a new international collaboration between the University of Melbourne and Yale University, and will demonstrate the importance of conserving Australian fauna to the public through scientific outreach.							
DP200100499 Goddard, Prof Michael E	This project aims to develop better methods for predicting traits in an individual based on their genome sequence. This method will be tested in agricultural animals and plants and in humans. The prediction formula is derived from a training dataset that has information on the traits and genome sequence of a sample of individuals. The prediction formula can then be applied to predict the trait in individuals where the trait is unknown. This is useful for selecting the best parents for breeding in agriculture and for predicting the future phenotype of animals, crops and people. The proposed method uses data on very many traits to identify sequence variants that have a function and to predict the traits affected by each variant.	66,500.00	135,500.00	141,000.00	72,000.00	0.00	0.00	415,000.00
	National Interest Test Statement							
	Future application of this method could be used to benefit agriculture and the health of the human population. It will benefit agriculture by helping to select the best animals and plants for breeding so that future generations are more profitable, healthier and have less environmental impact. It will benefit human health by identifying individuals who have high risk of contracting specific diseases so that they can take remedial action. For instance, selection to reduce methane emissions by ruminants is currently impractical due to the difficulty and cost of measuring this trait. This project will develop a method of selecting cattle and sheep for low methane emissions based on their genome sequence. This will have environmental benefits because methane is a potent greenhouse gas and economic benefits to Australia because, if methane emissions are not reduced, eventually ruminant agriculture will decline.							

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DP200100543 Saeed, Prof Abdullah	Traditional Islamic law and theology developed a wide range of negative positions about people of other faiths. Based on extensive fieldwork, this project aims to understand how and to what extent prominent Muslim religious leaders are transforming these negative positions to positive ones today in Australia, Indonesia, Pakistan and Singapore. The project will lead to an evidence-based understanding of the potential for future interreligious harmony in these countries. Since positive interreligious relations are of domestic, regional and global concern for social cohesion and peace and security, the outcomes of this project will be of significant interest to both scholars and policymakers in Australia.	29,000.00	120,000.00	162,500.00	71,500.00	0.00	0.00	383,000.00
	National Interest Test Statement Interreligious harmony is important to the Australian government. Current multicultural policy focuses on promoting acceptance and understanding among different groups so that Australia remains safe, cohesive and harmonious. Yet as Australia's religious diversity continues to grow, the country will need to take active steps to ensure it remains one of the most successful multicultural societies in the world. This study will reveal how Muslim religious leaders are framing relations between Muslims and those of other (or no) religions. Traditional Islamic norms were not always positive towards the religious 'other' and this thinking has a strong legacy among Muslims today. However, new movements in Islamic thought are challenging such negative views. Do Australia's Muslim religious leaders accept this new thinking? This study will answer this and other related questions. It will have important social and political benefits because it will provide insights into the potential for future interreligious harmony, cohesion and tolerance in Australia.							
DP200100625 McDonald, Prof Ronan D	This project aims fundamentally to change and enrich our understanding of a dynamic intellectual movement—academic literary criticism between 1920 and 1970. During this period, English (as it was often called) shaped the humanities at both the secondary and tertiary level. It also changed how and why we read literature. This project will produce what the scholarship still lacks: a detailed, analytic account of the history of English in the period, including in Australia, sensitive to the discipline's impact and to the forces which caused it to take new paths in the 1970s. Benefits include expanding academic and public awareness of this rich disciplinary history and informing strategic directions for English in Australia and abroad.	55,000.00	75,000.00	45,000.00	25,000.00	0.00	0.00	200,000.00
	National Interest Test Statement This project fundamentally changes our understanding of the history of English, placing Australia at the cutting edge of research on the history of a key humanities discipline. All Australians encounter English at school and it remains central to the humanities in universities. Many Australians cherish their memory of an inspiring English teacher. Yet the pedagogical methods and cultural values from which the subject grew, many of which still dominate the discipline, are neither widely known nor properly understood. The innovations, practices and ethos that were developed in English departments between 1920-70 had a huge impact in how literature was studied and understood both in Australia and internationally. This project will therefore benefit Australian social, cultural and educational life in affording a deep understanding of a key part of our intellectual life both in the education system and in the wider culture. In particular, it will enhance Australia's international reputation as a leader in humanities research because its findings will inform future directions for English.							
DP200100639 Voon, Prof Tania V	The project aims to investigate growing divergence between countries' inward foreign investment policies and their increasing links to national security. Novel interdisciplinary collaboration integrating political science, economics and law promises insights into these policy shifts, which appear driven by digitalisation of the economy and the rise of emerging markets (eg China) and State-linked investment. Expected outcomes include clarification of the causes and implications of these shifts and innovative understanding of the connection between national security and economic interests in investment. This new knowledge should enhance balance in investment policy and decision-making, with economic and foreign policy benefits for Australia.	59,000.00	122,500.00	85,000.00	21,500.00	0.00	0.00	288,000.00

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	National Interest Test Statement							
	The project promises major economic and foreign policy benefits to Australia by refining policy treatment of inward foreign investment to safeguard against emerging risks and capitalise on new opportunities. Significant potential exists for growth in foreign investment in Australia, including from China and in technology and services, with corresponding benefits for the Australian economy. Australia risks an overly restrictive approach to investment in Australia by State-linked entities in 'sensitive' sectors. An integrated approach combining economic, political and legal perspectives on investment policy will promote the benefits of economic integration and cooperation while balancing national security requirements. This research will also help mitigate negative foreign policy responses towards Australia arising from perceptions of a hostile Australian approach to inward investment. Finally, the project should assist Australian businesses and investors by providing a timely and comprehensive assessment of global patterns in investment policy, and policy motivations and directions in key partner countries.							
DP200100713 Caruso, Prof Frank	Materials self-assembled from metal ions and ligands have a range of important applications, including as advanced coatings, adhesives and catalysts. However, these materials have been largely limited to those assembled from naturally occurring ligands such as phenolics, restricting their properties and function. This project aims to greatly expand the range of accessible properties of metal–phenolic materials by combining self-assembly with advanced polymer synthesis techniques. The expected outcome of the project is a new class of functional materials applicable as self-healing coatings, nanoadhesives and antimicrobial surfaces, thus underpinning next-generation technologies in materials science and nanotechnology.	100,000.00	240,000.00	250,000.00	110,000.00	0.00	0.00	700,000.00
	National Interest Test Statement							
	Nanotechnology-enabled materials underpin emerging applications in energy, information technology, food safety, agriculture and healthcare. Central to enabling such applications is the development of new materials with precisely controlled properties and function. This project will develop a new class of engineered materials with tuneable properties applicable as self-healing coatings, nanoadhesives and antimicrobial surfaces. The project has the potential to deliver economic and commercial benefits by providing opportunities for start-up companies, leading to employment and investment in Australian science and industry. Further, the novel materials developed will provide strong intellectual property positioning for potential commercialisation. The project will provide additional national benefit by equipping PhD students and research fellows with strong cross-disciplinary skills that will be of benefit to industries recruiting graduates in science, technology and engineering. The project will enhance Australia's considerable international reputation as a leading country for advanced materials research.							
DP200100722 Rizzacasa, Prof Mark A	This proposal aims to investigate the chemical synthesis of a number of structurally different natural product target molecules by strategies involving the use of either three or four membered ring-strained compounds to afford key synthetic intermediates in an efficient manner. The key aim of this research is to provide more efficient routes to complex natural products and analogues. The research strives to be at the forefront of modern synthetic organic chemistry and aims to contribute to the Science of complex molecule synthesis.	22,500.00	45,000.00	45,000.00	22,500.00	0.00	0.00	135,000.00
	National Interest Test Statement							
	This project aims to achieve the total chemical synthesis of a number of bioactive natural products with diverse structures. Most significantly, this challenging research should deliver methods for the production of molecules that have applications in both basic and applied research. This research will expand Australia's knowledge base and support the high-quality education and training of students to increase Australia's research capability.							
DP200100728 McLeod, Prof Julie E	This project will provide a new history of progressive education in Australia in the mid-twentieth century by investigating its neglected relationship to and effect upon Indigenous education and colonial governance. Using transnational and comparative methods, it will examine how international progressive ideas informed local initiatives, explore the role of Indigenous advocacy for educational reform and build a genealogy of educability and colonial childhood. Brought together for the first time, these investigations will strengthen understanding of Australian Aboriginal and educational history in global and regional contexts and contribute new knowledge and perspectives to current debates about equity, race and divided educational futures.	43,327.50	111,327.50	141,172.50	73,172.50	0.00	0.00	369,000.00

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	National Interest Test Statement This project will provide a new history of Aboriginal education and progressive reform in mid-twentieth century Australia. It will show how this history connected to international and regional initiatives to reform Indigenous education and modernize colonial governance. Indigenous advocacy for educational change will be explored, along with the role of government and non-government organisations. The study will enhance knowledge about Australia's past and its role in world affairs during a crucial period of social transformation. Strengthening the educational outcomes of Indigenous students remains a policy and program priority at all levels of government. Addressing this also requires knowledge of previous reforms and types of educational provision and how they might continue to influence opportunities, equity and futures today. Providing this historical evidence-base is a key social benefit of the study, which will offer a fresh lens through which to view and assess current policy and program directions.							
DP200100747 Flegg, Dr Jennifer A	The project aims to advance mathematical knowledge by developing novel tools appropriate for modelling disease elimination. We will apply these new mathematical tools to the significant problem of malaria elimination in Vietnam. The expected outcomes are new tools for modelling disease elimination on a fine spatial resolution with heterogeneities in individual patient characteristics, calibrating models to household level data on disease transmission and designing intervention strategies for maximum effect on disease transmission. The innovative combination of modelling, inference and optimisation ensures that the mathematical methods developed will be broadly applicable to modelling elimination strategies for other infectious diseases.	50,000.00	130,000.00	160,000.00	130,000.00	50,000.00	0.00	520,000.00
	National Interest Test Statement This project aims to develop new mathematics and statistics to inform optimal strategies in the pursuit of malaria elimination. New mathematical models will be developed that incorporate key variables related to disease transmission on a high spatial resolution. New calibration methods and cutting-edge optimisation techniques will be developed to evaluate disease intervention strategies. We will illustrate the use of these new mathematical methods for the elimination of malaria in Vietnam, which is targeted by 2030. This project will contribute to Australia's national interest since Australia is a key stakeholder in the malaria elimination targets set for the Greater Mekong Subregion, with substantial financial contributions to the Asia Pacific Leaders Malaria Alliance and Asia Pacific Malaria Elimination Network. Our proposed research addresses the Science and Research Priority for "Improved prediction, identification, tracking, prevention and management of emerging local and regional health threats".							
DP200100902 Rogers, A/Prof Juliet B	This project aims to produce new knowledge about laws that have criminalised female genital mutilation (FGM) in Australia since 1994. FGM laws are now subject to robust international criticism, as well as increased concerns among the affected communities. Through the use of innovative primary data collection strategies with law and policy makers, justice system officials and with affected communities in Australia and the UK, the project seeks to produce robust evidence and original insights into the effects of these laws and the potential impacts of proposed legal initiatives. Expected benefits include enhanced legal and policy approaches to FGM that will assist with safeguarding the wellbeing of women and children.	55,000.00	155,500.00	169,500.00	69,000.00	0.00	0.00	449,000.00
	National Interest Test Statement This project facilitates Australian national cohesion by investigating an issue that divides a multicultural society; responding to calls from the Commonwealth Attorney General, the Australian Medical Association, the New South Wales Bar Association and others for further research, this is the first systematic study internationally of the laws criminalising female genital cutting, defined in law as Female Genital Mutilation (FGM). Through innovative, in-depth empirical research with key law and policy stakeholders and members of the affected communities, it investigates issues identified with these laws internationally: the lack of convictions in Australia; distinctions between FGM and female genital cosmetic surgery; and emerging evidence of harm to women and children. It will produce new knowledge and insights into FGM laws and their impact on the affected communities, contributing to inform law and policy reform. Other expected benefits are the improved wellbeing of women and children in Australia from minimising the harmful effects of the laws and of future of law and policy reform.							

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DP200100914 Reynolds, Prof Eric C	The Type IX Secretion System present in diverse bacteria of veterinary, agricultural, environmental and industrial importance enables effector proteins to be secreted and attached to the cell surface where they contribute to disease pathogenesis or degrade biopolymers of commercial interest. This project aims to determine the structure and assembly mechanism of this complex secretion nanomachine comprising 15 different proteins using state of the art microscopy. Knowledge of the structure will greatly enhance our understanding of secretion mechanisms and our ability to both inhibit the system to treat disease in animals or manipulate the system for industrial applications providing future economic and environmental benefits to our nation.	94,272.00	187,103.00	197,676.50	104,845.50	0.00	0.00	583,897.00
	National Interest Test Statement Our research will result in the structural characterisation of a novel bacterial secretion system that is present in a variety of important bacteria. This will lead to the development of new therapies (antibiotics/vaccine) for animal pathogens and provide important knowledge to allow manipulation of this secretion system in environmentally important bacteria for critical industrial applications. Overall the work will provide future economic, enviromental and productivity benefits for Australia.							
DP200100961 Wilson, Prof Sarah J	Music abilities are core to what makes us human, with singing ubiquitous in all cultures. Anecdotal evidence suggests that singing ability runs in families, supporting its genetic basis, however no research has systematically traced it across generations. Using an innovative web-based singing program and the latest molecular genetic techniques, this project aims to discover singing ability genes through the first Australian study of large families with many talented singers. This will generate new knowledge on the origins of human musicality and help Australia develop a sustainable source of cultural capital. It will build interdisciplinary research capacity and inform bespoke music learning programs that account for individual differences.	70,566.00	149,894.50	199,131.00	119,802.50	0.00	0.00	539,394.00
	National Interest Test Statement Singing is the most universal means of music-making and has many documented benefits for human development, emotional and social wellbeing, and cultural life. Understanding the genetic basis of singing ability is fundamental to cultivating Australia's cultural and social capital. More broadly, discovering how gene-environment interactions shape the optimal development of human talent underscores our nation's future economic growth and competitiveness. Based on the collaborative efforts of geneticists, neuroscientists and music educators, this interdisciplinary research will benefit the Australian community by guiding the development of bespoke educational programs, performance training and talent development that take individual differences into account. This offers a future where individuals may select learning environments that complement their potential, allowing Australians to flourish. This project will also place Australia at the forefront of the rapidly growing field of behavioural genetics, creating new jobs and expanding our nation's international research standing.							
DP200100969 Chung, A/Prof Daniel	Heat transfer dictates the efficiency of energy and transport systems such as gas turbines, high-speed generators and turbochargers. These are among many applications where heat transfer involves turbulent fluid flow over solid surfaces, but where poor understanding of surface conditions leads to dubious models, suboptimal designs and cost penalties. This project therefore aims to advance our fundamental understanding of heat transfer accounting for the practical surface conditions of roughness, solid-fluid pairing and uneven heating. Building on capabilities that now place systematic data within reach, this project will deliver physics-based models that can robustly predict heat transfer, leading to reduced costs of energy and transport.	57,500.00	112,500.00	110,000.00	55,000.00	0.00	0.00	335,000.00

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	National Interest Test Statement							
	Energy and transport systems, such as gas turbines for power generation and passenger aeroplanes, turbochargers in cars and trucks and high-speed generators that convert rotating machinery to electricity for powering homes and industries, are Science and Research Priorities in Australia. The efficiencies of these systems are currently limited due to our poor understanding of heat transfer under the practical conditions found in these systems, involving high-speed turbulent gas or liquid flows over rough solid surfaces with uneven heating. This project will advance our fundamental understanding of this problem to underpin better heat-transfer management and ultimately to reduce costs. This research will deliver significant economic, commercial and environmental benefits to Australia where vast distances and the need for affordable, sustainable energy are fundamental to everyday life. Partnering with a world-renowned fluid physicist, this collaboration represents an opportunity for Australia to lead the research and innovation in heat transfer, while training the next generation of world-class researchers.							
DP200100991 Hime, Prof Gary R	Aims: This proposal aims to use genetic and cell biological analysis of the vinegar fly, Drosophila, to identify the function of the grainyhead gene in intestinal regeneration. Significance: This gene is conserved in all animal species and appears to be a master regulator of epithelial tissue development but it is unclear how it can both influence stem cell maintenance and production of functional cell types. Expected outcomes: We will identify a new mechanism that governs tissue development, and introduce new imaging and genetic technologies to the Australian research community. Benefit: We expect potential economic and commercial interest in development of new gene analysis tools and biotechnological tissue manipulation applications.	102,500.00	212,500.00	210,000.00	100,000.00	0.00	0.00	625,000.00
	National Interest Test Statement							
	New biotechnological and tissue engineering technologies are dependent upon our ability to precisely manipulate cell growth and the ability of cells to form specific tissues. We have identified a particular gene that can both maintain stem cells and facilitate functional cell production, depending upon its state of activity. This project aims to precisely determine how this gene functions, and how we can tweak its activity to produce tissues on demand. As part of this proposal we will develop genetic technologies and cellular imaging tools. We envisage economic and commercial interest in further development of these technologies and more specifically tissue engineering applications that will arise from an understanding of the genetics of tissue development..							
DP200101016 Maddison, Prof Sarah	This project aims to investigate the complexity of Indigenous affairs governance and the ongoing tensions in the relationship between Aboriginal and Torres Strait Islander peoples and the Australian state. The project expects to generate new data on contemporary Indigenous governance arrangements and analyse them using an original conceptual framework to inform knowledge-exchange workshops designed to advance proposed new approaches. Expected outcomes of this project include concrete proposals for re-setting Indigenous-settler relations and Indigenous affairs policy. This should provide significant benefits in the field of Indigenous governance including plans for more genuine transformation in Australian Indigenous-settler relations.	51,606.00	122,106.00	114,500.00	44,000.00	0.00	0.00	332,212.00
	National Interest Test Statement							
	This project will make an important contribution to the quality of Australian social and political life, particularly the relationship between Aboriginal and Torres Strait Islander peoples and the Australian settler state. It is widely understood that Australian Indigenous populations experience social circumstances that are drastically below the standards enjoyed by non-Indigenous Australians. While political opinion is divided concerning both the causes of and solutions to this situation, scholarly research and government data make clear that churn and complexity in Indigenous policy and governance are having deleterious effects. Data from this project will document what is and is not working in Indigenous affairs governance, and will use this data to develop and test concrete proposals for new ways of working. The most significant benefit of this project, therefore, will be to provide a ‘circuit breaker’ for this dilemma, bringing a diverse range of Indigenous experiences of governance to the fore in order to develop innovative new proposals about more fruitful models of Indigenous-settler coexistence.							

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DP200101068 Reichardt, Dr Christian L	This project seeks to reveal the nature of dark energy and thereby explain what is causing expansion of the Universe to accelerate. The project will develop new deep machine learning techniques to weigh galaxy clusters, and apply them to data from the SPT-3G experiment at the South Pole. By comparing theoretical predictions to the observed numbers and masses of galaxy clusters, the project will help determine whether the acceleration is due to dark energy or a breakdown in general relativity. The data science training received by students and researchers on the project will also contribute to a highly skilled STEM workforce for Australia.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
	National Interest Test Statement This Project will build Australia's scientific capacity and skills by training the next generation of scientists and engineers in advanced scientific analysis and the practical skills for handling 'Big Data'. Handling the project's Petabyte data sets will give students the computational skills that are central to today's economy; it will also transfer key data science technologies from international partners to Australia. Experience shows that many of these students will cross over to the industrial, financial and technology sectors, bringing new perspectives that will enhance the capacity for innovation in these critical fields. All human societies have a story about the Universe and their place within it. This Project, by studying why the expansion of the Universe is accelerating, has the potential to update the modern worldview. Finally, this Project's outreach to secondary schools and news media will support the goal of "Engaging all Australians with science". Astronomy is known as a gateway to STEM fields precisely because of its ability to inspire the general public.							
DP200101118 Rachel, Dr Stephan	This project will identify magnet-superconductor hybrid structures which feature topological superconductivity, a new material class which promises to revolutionise future technology. By performing cutting-edge transport calculations, this project will also predict signatures of topological superconductors for ongoing and future experiments. Expected outcomes of this project include identification of suitable candidate materials and protocols for the quantum design of prototype devices. By providing the theory of advanced structures and devices, this project will inform experiments and pave the way for future technology based on topological phenomena.	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00
	National Interest Test Statement This project will support advanced basic research on magnet-superconductor structures, expand Australia's international competitiveness in theoretical condensed matter physics and will foster collaborations with leading experimental groups in Australia and abroad. It will provide enhanced research training for young scientists by integrating computational abilities with complex physics problems, establishing the skills and abilities to adapt to technological changes that are crucial for the future economy and our capacity to engage with global affairs. The advanced materials and exotic particles identified in this project will inform the development of next generation technologies, becoming the quantum bits in future quantum computers.							
DP200101138 Renfree, Prof Marilyn B	Genomic imprinting is the differential expression pattern of some genes depending on whether the gene copy came from the mother or the father. This differential expression is essential for embryonic development and errors lead to disease. To date, most of our knowledge of the control of genomic imprinting comes from the mouse, but much less is known about this process in marsupials. Our comparative approach, using marsupial mammals that are distantly related to mice and humans, aims to clarify how genomic imprinting mechanisms have evolved, which patterns are conserved across mammals, and which vary. Our proposed research aims to provide new approaches and understanding of this fundamental process essential for the continuation of life.	125,000.00	256,500.00	259,000.00	255,000.00	127,500.00	0.00	1,023,000.00
	National Interest Test Statement Mammals inherit two copies of their genes, one from the mother and one from the father. In some cases only one copy is turned on, a phenomenon known as genomic imprinting. Most imprinted genes in mammals control the growth of the embryo and placenta and if mutated cause abnormal development. Imprints are established in the germ cells (the eggs and sperm). Almost all studies have been in mice, but we have shown that marsupials also have genomic imprinting. This project, using our iconic native fauna, will conduct fundamental research on the signals and mechanisms involved in imprinting of germ cells, embryos and fetuses, will encourage cutting-edge research and produce highly cited publications increasing the profile of Australian science. Extending knowledge of the evolution of genomic imprinting and developing new experimental models based on the unusual developmental strategies of our marsupials will enhance the scope and focus of Australia's research, train PhD students, foster international collaborations and bring new opportunities to Australia including international funding							

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DP200101162 Wille, Prof Uta	This project will use synthetic organic chemistry, biochemistry, root and rhizosphere biology and rhizosphere modelling to establish detailed mechanistic knowledge of the nitrogen (N) transport and uptake processes at the soil-root interface to develop new, efficient urease and nitrification inhibitors for reliable provision of N to the plant/root system. The reduction of excessive N fertilisation has significant environmental benefits by reducing greenhouse gas emissions and water pollution. This project will lead to a breakthrough for the triple challenge of food security, environmental degradation and climate change, while improving plant productivity and increasing the profitability of agriculture through lower fertiliser costs.	72,500.00	142,500.00	115,000.00	45,000.00	0.00	0.00	375,000.00
	National Interest Test Statement Agriculture plays a vital role in Australia, contributing to its environmental, economic and social sustainability, but is challenged by an increasing demand for food for a rapidly growing population. A key to ensure food security is to increase crop production through the use of fertilisers. The total cost of synthetic nitrogen fertiliser for Australia's grains industry is over AUD 1 billion per year. Unfortunately, the efficiency of nitrogen use in the agricultural industry is low, with about 50% of the applied nitrogen escaping from the production system, amounting to a direct financial loss of ca. AUD 500 million each year. Much of the excess nitrogen fertiliser flows into waterways and is released to the atmosphere, resulting in groundwater pollution, eutrophication and increased levels of greenhouse gas emissions. This proposal will provide new strategies to enhance nitrogen fertiliser efficiency in agriculture by improving nitrogen uptake efficiency by plants and reducing nitrogen loss from soils, which will have significant economic and environmental benefits for the Australian agricultural industry.							
DP200101230 Martin, A/Prof Gregory J	Capturing CO2 directly from the atmosphere is challenging due to inherently slow mass transfer kinetics. This project aims to overcome this using an enzyme that can rapidly solubilise CO2 from air into water, to produce algae. By engineering the enzyme immobilisation at the air-water interface, this project will activate and protect the enzymes, increasing their lifespan and reducing costs. By understanding mass transfer and enzyme activity in the interfacial immobilisation media, floating enzyme rafts can be developed for deployment over expansive areas, facilitating large-scale conversion of atmospheric CO2 into algae-derived fuels, feeds and chemicals.	67,456.00	137,800.50	146,392.50	76,048.00	0.00	0.00	427,697.00
	National Interest Test Statement This project aims to establish a means of removing carbon dioxide from the atmosphere for conversion into valuable algae biomass, which could be used for food, fuels and chemicals. The project will provide the knowledge required to design enzymatic rafts capable of providing algae with CO2 directly from the air. This knowledge is foundational for future technological innovations needed to take advantage of the tremendous potential for expansion of the algae industry, for which Australia has unique geographic and climatic advantages. The ability for production sites to be located away from point sources of carbon dioxide would expand the feasible range of sites and scale of algae cultivation, facilitating rural development and helping Australia meet its emission targets. By establishing the knowledge and scientific capabilities required to implement algal systems for utilising atmospheric CO2, Australia will be better positioned to lead the development of a patentable platform with significant environmental, economic and commercial benefits.							
DP200101266 Hartley, A/Prof Carol A	Vaccines are used to help control disease caused by herpesviruses in animals, but some vaccination programs may drive the evolution and spread of herpesviruses with increased fitness (transmissibility, replication and virulence) through recombination. This project aims to study an important avian herpesvirus (infectious laryngotracheitis virus) in the natural host (poultry) to gain fundamental knowledge of how vaccination programs influence the emergence of diverse recombinant viruses, and identify which types of vaccination programs are best at preventing the emergence of fitter and more virulent viruses. The results are expected to inform vaccination practices to allow more effective control of these viruses in poultry and other animals.	98,652.50	200,511.00	194,429.00	158,170.50	65,600.00	0.00	717,363.00
	National Interest Test Statement This project aims to identify how veterinary vaccines can be used most effectively to prevent the emergence and spread of recombinant herpesviruses in animals, particularly poultry. Herpesviruses cause significant diseases in a wide variety of animals, including livestock and companion animals. Infection can result in severe disease and causes economic losses to livestock industries. This project aims to provide fundamental knowledge of how herpesviruses evolve to cause more severe disease in animals and how different vaccine programs can be used to help prevent the emergence of these viruses. Improved control of diseases caused by herpesviruses in individual animals and animal populations through improved vaccination practices, will have benefits for animal health, welfare and production. There will also be economic benefits for the associated livestock industries that are important for the Australian economy and for food security.							

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DP200101279 Kearney, A/Prof Michael R	Life histories are the trajectories organisms follow as they develop, grow, reproduce and age; they are shaped by evolution and limited by the physical and biological environment. Recent breakthroughs by the CI allow the computation of life histories in any sequence of climatic environments, with demonstrated potential to gain new insights into the past, present and future responses of species to climate variability and change. This project aims to apply the new methods to understand how species' life histories have adapted to Australia's unique physical conditions and predict how they will respond to future conditions. It will simultaneously lay the foundations for a long-term, open-access research program on species' climate responses.	61,500.00	123,000.00	127,000.00	65,500.00	0.00	0.00	377,000.00
	National Interest Test Statement This project aims to apply apply cutting-edge tools and conceptual advances to understand how Australian species adapt and respond to the unique and often harsh climate of this continent. The new approaches connect the actual environments species experience to their ecological responses, predicting how fast they can grow and reproduce in the face of stressors such as heat, cold, dehydration and starvation. It will provide the means for hundreds of species to be modelled so that we can better understand and predict which of our native species will be most vulnerable to future climatic stress. The project findings will also deepen our understanding of how the ecology our native species, including lizards, venomous snakes and parrots, has been molded by climates of the past. The outputs of the project will be integrated into the Atlas of Living Australia. This will allow other researchers to use and build upon the approach well beyond the life of the project, and set in motion a global research program to better understand how species will respond to natural and artificial climate and habitat changes.							
DP200101281 Hautphenne, Dr Sophie M	Branching processes are the primary mathematical tool used to model populations that evolve randomly in time. Most key results in the theory are derived under the simplifying assumption that individuals reproduce and die independently of each other. However, this assumption fails in most real-life situations, in particular when the environment has limited resources or when the habitat has a restricted capacity. This project aims to develop novel and effective algorithmic techniques and statistical methods for a class of branching processes with dependences. We will use these results to study significant problems in the conservation of endangered island bird populations in Oceania, and to help inform their conservation management.	70,000.00	130,000.00	120,000.00	60,000.00	0.00	0.00	380,000.00
	National Interest Test Statement The project focuses on the development of new computational methods for a class of mathematical models used to analyse populations in which individuals compete for resources. Our results will be applied to two currently threatened island bird species for which we have extensive datasets: the endangered Chatham Island black robin in New Zealand and the threatened Lord Howe currawong in Australia. The application of our models and computational methods will directly inform the conservation management of these two species. Also importantly, our newly developed tools will reinforce considerably the use of these mathematical models in several fields including ecology, conservation and population biology, thereby advancing knowledge in these areas. As the world is currently facing the sixth mass extinction event and an ever-increasing number of species are declining, there is a need for efficient and accurate probabilistic and statistical methods that can be used by conservation biologists to ensure the long-term survival of species							
DP200101303 Nesic, Prof Dragan	Networked control systems are an emerging technology that combines control, communication and computation to deliver solutions for a range of manufacturing, safety-critical infrastructure, such as transport, defence and other Industrial Interent of Things (IIoT) applications. The current analysis and design approaches often take a ``monolithic'' view of the system, which render them inadequate for addressing many important IIoT applications. This proposal will exploit specific features and structure of the plant, the communication network and the distributed computation to provide an analysis and design methodology which will deliver significant advances in control and optimised performance of IIoT with benefits to the economy and society.	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00

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	National Interest Test Statement							
	A range of manufacturing, safety-critical infrastructure, such as transport, and defence applications will increasingly rely on engineered solutions that exploit a fusion of control, communication and computation to control and optimise their performance. Further, companies globally are moving towards "digitalization of their business" and they want to use Internet of Things as a paradigm that drives their transformation. This project will deliver fundamental research on structured networked control systems that will enable significant advances in control, robustness and performance to deliver benefits to a range of novel applications and eventually make IoT/IIoT a reality. The potential benefits to the economy and society are enormous, including improvements in productivity and outputs in manufacturing and process industries, transportation and communication, energy efficiency, reduced pollution, regulation of our built environments and sophisticated devices for medical applications.							
DP200101325 Trigg, Prof Stephanie J	The project aims to chart and analyse the representation of the human face in literary texts from the medieval to the contemporary era. It expects to generate comprehensive new knowledge about changing literary and textual discourses about the face by combining rhetorical analysis, the insights of cognitive literary theory, and digital methodologies. Significant outcomes include a deeper understanding of the cultural history of facial expression, identity and emotion, with particular attention to gender and ethnicity. The project's engagement activities will illuminate the relationship between literary history and contemporary social understandings of the face and allow us to better understand current transformations in facial recognition.	34,500.00	102,000.00	129,000.00	106,000.00	44,500.00	0.00	416,000.00
	National Interest Test Statement							
	This new history of the face in European and Australian literature proposes a bold and comprehensive way of writing literary and cultural history. It combines detailed rhetorical analysis with long-range cultural history, cognitive theory, and the insights made possible by digitised texts and sophisticated data mapping. Through its international collaborative network it will produce an unprecedented, original and timely understanding of the way the face seems to 'speak' in European and Australian literary texts. It will make the powerful insights of humanities research and literary scholarship available for productive dialogue with the general public through a series of engagement activities. It will contribute to public debates on topics such as the use of facial recognition software, social media practices, the shaping forces of gendered and ethnic identities, and the way we increasingly use the face as a social commodity. The project will lead to a deeper understanding of the significant contribution humanities research can make to contemporary technological developments and forms of social change.							
DP200101378 Hurlimann, Dr Anna C	This project aims to facilitate the integration of climate change adaptation and mitigation across Australia's built environment sectors: design, urban planning, construction and property. Cities are significant contributors to climate change but actions are presently limited, and largely unintegrated across sectors. The project expects to generate new knowledge to advance climate change action. An expected outcome is a framework to guide decision making in the built environment. Through communication to practitioners and policy makers, this project plans to provide significant benefit for Australian cities and society: progressing climate change action, informing investment decisions and reducing the harm and cost of climate change impacts	62,858.50	119,702.00	114,313.50	57,470.00	0.00	0.00	354,344.00
	National Interest Test Statement							
	Significant economic, environmental, social, and cultural benefit can be gained for Australian cities if action to address climate change impacts occurs sooner rather than later. This project intends to generate new knowledge to ensure Australian cities are planned, designed, constructed and managed to minimise greenhouse gas emissions, and to ensure they are well adapted to the changes in climate that cannot be avoided. An expected outcome of this project is a framework for integrating climate change adaptation and mitigation across the built environment to provide guidance for practitioners and policy makers. This would provide significant benefit to Australia by advancing the further development and integration of climate change adaptation and mitigation actions across Australia's built environment sectors (design, urban planning, construction and property). It would contribute to emissions reductions and facilitate a built environment that is well adapted to climate change risk. The project's findings would inform investment decisions, and reduce the harm and cost predicted as a result of climate change.							

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DP200101446 Bastian, A/Prof Brock	The collective benefits of sustainable behaviour tend to be abstract and less obvious compared to the immediate benefits of self-interest. This project aims to examine an avenue through which to make these benefits more concrete and personal – by providing a moral frame to nature. The studies aim to explore how this may be achieved, the socio-ecological factors that might limit such attempts, and the downstream implications for generalised trust and cooperation amongst human groups. We expect the findings will offer insight into an important avenue through which we can leverage human cooperation and trust and promote the value of the common good.	48,258.50	112,731.00	105,080.50	40,608.00	0.00	0.00	306,678.00
	National Interest Test Statement We expect the findings from this project will provide tangible avenues through which to respond to environmental change. With a better understanding of when and why people care about the natural environment, we aim to enhance conservation efforts. Furthermore, the findings will reveal how using a moral frame for thinking about environmental resources can promote cooperation between humans. Beyond building an understanding of how to better promote conservation efforts, the findings will also contribute to our general knowledge around issues of human trust and fairness. We expect this will be of great value as we face a bottleneck of increasing human population and growing resource scarcity.							
DP200101552 Gallego Romero, Dr Irene	This project aims to investigate the impact gene flow from Denisovans, an archaic hominin species, has had on individuals from Papua New Guinea and eastern Indonesia. These people owe up to 5% of their genomes to these mysterious ancestors, but the repercussions of this finding remain poorly understood. In order to identify the biological contributions these fragments of DNA make to the individuals who carry them, this project aims to combine anthropological genetics with cutting-edge functional genomics in a pioneer multidisciplinary approach. Ultimately, this project may transform our understanding of both the population and evolutionary pressures that have acted upon these groups in the past 50,000 years.	90,000.00	195,000.00	190,000.00	85,000.00	0.00	0.00	560,000.00
	National Interest Test Statement This project represents a substantial advancement of the state of the art in studies of human evolution, and will have a transformative impact on the discipline. Although it does not directly involve Aboriginal Australians, they too carry Denisovan DNA within their genomes. As such, findings from this project may have direct repercussions for Australian populations. More immediately, this project will grant a PhD student and a postdoctoral researcher the opportunity to join a highly qualified team committed to supporting their successful transitions into independent research careers of their own. It will also lead to the local development of expertise in cutting edge functional genomic technologies, highlighting the potential of Australian research. Our multi-country team will strengthen ties between Australia, Indonesia, Papua New Guinea and New Zealand, and establish the groundwork for sustained, long-term research collaboration with these strategic regional partners.							
DP200101613 Verbruggen, Dr Heroen	Little is known about the microbiota inhabiting coral skeletons, but several sources of evidence point to their importance in the coral holobiont. Particularly during coral bleaching, drastic changes happen in the skeletal microbiome, with potential beneficial as well as detrimental effects on the holobiont. This project will characterise the functions of skeletal microbiota, how microbial communities are structured along physico-chemical gradients, and how microbial gene expression changes through coral bleaching. This will lead to better insights into the roles of skeletal microbiota in the holobiont, the processes occurring in the skeleton during bleaching, and the role that skeletal microbiota may play in the fate of bleached corals.	85,000.00	185,000.00	195,000.00	95,000.00	0.00	0.00	560,000.00
	National Interest Test Statement Coral bleaching occurs increasingly frequently and is a pressing problem for the survival of the Great Barrier Reef and other Australian coral reefs. This project on the rarely-studied coral skeleton will provide critical information about physico-chemical and metabolic processes occurring through these stress events. By providing a critical baseline of the functioning of healthy and diseased coral holobionts, it can serve as the basis for future strategies to mitigate coral mortality due to bleaching. The project brings together a multi-disciplinary team of top scientists from Australia and overseas and will strengthen Australia's international position in coral reef studies and conservation. This transformative research will train early career scientists in bioinformatics, a key enabling skill the shortage of which has been identified as a national vulnerability.							

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DP200101615 Elgar, Prof Mark A	Insects use chemical signals, or pheromones, to communicate with conspecifics. To convey information, the pheromone molecules must pass through the atmosphere and physically interact with receptors, typically located on the antennae of the receiver. Pheromones, like other organic compounds, are degraded by ozone, UV light, and radicals. While we know that pheromone plumes attenuate through the dispersal of molecules, the additional impact of pheromone degradation has been ignored. Our project aims to highlight the significance of odour survival for insect chemical communication by examining how atmospheric conditions, including air pollution, affects signal integrity, antennal morphology and signal perception.	79,000.00	158,000.00	163,000.00	84,000.00	0.00	0.00	484,000.00
	National Interest Test Statement Insects communicate with pheromones, chemical molecules released by one individual and detected by receptors on the antennae of another. Pheromones may convey information about the location of a potential mate, and their suitability as a partner, and so it is crucial that they can be detected, both for individual reproduction and the viability of the population. Like any chemical, pheromones may degraded through reactions with other chemicals, including air pollutants in the atmosphere. The presence of these reactions can markedly reduce the 'half life' of a pheromone, thereby increasing the risk the pheromone is not detected. And yet we know next to nothing about these effects. While this is represents an important gap in our knowledge, it also has more profound, practical implications. Insects play an important role in our lives – pollinating crops; removing decaying material; or representing food for other animals. There is an alarming global decline in the abundance of insects, and this project could reveal the possibilty that an inability to communicate effectively is a contributing factor.							
DP200101668 Hogan, Prof Benjamin M	The vertebrate brain is responsible for up to a quarter of the body's metabolism, a metabolic load that produces large amounts of tissue waste and requires an efficient cleaning system. A recent discovery in zebrafish and preliminary data has uncovered a cell type surrounding the brain that derives from vasculature. These cells play fundamental roles in scavenging and clearing tissue wastes. The project aims to investigate the origins and control of this cell type in zebrafish and mouse brains. This will produce new knowledge in brain development, cellular composition, structure, function and evolution. Outcomes are expected to generate new approaches in stem cell biology, tissue engineering, regeneration and ageing of the brain.	106,000.00	215,500.00	218,000.00	108,500.00	0.00	0.00	648,000.00
	National Interest Test Statement There is a fundamental knowledge gap in understanding the cellular and molecular interactions that control cleaning of the brain. Cellular and metabolic wastes accumulate over time in the brain and negatively influence brain function, reducing workplace and social participation in an ageing population. This project aims to improve our fundamental understanding of cells involved in clearing wastes in the tissues that surround the brain in vertebrate organisms. The project will also build new knowledge, capacity and research directions in stem cell biology. Project outcomes therefore include economic benefits to Australia in building new cutting-edge research directions and research capacity, new fundamental knowledge with potential direct economic benefit in improving workplace and social participation and knowledge towards new technologies in tissue engineering, tissue repair and regenerative targeting of the ageing brain. Importantly, this project will train future scientists in world-class molecular, developmental and cellular biology, building future capacity for Australian science.							
DP200101728 Lewis, Prof Alison M	A generation has passed since the fall of Soviet communism, and yet our knowledge about the functioning of the institution at the heart of that system—the chekist state security apparatus—remains highly fragmentary and incomplete. This project will shed light on its history and ongoing legacy through a comparative study of state security archives across a range of East European countries. The project has a double focus, comprising historical work in the archives—using archival documents to advance our understanding of how the security apparatus operated during the late socialist period; and historical work on the archives—investigating how these archives are being used and misused in the region today.	40,500.00	74,750.00	87,750.00	53,500.00	0.00	0.00	256,500.00

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	National Interest Test Statement							
	The post-Cold War international order is increasingly unstable and challenged by rising authoritarian actors. In the case of the former Eastern bloc, the history and legacy of a powerful and distinctive state security apparatus is an important factor shaping these contemporary processes. In 2018, the use of a deadly nerve agent on British soil, apparently carried out by the Russian security apparatus, was a reminder that the ramifications of this legacy extend across international borders. Specialist expertise on the past and present of these security agencies will help Australia to navigate this complex and volatile terrain. The project will also position Australian scholars at the forefront of the international research effort to study former socialist state security archives, including those only now undergoing declassification (Ukraine, Latvia). It will enable Australian scholars to contribute to advancing knowledge on state persecution and collaboration under authoritarian regimes, and on the ongoing legacies of histories of state violence today.							
DP200101777 Damousi, Prof Joy	This project aims to investigate the cultural, social and psychological aftermaths of wars between 1815 to 1950 from a comparative, transnational perspective. By connecting the displacement of people, the brutalization of warfare and the trauma associated with it, this study will offer a broader and more complex understanding of the experience of civilians and combatants in the wake of armed conflicts. In so doing, it will challenge traditional periodizations which delineate between periods of war and peace, and seek to uncover the profound legacies of war not just within but beyond nation states. This will prompt a re-evaluation of our understanding of what constitutes warfare and its aftermaths.	77,000.00	142,500.00	123,000.00	81,500.00	24,000.00	0.00	448,000.00
	National Interest Test Statement							
	The Australian nation is comprised of displaced peoples from both within and beyond our borders. The experience of refugees and the long-term effects of war are thus central to understanding both Australian identity and the history of the modern world. The public benefit of this project lies in enhancing the quality and profile of Australia's research in modern history, and in extending the research capacity of a productive research network in violence studies. It creates a focused new team, consolidates strategic international research linkages, and will generate both high-impact publication outputs and transformative disciplinary interventions. This project will also be of social and cultural benefit to the Australian public. Outcomes include new knowledge to be disseminated to the Australian community through accessible publications and media interviews. These outcomes are expected to enhance public understanding and contribute to a more informed discourse on refugees and population displacement more broadly.							
DP200101827 Lim, Prof Christina	Future wireless systems of mobile networks and defence platforms will need to offer high-speed, low-delay, reliable connectivity and high bandwidth. With the explosive growth of wireless systems, this creates significant challenges in fronthaul - the link connecting antennas with the signal processors and core network. This project aims to design and develop an innovative fronthaul for wireless systems based on a dynamically reconfigurable, software-defined photonic platform capable of meeting diverse requirements. The outcomes of this project will help build a scalable fronthaul solution to overcome fundamental challenges and realise cost-effective pathways for transforming how future wireless networks and defence platforms are realised.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement							
	Wireless communication has transformed society over the past decade. Continual technological advances provide fast and seamless connectivity to ever-increasing mobile devices. Global wireless data traffic is expected to increase 8-fold by 2023. Mobile networks will require a major transformation to meet these future demands and similar challenge also exist in future defence platforms. This proposal aims to solve an important bottleneck in our current systems by designing and developing an intelligent reconfigurable software-defined photonic platform for fronthaul. The use of reconfigurable photonic technologies in the fronthaul will offer unprecedented capacity, transmission speed, and latency as well as the programmability of fronthaul. The project will demonstrate pathways for low-cost wireless broadband services and new high-performance architectures for defence platforms. Through the transformative potential of this new approach, the project will help to cement Australia's ambition for a stronger wireless and defence industry, delivering social, environmental, and economic benefits to all Australians.							

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DP200101875 May, Dr Jan-Hendrik	The aim of this project is to understand how past people in the riverine landscapes of the Murray-Darling Basin (MDB) were influenced by and adapted to environmental change. This will be achieved using a novel cross-disciplinary approach combining state-of-the-art palaeoenvironmental and archaeological methods. Indigenous people of the MDB have always been closely linked to rivers, however, over the period of human habitation flows on these rivers were likely subject to changes that exceeded present-day variability. Understanding how these changes have impacted humans, offers clues on adaption to environmental change and aids in developing strategies for living with the inherently variable and vulnerable rivers in drylands.	64,000.00	133,500.00	126,000.00	56,500.00	0.00	0.00	380,000.00
	National Interest Test Statement This project will examine how past climate change affected humans in the Central Murray Valley by reconstructing hydrological and environmental variability since human arrival in the region and through investigating the close and long-standing link between indigenous populations and rivers in the region. The Murray-Darling Basin is Australia's most important agricultural region, and its rivers are the continent's lifelines. Understanding long-term indigenous adaption to environmental change is thus anticipated to provide a crucial baseline for developing much-needed sustainable strategies for living with the inherently variable, yet critically vulnerable, dryland rivers of Australia. The novel integrative approach suggested here is expected to (i) strengthen Australia's capacity to respond to environmental change and thus contribute to future water security and sustainability, (ii) provide new insights into Australia's cultural heritage, and (iii) allow Australian researchers to push the boundaries of global knowledge on human-environmental interaction.							
DP200101960 Leckie, Prof Christopher	Cyber security analysts need to detect and respond to attacks as soon as possible, to minimise the damage attackers can inflict. However, the growth in highly distributed attacks that span multiple networks has meant that massive volumes of data need to be analysed. While machine learning techniques can help filter the data, we need techniques that can automatically provide a focus of attention for analysts on the most relevant observations. Our aim is to devise a novel suite of attention mechanisms that can focus the search of machine learning techniques for cyber security. The results of this project will improve the accuracy and efficiency of detecting distributed attacks across multiple networks.	81,500.00	160,000.00	157,000.00	78,500.00	0.00	0.00	477,000.00
	National Interest Test Statement This project addresses the Science and Research Priority on Cyber Security by devising new machine learning techniques to focus the attention of security analysts on the most likely attacks in complex monitoring environments. One of the major challenges facing cyber security analysts is the volume of data that needs to be analysed by experts to detect attacks. The techniques developed to learn the focus of attention for analysts will reduce the time required to detect attacks, thus limiting their impact and improving the productivity of security operations teams. This project will also train highly skilled graduates with expertise in machine learning for cyber security, who can contribute to the skills base in Australia.							
DP200101990 Klewicki, Prof Joseph C	Design optimization in areas of energy, materials processing, manufacturing and aerodynamics often depends on fluid flows adjacent to surfaces (wall-flows), and many such flows are three-dimensional (3-D). At present, 3-D wall-flows are poorly understood, and thus we aim to provide the first comprehensive study of the prototypical 3-D wall-flow on a rotating disk. Experiments in a bespoke facility will cover the important flow regimes (transitional and turbulent), and novel sensors will quantify the detailed 3-D flow structure. By clarifying critical instability scenarios and revealing turbulent flow scaling structure, this project will fundamentally advance physical understanding and analytical and computational models of 3-D wall-flows	75,000.00	145,000.00	140,000.00	70,000.00	0.00	0.00	430,000.00
	National Interest Test Statement Complex fluid flows along solid surfaces are poorly understood but fundamental to the optimal performance of such things as swept wing aircraft, rotating machinery (such as gas turbine engines), and a number of industrial and materials processing applications. By elucidating the flow structure of the prototypical 3-D boundary layer, the proposed work will lay the foundation for the performance enhancement of applications connected to the transportation, energy and manufacturing sectors within Australia. The technological enhancements will have the potential to benefit economic and commercial interests within Australia and increase our ability to compete in global markets. For example, an increase in the efficiency of gas turbines would benefit the transport industry and help mitigate the costs of air travel. In addition, the increase in efficiency of energy-producing and -consuming devices will have the potential to reduce the generation of pollutants, which would benefit the environment and help Australia meet its emission reduction targets.							

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DP200102001 Fletcher, Prof Erica L	Tight control of the retinal vasculature is crucial for maintaining normal vision. Unlike most blood vessels in the body, those in the retina and brain receive no direct neural control. Rather they rely on support cells to communicate the needs of neurons. This project aims to examine the mechanisms by which resident immune cells, called microglia, regulate retinal capillaries in response to neural activity. New knowledge examining a novel mechanism will be generated. This information is crucial for enhancing our understanding of how blood vessels are controlled in the retina and brain and will guide the development of novel ways of examining blood vessel function.	91,000.00	195,500.00	209,000.00	104,500.00	0.00	0.00	600,000.00
	National Interest Test Statement The outcomes of the research proposed are critical for understanding how the blood vessels in the retina are regulated. This knowledge forms a foundation on which assessment of the vasculature can be made, which is central to a range of imaging modalities that are used to assess the brain and eye. Thus, this project will have commercial and economic benefits to Australia. In addition, we will be training PhD students and employing research personnel to undertake the research. Finally, the knowledge gained will place Australia at the forefront of biological sciences internationally. In the longer term the information gained is likely to form a foundation on which to not only improve the way blood vessels in the eye are examined but also information that could be useful for the understanding of diseases of the vasculature including diabetic retinopathy and occlusions.							
DP200102090 Jackson, Prof David C	Bovine Respiratory Disease (BRD) is the most significant health problem faced by the beef industry worldwide, causing economic losses of up to $40 million annually in Australia alone. This Project aims to assess an immunostimulant for its ability to induce resistance to infection with bovine respiratory viruses associated with BRD. The Project is expected to generate fundamental new knowledge in veterinary virology. Expected outcomes include scholarly publications. The Project will provide significant benefits, such as advances to fundamental knowledge, training of higher research degree students and proof-of-concept data to promote collaborations with commercial partners to develop novel treatment strategies to limit BRD.	88,978.50	186,612.00	202,546.00	104,912.50	0.00	0.00	583,049.00
	National Interest Test Statement Bovine Respiratory Disease (BRD) is a major health problem faced by the beef industry in Australia and worldwide where feedlot-based beef production is practiced. BRD is a multifactorial condition involving viral and bacterial pathogens and is associated with economic losses of up to $40 million annually in Australia alone. Current vaccines and antimicrobial treatments have not been effective in reducing this disease. This Project will investigate an alternative prevention strategy in the form of an immunostimulant which can be administered intranasally, at feedlot entry, to activate innate immunity and provide immediate defence against multiple respiratory pathogens. Immunostimulants have the potential to improve animal welfare, feedlot productivity and profitability by improving weight gain and feed conversion efficiency in cattle by decreasing the incidence of BRD. The outcomes of this Project have the potential to transform treatment of BRD in Australia and worldwide, promoting effective beef production and reducing reliance on antibiotics in the beef industry for treatment of BRD.							
DP200102402 Tan, A/Prof Ying	Robotic assistance for humans performing physical tasks provides significant benefits in various sectors from advanced manufacturing and defence through to rehabilitation, prosthetics and aged care. However, most robotic systems are designed with an average user in mind rather than tailored to the individual. This innovative project will focus on developing new techniques for adapting the interface between human and robotic systems, leading to personalised physical interactions that outperform traditional approaches in achieving a shared performance goal even in unstructured environments. The tools developed will be demonstrated using state-of-the-art facilities, and will leverage the unique skill sets of the international project team.	73,500.00	150,000.00	153,500.00	77,000.00	0.00	0.00	454,000.00

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	National Interest Test Statement							
	Two of Australia's main challenges over future decades revolve around an ageing population and maintaining a high-value added manufacturing industry. Assistive robotic systems offer significant potential benefit in both these (and more) domains by alleviating manual tasks from users, yet the uptake has been limited. One contributing factor is the assistive robotic systems are, for cost reasons, typically designed around a population-averaged human model, leading to less than optimal performance amongst for a given individual. This project will utilise recent developments in systems theory and human motor dynamics to provide methods that can personalise collaborations between humans and robotic systems, thereby leading to higher performance without compromising on cost of the assistive robotic platform. The outcomes will be demonstrated in our state-of-the-art facilities, and communicated through extensive industry networks to enhance the benefit to Australia.							
DP200102424 Dyson, Dr Jane P	This project investigates the role of youth in India in challenging or defending notions of equality and freedom. The project will generate new knowledge on liberalism, youth, and political practice using an innovative approach to data collection termed project ethnography and deploying interdisciplinary methods. Expected outcomes of the project include enhanced capacity in Indian studies in Australia, new interdisciplinary collaborations around the topic of youth agency, the development of theory related to liberalism and youth, and a refined set of methods applicable to youth research. Benefits would include greater India literacy in Australia, better knowledge of youth action globally, and an enhanced knowledge base for policymakers.	73,000.00	143,500.00	166,500.00	96,000.00	0.00	0.00	479,000.00
	National Interest Test Statement							
	This project examines the role of youth in undermining or defending liberalism in the sense of a belief in formal equality and individual freedoms. This is explored with reference to India, a country that contains a quarter of all the world's young people and which is crucial for the future of Australia. Through innovative methods, the project will examine whether and how Indian youth are challenging notions of equal rights and individual freedom or defending these principles. The project emphasises a need to train early career researchers in qualitative research. It also stresses building networks with scholars in other countries and disciplines, leading to enhanced capacity in Indian studies in Australia. In focussing on liberal values and youth, the project would inform policymakers in Australia on key aspects of social change in India, including government, NGOs and foundations, and improve public understanding of India in Australia through disseminating research findings in an accessible way to a wide range of audiences.							
DP200102460 Clark, Dr Michael B	This project aims to investigate how genes vary their products to control human brain development, by creating new methods to study gene activity in individual brain cells. Using these innovative methods, this project expects to generate fundamental new knowledge of how the human brain forms. Expected outcomes of this project include widely applicable techniques, strengthened international (UK) research collaborations and highly trained personnel in genomics and neuroscience. This should deliver many benefits, including a better understanding of how the brain forms, training of higher degree by research students, as well as tools and methods of benefit to the academic research and biotechnology sectors.	77,500.00	157,500.00	160,000.00	80,000.00	0.00	0.00	475,000.00
	National Interest Test Statement							
	This project will contribute to Australia’s national interest in a number of ways. Outcomes will include widely applicable new techniques and software tools for genomic analysis. These will form the basis for intellectual property development and could be of use in agriculture, environmental monitoring, biotechnology and human health services. In the medium-term our tools have the potential to improve the productivity and competitiveness of these areas, benefiting the Australian economy. The training of students and junior scientists in cutting-edge stem-cell and genomics techniques and in software development will provide them with valuable skills they can apply in the knowledge and biotechnology economy, bringing economic and commercial benefits. In the long-term, an improved understanding of how the human brain forms and functions will likewise improve our understanding of human behaviour. This will have economic and social benefits by facilitating the design of social programs better suited to the needs of all members of society.							

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DP200102516 Lane, A/Prof Todd P	One of the most critical weather-related safety issues for aviation is atmospheric turbulence caused by thunderstorms. Thunderstorm-generated turbulence is responsible for frequent serious injuries and significant costs to airlines that are ultimately passed on to passengers. Using extensive new data, case studies and state-of-the-art simulations, this project aims to improve our understanding of the dynamics and behaviour of thunderstorm-generated turbulence and its representation in weather forecast models. Expected outcomes of this project include the development of new methods to avoid and predict turbulence for use by the aviation industry. This research should provide significant benefits, such as safer and more efficient air travel.	77,500.00	155,500.00	156,500.00	78,500.00	0.00	0.00	468,000.00
	National Interest Test Statement Turbulence is the leading cause of weather-related aviation accidents and costs the global aviation industry hundreds of millions of dollars each year. Of all the turbulence sources, thunderstorm-generated turbulence is the leading contributor to injuries; it is particularly relevant in thunderstorm-prone regions of Australian airspace (e.g., Sydney, Brisbane, Darwin), and flights to Asia and across the Pacific, where tropical thunderstorms are prevalent. Yet, methods to avoid and predict thunderstorm-generated turbulence have been mostly unchanged for decades, making commercial aviation more dangerous and less efficient than it should be. This project will use extensive new turbulence datasets and state-of-the-art simulation capability to study thunderstorm-generated turbulence and develop new methods for its avoidance and prediction. The research outcomes will ultimately lead to safer and more efficient air travel for all Australians.							
DP200102519 Cohn, A/Prof Trevor A	Natural language processing (NLP) has achieved spectacular commercial successes in recent years, and has been deployed across an ever-increasing breadth of devices and application areas. At the same time, there has been stark evidence to indicate that naively-trained models amplify biases in training data, and perform inconsistently across text relating to different demographic groupings of individuals. This project aims to systematically quantify the extent of such biases, and develop models that are both more socially equitable, as well as less prone to expose private data in the learned representations. In doing so, it will make NLP more accessible to new populations of users, and remove socio-technological barriers to NLP uptake.	85,000.00	160,000.00	150,000.00	75,000.00	0.00	0.00	470,000.00
	National Interest Test Statement As AI technologies becoming increasingly pervasive, it is critical that they work equally well for all members of our society, irrespective of age, gender, and cultural and linguistic background. This is particularly pertinent in Australia, one of the most diverse nations in the world in terms of multilingualism and multiculturalism. This project will systematically quantify the degree of inequality that exists in current AI technologies for different segments of society and develop methods to mitigate these inequalities. This will remove a potentially damaging bias when AI is used as part of the decision making in life-impacting applications such as loan approvals or criminal sentencing and extend the benefits of AI to encompass all Australian demographics and socio-economic classes, including benefits in productivity gains, reduced human error, and accelerated innovation.							
DP200102600 Grayden, Prof David B	This project aims to develop a mathematical framework that bridges the different scales of brain activities to provide a new tool for understanding the brain. Methods will be developed that unify individual neural activity with large scale brain activity. The approach will be validated by comparing predictions of interconnected models of neural populations (called mean-field models) to experimental data. The creation of subject-specific models from data is important, as there is large variability in neural circuits between individuals despite seemingly similar network activity. The intended outcome is new insights into the processes that govern brain function and methods for improving functional imaging of, and interfacing to, the brain.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00

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	National Interest Test Statement This project will provide a framework to enable the creation of subject-specific neural circuit diagrams. Through this project we will link the activities of microscopic neurons to macroscopic brain behaviour, providing a novel technique for neuroimaging. This technique will enable insights into brain function and provide potential benefits for understanding and treating neurological disorders as well as for the development of artificial intelligence (AI) technologies. The outcomes may be applied to better image and understand the brain, and in turn develop powerful bioinspired computing technologies; this will provide benefits to Australia by advancing commercial application of AI. The outcomes will also enable new physiologically- and scientifically-grounded ways to track, monitor and modulate brain states in health and disease using bionic or brain-computer interface technology; this will have a significant impact on the treatment of neurological conditions in the future through greater understanding of diseases, improved diagnostics and subsequent treatments.							
DP200102693 Cox, Dr Andrew G	Biologists have long been intrigued at the phenomenon of organ regeneration. Unlike most human organs, the liver exhibits the remarkable capacity to regenerate. Despite decades of research, the molecular underpinnings of liver regeneration are poorly understood. This research proposal aims to use zebrafish to elucidate the pathways involved in sensing injury and activating an adaptive transcriptional and metabolic response to orchestrate regeneration. Ultimately, this works aims to understand the metabolic requirements for regeneration. Expected outcomes include scholarly publications revealing fundamental principles of regeneration, new resources and pipelines for the research community as well as training for research students.	66,000.00	133,000.00	134,000.00	67,000.00	0.00	0.00	400,000.00
	National Interest Test Statement The studies outlined will provide fundamental insights into the role that metabolism plays in regulating growth during organ regeneration. We will leverage our innovative imaging, metabolomic and transcriptomic approaches in zebrafish to illuminate the key role Nrf2 plays in reprogramming metabolism to fuel tissue growth during organ regeneration. Our multidisciplinary studies will forge strong collaborative ties across research organizations, enhancing Australia's research capacity, producing high impact research. We anticipate that a better understanding of the metabolic requirements for tissue growth and regeneration will reveal important molecular insights that will provide opportunities for future pharmacological and commercial development. For example, there is the possibility that our insights into the metabolic requirements for tissue growth may have commercial value for the fisheries industry.							
DP200102753 Mackay, A/Prof Laura K	T cells provide critical immune protection against infection and cancer. However, the pathways that regulate these immune cells are not fully understood. T cells express a molecule called S1P5 that has an unknown function in these cells. In this proposal, we reveal new evidence that this molecule is an unappreciated and crucial regulator of T cell behaviour. Using state-of-the-art techniques and novel genetic tools, this project aims to discover the involvement of S1P5 in the immune response, and determine how S1P5 can be controlled to enhance protective T cell immunity. The expected outcomes are to generate fundamental new knowledge that will have significance for regulation of the immune response.	91,250.00	184,250.00	189,000.00	96,000.00	0.00	0.00	560,500.00
	National Interest Test Statement This project will generate fundamental new knowledge on how the immune system is regulated. It is anticipated that discoveries made in this project will lead to highly cited academic articles and the opportunity to represent Australia at leading international scientific meetings. Knowledge generated through this effort will lead to new insights for innovative strategies for vaccination against disease, with the ultimate goal of improving veterinary and human health. We expect to develop new collaborations to build commercial products and patent applications for improved vaccination strategies, encouraging multi-disciplinary research that will foster Australian research capacity and economic growth.							

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DP200102781 McQuire, Prof Scott	This project aims to address the social impact of major shifts in the production, distribution, viewing and storage of photographic images which have profoundly altered their everyday use. By adopting an interdisciplinary, user-centred approach to digitally networked photography, the project will provide a more holistic understanding of how photographs mediate communication, sociality and memory in the present. Expected outcomes include generating original empirical data, building international collaboration, and creating a new conceptual framework for assessing contemporary photographic practices. The research will provide community benefit by enabling insight into the social and ethical tensions affecting photography in the present. **National Interest Test Statement** Taking and sharing photographs is a popular activity engaged in by millions of Australians. This project will examine profound changes in how photographs are made, circulated, viewed and stored in digitally networked societies. While photographic technology has never been so widely available, understanding this availability simply as ‘democratization’ is complicated by the growing use of photographs as data-collection tools, with digital images becoming subject to new forms of algorithmic analysis. Experiences such as receiving ‘memories’ individually curated by a software program from a set of personal photographs raise new social and ethical questions. This project aims to generate rich empirical data about user experience in order to provide a more holistic account of the contribution of everyday photography to practices of communication, memory and the mediation of social life in the present. The key benefit to the Australian community expected from this research is an evidence-based, interdisciplinary framework for understanding the social and ethical tensions affecting photography today.	42,500.00	94,500.00	90,787.00	38,787.00	0.00	0.00	266,574.00
DP200102794 McLean, Prof Ian A	In fully documenting Australian artists who worked at the Abbey Arts Centre, London, 1946-56, and the British and European avant-garde in which they mixed, this DP throws light on this historically neglected art colony and recasts conventional understandings of post-WW2 Australian artists’s role in the European postwar period. At a time when this period is being extensively revised within a postcolonial frame, this DP is a timely contribution to current art historiography that will add significance to Australian art, especially within global institutional contexts. Outcomes include a state gallery exhibition, monograph and catalogue for retail, and potential additions of artworks and archives to national collections. **National Interest Test Statement** By developing new knowledge about the depth and breadth of the involvement of Australian artists with post-WW2 European artists and intellectuals and the connections they forged both in Europe and with developments in Australia, we will will provide new insights into the impact of WW2, the demise of European empires and the rise of the postcolonial world order on Australian national culture, including their legacy in the contemporary realignments of identities that today disturb national polities in Australia and across the globe. As windows onto individual and collective social feelings, the arts offer unique insights into the life of a place, a time and a nation, and are increasingly recognized for being as important as economic and political factors in understanding and finding solutions to social disaffection. Further, working with scholars involved in the current international interest in developing new perspectives on national cultures in the post-WW2 period, we will strengthen Australia’s place in international research and the wider art world.	42,634.50	79,336.00	75,226.00	38,524.50	0.00	0.00	235,721.00
DP200102824 Hutchins, Prof Nicholas	Roughness on ship hulls is a prevalent global problem, causing up to 80% increases in resistance compared to ideal smooth surfaces. Targeting a key capability gap, this project aims to build practical tools for predicting the performance penalty in shipping due to hull roughness, requiring only hull observations as an input. Observations made with a custom-built underwater surface scanner will be combined with world-first laser-based flow measurements on the hull of an operating ship, and backed-up by complimentary laboratory experiments. This project will deliver an advanced fundamental understanding of hull roughness and enable more informed decisions for ship operators and regulatory bodies, leading to increased shipping efficiency.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00

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	National Interest Test Statement							
	Owing to its geographic isolation and dispersed population centres, Australia is unusually reliant on long-haul transportation with shipping contributing substantially to Australia's energy usage. Roughness on ship hulls due to fouling is a prevalent global problem, causing up to 80% increases in resistance compared to ideal smooth surfaces. This project will deliver a set of tools that enable accurate prediction of the drag penalty on shipping due to hull roughness. This will permit more informed decisions for ship operators, enabling the cost of the fuel penalty due to fouling (estimated globally to exceed $10 Billion) to be accurately weighed against the cost of improving the hull state. The project expects to provide much-needed data to regulatory bodies - in terms of energy expenditure, emissions and health impacts due to hull roughness - leading to improved international regulation. Accompanying fundamental advances to predictions of air and water flows over rough surfaces will also benefit a diverse range of engineering, environmental and meteorological studies.							
DP200102870 Parish, A/Prof Clare L	With limited resources to directly study and advance our understanding of human neural development, this proposal will establish models of 4 key stages. Employing innovative, interdisciplinary approaches, biomaterials will be fabricated to provide structural and chemical support for human stem cells during: (i) neural induction, (ii) specification into neuronal progenitor subpopulations, (iii) neuronal maturation and integration into complex neural networks as well as, (iv) the organisation of neurons into larger 3-dimensional brain structures, namely folding of the human cortex. Further, biomaterials developed here have commercialisation potential, targeted at standardizing the culturing of human stem cells to defined neural populations.	80,000.00	165,000.00	170,000.00	85,000.00	0.00	0.00	500,000.00
	National Interest Test Statement							
	This proposal is intended to create models in which to study key aspects of human brain development including the maturation of different subpopulations of nerve cells (neurons), their integration into complex neural networks, and establishment of larger 3-dimensional brain structures. These models will provide a significant benefit for developmental biologists to study specific aspects and/or regulators of neural maturation, thereby advancing knowledge of human biology. Furthermore, fabricated biomaterials developed within this proposal have the potential for commercialisation, targeted at standardising the culturing of human stem cells into neuronal subpopulations.							
DP200102871 Parker, Prof Michael W	Animals, plants, fungi and bacteria all use pore-forming proteins as cell-killing weapons of mass destruction. Despite their lethal nature and their roles in infection and immunity, how these proteins work remains enigmatic. This project aims to unravel missing molecular details of how a major superfamily of such proteins is able to drill holes in cell membranes. The outcomes could reveal novel mechanisms general to these proteins and provide fundamental insights in understanding vital physiological processes across all kingdoms of life. Ultimately, this knowledge may guide the design of artificial protein pores that are selective for specific molecules with applications such as measuring metal ions, sugars, pesticides or pollutants.	90,000.00	185,000.00	190,000.00	95,000.00	0.00	0.00	560,000.00
	National Interest Test Statement							
	This project will provide insights into fundamental biology of bacteria including many with known importance in agriculture, biotechnology and human and animal disease. This could lead to the development of novel approaches in the biotechnology industry for the control of both bacterial and insect pests, as insects such as mosquitoes host some of these bacteria.The project also has the potential to lead to development of engineered proteins with great importance in the biotechnology industry, placing Australian science at the forefront of an emerging technology. This may have significant impact on the Australian economy through spin-off companies and licensing agreements. For example, Oxford Nanopore, a UK company that specialises in applications of engineered pores, has been valued at 1.5 billion pounds.							
DP200102903 Lê Cao, Dr Kim-Anh	Emerging single-cell sequencing technologies are transforming molecular cell biology, but identifying novel cell types and their functions requires the integration of highly heterogeneous data. The development of computational methods able to extract biologically relevant results is hindered by the lack of high-quality datasets. This project aims to develop novel sequencing methodologies and generate data to drive our dimension reduction multivariate method developments for data integration. By combining in silico and in vivo approaches, the project is anticipated to benefit scientists willing to work in cutting-edge single-cell research by providing useful protocols and tools to generate novel insights in cell biology.	162,500.00	262,500.00	162,500.00	62,500.00	0.00	0.00	650,000.00

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	National Interest Test Statement							
	Australian researchers have contributed substantially to the generation of big biological data across research and industry, and its dissemination through national and international consortiums. To capitalize on these costly experiments and highly complex data, the outcomes of this project are anticipated to empower researchers to extract relevant information that would not be otherwise obtained with current methodologies. As our project sits at the interface between multiple disciplines (bioinformatics, applied statistics, molecular biology), it is anticipated to accelerate scientific innovation and translation across Australia's research and industry sectors that rely on single-cell applications to deliver quality outcomes. As such, this project expects to build intellectual and human capacity, and place Australia at a competitive advantage at the interface of cutting-edge biotechnologies, genomics, and bioinformatics.							
DP200103110 Wang, Dr Nancy	CD4+ T (T helper) cells are required to control many important bacterial infections. This Project aims to identify the key targets of CD4+ T cells responding to a model bacterial infection, and to correlate potential antigen effectiveness with native expression, antigen presentation, and the function of antigen-specific CD4+ T cells over time. Our validated experimental 'pipeline' has unprecedented potential to define potent CD4+ T cell antigens within the thousands of proteins expressed by a bacterial pathogen. Our unbiased analysis may help establish the rules that define effective antigenicity. Our work will improve the understanding of bacterial immunity, and inform future design of T-cell based vaccines in the agricultural sector.	93,000.00	203,500.00	200,500.00	90,000.00	0.00	0.00	587,000.00
	National Interest Test Statement							
	Antimicrobial resistance (AMR) within infectious diseases is one of the major health threats worldwide. Vaccines are a fundamental component of the solution, and one of the key priority areas identified by Australia's first National Antimicrobial Resistance Strategy (2015-19). The efficacy of vaccines critically depends on the 'correct' selection of a set of antigens that effectively mimic the pathogen and, when recognised by the host immune system, will lead to the formation of long term immunity. This Proposal aims to address the critical knowledge gap on the mechanism and specificity of protective immunity conferred by an important subset of immune cells called CD4+ T cells. Building on our discovery, we hope there will be economic opportunities to develop new and improved animal vaccines in order to protect the efficiency of intensive animal husbandry settings without generating AMR. The same technologies, proven at scale in veterinary use, might also ultimately be deployed in human vaccine development to combat, for example, multi-drug resistant hospital acquired pathogens.							
DP200103136 Moffat, Prof Alistair	Web search services have become a fundamental tool used by governments, businesses, and individuals, and play a key role in our access to knowledge and information. In this project we aim to develop new techniques for representing the indexes at the heart of web search services, and to devise new processing algorithms with reduced resource requirements for resolving queries and providing useful and topical answers. Higher query throughput and reduced storage load will benefit providers though reduced hardware and electricity costs, and will benefit society through better access to information, enhanced opportunities to connect and collaborate, and greater long-term scalability as on-line resources continue to multiply.	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00
	National Interest Test Statement							
	Web search and on-line access to information are one of the most powerful tools to have emerged over the last twenty years. People in all walks of life -- business, government, and individuals -- perform billions of web searches a day, seeking the mundane (tomorrow's weather forecast), the personal (long-lost school friends, or family connections in another country), the vital (information in regard to a diagnosed health condition), and the professional (recent research findings, and legal precedents). But those web search services come at a significant cost in terms of computing hardware and electricity consumption. This project aims to develop new web index storage techniques and innovative web query processing algorithms, reducing the resource footprint of web search both in Australia and the rest of the world. The new techniques can be expected to allow more scalable web search for everybody, including all Australians.							

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DP200103233 McCallum, A/Prof Jeffrey C	This project will investigate superconductivity in silicon nanowire devices exhibiting both p-type and n-type conductivity. It builds on the recent demonstration at the University of Melbourne of superconductivity in nanowire devices at length-scales suitable for realisation of a broad range of superconducting device structures and utilises standard semiconductor-industry processes. This project will create a new platform for superconducting device development in silicon with potential for building devices with new functionality and improved performance for applications in quantum information technologies, enhancing Australia's global reputation in quantum information science and assisting emerging industries in this high-valued added area.	105,000.00	220,000.00	210,000.00	95,000.00	0.00	0.00	630,000.00
	National Interest Test Statement This project is within the Science and Research Priority area of Advanced Manufacturing: contributing to development of new and advanced manufacturing capabilities in high value-added materials. The emphasis on development of superconducting devices is highly relevant to quantum information science and quantum sensing and will enhance Australia's research strength in quantum computing. The fabrication processes devised in the program will promote expertise in nanotechnology and manufacture and measurement of nanoscale devices. The research will lead to advancement through technological development of superconducting devices in silicon; bringing together superconducting and semiconducting elements into the one material platform and utilising the high-quality materials and device engineering skills of the semiconductor industry to design and build entirely new electronic devices. It is complimentary to research in two ARC Centres of Excellence: CoE for Engineered Quantum Systems and CoE for Quantum Computation and Communication Technology, and will enhance Australia's track record in nanoelectronics.							
DP200103243 Moreau, A/Prof John W	This project aims to discover how microbes dissolve weathering-resistant phosphate minerals that contain valuable rare earth elements used widely in modern technology. This discovery would create new knowledge in the interdisciplinary fields of biogeochemistry and biohydrometallurgy, using an innovative combination of techniques in metagenomics, microbiology and mineralogy. Expected research outcomes include new, more economic and environmentally sustainable biotechnologies for recovering rare earth elements and increasing phosphorus availability in Australian mineral deposits and soils. These outcomes should benefit the mining and agricultural sectors, by decreasing Australia's dependency on overseas REE supply and the use of fertilizers.	99,531.50	203,029.50	206,215.00	102,717.00	0.00	0.00	611,493.00
	National Interest Test Statement This project would address basic unanswered questions about how microbes in the environment dissolve phosphorus out of weathering-resistant minerals, and by doing so cause the release of valuable rare earth elements that are essential for today's smarter and "greener" technologies. With this information, new microbial biotechnologies could be developed for recovering the rare earth elements from Australian ore deposits and mine tailings, thereby increasing their monetary value and the flow-on benefits to the Australian economy. These biotechnologies are likely to involve currently unknown microbial processes or cell-to-cell interactions, which if recognised and enhanced could provide a basis for commercialisation. Microbial bio-recovery methods for rare earth elements would almost certainly yield less chemically harsh, and therefore more environmentally friendly, techniques than are currently being applied worldwide. Such scientific, technological, environmental and economic advances would significantly decrease Australia's dependency on overseas providers for this critical 21st century natural resource.							
DP200103452 Scholten, Prof Robert E	This project will develop next-generation focused ion beam microscopy and nanofabrication using a novel cold ion source based on photoionisation of a laser-cooled atom beam. The low temperature and complex internal state structure of the constituent atoms combine to allow generation of ions with unprecedented brightness and resolution. We will use three unique and innovative ideas: field ionisation of atoms in so-called 'exceptional' states to reduce chromatic aberration; electron-ion correlations to enhance control of the ions at the nanoscale; and atom-atom interactions to isolate and manipulate individual ions. The new technology will enable advances in semiconductor nanofabrication and material characterisation.	75,708.50	164,291.50	165,251.00	76,668.00	0.00	0.00	481,919.00

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	National Interest Test Statement							
	Focused ion beam microscopes are an important and nearly ubiquitous tool in nanotechnology, for example to create sub-micron sections of biological tissue for high resolution electron microscopy, or to prototype and characterise next-generation semiconductor devices. But advances in these areas are in many cases constrained by the 10nm resolution limit of existing focused ion beam sources. We have been leaders in development of new cold-atom ion sources which have already demonstrated 20 times improvement over conventional devices. This project will continue that progression of cold-atom ion source technology, in particular enabling the ultimate goal of nanoscale device fabrication - the creation of single ions and placement of those ions with atomic scale resolution. That capability will support Australia's advanced manufacturing and development of advanced materials for the future.							
DP200103574 Loertscher, Prof Simon	Mergers, acquisitions, and collusive conduct take place in imperfectly competitive environments where firms have incomplete information about others. Despite this, standard workhorse models for analyzing the associated competitive effects assume that firms have complete information and typically only accommodate imperfect competition on one side of the market. This project aims to remedy this deficiency by developing the economic theory and associated practical tools for the analysis of competitive effects in settings with incomplete information and market power on both sides. The project work will be presented at seminars and workshops around the globe to both academic audiences and to practitioners at competition authorities.	38,560.50	76,707.50	76,881.00	38,734.00	0.00	0.00	230,883.00
	National Interest Test Statement							
	This project will increase the range of tools that are available to economists and competition authorities for the evaluation of the competitive effects of mergers and collusive conduct. The project aims to develop those tools and engage competition authorities around the world to put those tools into practice. For example, competition authorities currently consider the roles of countervailing buyer power and maverick firms when considering the likely competitive effects of a merger; however, they do not have available to them rigorous quantitative tools to evaluate those effects. A key benefit of the project will be more informed and more sophisticated, and hence improved, decision making by competition authorities when evaluating the competitive effects of economic conduct. Besides producing significant new knowledge, the dissemination of the insights from the project to a wider audience promises to deliver innovative economic, social, and cultural benefit to the Australian and international community.							
DP200103625 Evans, Prof Jamie S	High data rate communication links between vehicles and surrounding objects are needed to enhance advanced driver assistance systems, enable a wider range of infotainment options and pave the way towards fully automated driving. This project aims to develop a novel framework to use millimeter wave frequencies (the newest candidate for 5G cellular) to enable future high data rate vehicle-to-everything (V2X) communication systems. Based on an innovative approach, the project combines communication and sensor technologies in an integrated system that simultaneously reaps the benefits of autonomously sensing the driving environment and cooperatively exchanging information, thus providing significant savings in hardware costs and spectrum usage.	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00
	National Interest Test Statement							
	Communication is key to the development of a fully automated vehicle. It is estimated that the overall economic benefit to Australia that comes with an automotive industry is over $95 billion per annum. Contributing directly towards enabling future vehicle-to-everything (V2X) communication systems, this project aims to combine the newest trends in wireless communications and sensor technology to build efficient, reliable and secure communication links that can provide the terabytes per second data rates required to enable fully automated vehicles. The project identifies the great potential of using millimeter wave frequency bands for vehicular communications and provide the means to re-purpose already available automotive radars for communication purposes, thus significantly reducing hardware costs and increasing market penetration. The innovations from project will be of interest and relevance all over the world and position Australia as a leader in providing autonomous driving solutions and technology to make our roads safer and less congested.							

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DP200103642 Smith, A/Prof Kelly A	The body demands that the heart function at utmost efficiency. Trabeculae – folds within the heart lumen – maximise blood flow, contribute to chamber development and form the electrical conduction network of the heart. Problems with trabeculae formation cause cardiomyopathy and arrhythmia and yet we do not understand its basic development. The project will investigate the earliest stages of when this tissue develops its identity and examine the signalling, genetic, cellular and extracellular cues required to instruct trabeculae to form in the heart. Findings from this research will revise our understanding of when and how trabeculae form and provide key information about how to grow and repair this important tissue.	75,000.00	155,000.00	160,000.00	80,000.00	0.00	0.00	470,000.00
	National Interest Test Statement The heart is essential for survival and defects in its form or function are the leading cause of death in Australia. Unfortunately, there is a knowledge gap in our basic understanding of how the heart forms. Understanding which genes pattern the heart are crucial for the development of any technology, drug design or bioengineering efforts. The project will investigate how trabeculae form. Trabeculae are folds on the inner surface of the heart that allow it to pump blood more efficiently. They also carry a network of electrical tissue, ensuring heart contraction. Defective trabeculation can cause cardiomyopathy (leading to heart failure) and arrhythmias. This project will build basic knowledge of how this tissue forms. It may also help the development of diagnostics and be used to guide tissue engineering efforts. Outcomes from this research include knowledge gain, training of Australians in cutting-edge research, enhancing Australia's international research standing and provide potential economic benefits through knowledge & health gains and biotechnology opportunities.							
DP200103712 Simpson, Dr David A	The project aims to develop new imaging technology for real time recording of electrical activity from cell and neuronal networks with unprecedented resolution and scale. The technology innovation stems from an optical defect in diamond which can be engineered to sensitively detect local changes in electric field. The all-optical diamond optrode array devices will be applied to biological model systems including cardiomyocytes, mammalian cells, and neurons; and will be benchmarked against current state-of-the-art technologies. The knowledge gained from the high density recordings will aid predictive models of disease and will lead to an improved understanding of the brain's micro circuity and functional connectome.	75,000.00	150,000.00	145,500.00	70,500.00	0.00	0.00	441,000.00
	National Interest Test Statement Here we propose the development of an all-optical, non-invasive electrophysiology platform for real time recording of neuronal networks. This technology has the potential to transform the way we interface with neurological systems, and provides new opportunities to analyse neural networks and excitable cells/tissues with unprecedented scale and resolution. The nanotechnology breakthrough addresses a critical unmet in functional connectomics of neuronal circuits, and will improve our understanding of how the brain functions. The knowledge gained may enable future development of more efficient drugs to target cardiovascular disease and neurological disorders such as Alzheimer's and epilepsy. Australia is among the top five countries globally in biotechnology, and possesses a rich history in technology innovation and pharmaceutical drug discovery. The technology developed under this proposal would continue to drive innovation in these key areas to strengthen Australia's global reputation in biotechnology.							
	The University of Melbourne	4,765,452.00	9,804,521.50	9,831,735.00	5,104,265.50	311,600.00	0.00	29,817,574.00
Victoria University								
DP200101175 Zhang, Prof Yanchun	Crisis management services using traditional methods like phone calls can be easily delayed due to limited communication ability in the disaster area. This project aims to help users make smart decision in critical situations by using big social media data to detect complex social events, receive recommendations, and observe event summaries. We will invent advanced social data models, efficient indices and query techniques for situation awareness in big media. We expect to develop a system to evaluate the proposed situation awareness framework. The outcomes of the project will benefit social media analysis and big data fields. It will also improve the government services by enabling the real time situation awareness in crisis.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00

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	National Interest Test Statement							
	This project will develop data modelling techniques to analyse big social media data and more efficiently develop critical situation awareness over online services. The social media-based situation awareness framework developed in this project will have many practical applications, such as improving disaster management and decision making. Success in this project will advance techniques in social media analysis and big data, make fundamental contributions to computing, foster an innovation culture in Australia in the area of big data, By enhancing the services and capabilities of crisis management users and reducing the loss in disasters, significant economic and social benefits will be brought to government, society, enterprises and social users.							
DP200101830 Eynon, A/Prof Nir	The aged population accounts for a significant amount of Australia's health budget. This project aims to uncover novel molecular biomarkers that slow the ageing process and maintain good health for longer. This project aims to use innovative epigenetic analysis to study the molecular 'clocks' of young and old populations and to test whether exercise can slow the ageing process. This is expected to lead to a better understanding of how humans respond to changing environments during their lifetime, and will underpin the development of evidence-based personalised health interventions to keep Australians healthier for longer.	34,500.00	167,000.00	187,500.00	55,000.00	0.00	0.00	444,000.00
	National Interest Test Statement							
	Approximately 15% of Australians are over 65, and this proportion is expected to rise to 22.5% by 2050. The expenditure for an average patient over 65 is 2-5 times higher than for an average patient under 65. "Ageing well" must be a national priority both from an economic and a population health perspective. Regular physical exercise is a low-cost, efficient way to delay the occurrence of age-related diseases that constitute an important health and economic burden on society. This project aims to uncover novel molecular biomarkers and biosensors that slow the ageing process. This project expects to generate new knowledge in the priority area of Health, with a focus on preventative strategies to improve physical wellbeing. This work will lead to a much better understanding of how humans respond to changing environments during their lifetime, and will underpin evidence-based personalised health interventions to keep Australians healthier for longer. The outcomes of this project will therefore have significant economic and social benefits to the Australian community.							
DP200102844 Wang, Prof Hua	Confidential data such as military secrets or intellectual property must never be disclosed outside the organisation; formally protecting data exfiltration from insider attacks is a major challenge. This project aims to develop a pattern matching based systematic methodology for data exfiltration in database systems. We will devise highly accurate detection tools and secure provenance techniques that can effectively protect against insider attacks. The outcomes of the project will incorporate new security constraints and policies raised by emerging technologies to enable better protection of sensitive information.	80,000.00	160,000.00	160,000.00	80,000.00	0.00	0.00	480,000.00
	National Interest Test Statement							
	This project will develop fine-tuned mechanisms for early detection of data exfiltration by insiders and confine-and-mark approaches to prevent disclosure from database systems. The developed algorithms and techniques will be implemented in freely available open-source prototype software that will attract researcher to involve in insider attack challenges. The publicly accessible software will make the developed methods more reliable and stronger. The prototype will be a web-based application supporting secure sensitive information in relational database systems. Note that the web server and the application server have the responsibility of authenticating user identification information and providing confidential data transmission through secure socket layer connection. Australian organisations that take on these strategies can trust in the integrity of the innovative technology. The outcomes of the project will be highly beneficial to Australian government, businesses, enabling them to share and link confidential datasets securely and at low cost.							
DP200103542 Bishop, Prof David J	Mitochondria are essential for life, and we propose a highly-innovative approach (employing multiple, cutting-edge 'omic' technologies and bioinformatics) to advance the fundamental understanding of how mitochondria respond and adapt to exercise in humans. The project outcomes should include significant new knowledge and advanced expertise that can be used by others to facilitate additional research outcomes. The project anticipates the contribution of innovative tools for molecular biology research, benefiting therapeutic and biotechnology applications. This project will support advanced training of young researchers in frontier technologies, which will expand Australian research capabilities and help produce a higher quality workforce.	25,000.00	137,000.00	204,500.00	109,500.00	17,000.00	0.00	493,000.00

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	National Interest Test Statement Mitochondria are the energy-producing “power houses” of the cell and are critical to sustain life and promote healthy ageing. Our research has exposed critical gaps regarding the biological mechanisms responsible for how mitochondria respond and adapt to exercise and enhanced Australia’s international reputation via highly-cited publications in high-impact journals. By further advancing the understanding of these mechanisms, our research may benefit others to develop novel strategies to improve mitochondrial function. This project also anticipates the contribution of innovative tools for molecular biology research, benefiting therapeutic and biotechnology applications. Our research has contributed to the advanced training of early-career researchers and PhD students in the molecular biology of exercise, and another intended benefit of this research is to expand Australian research capabilities and to help produce a higher quality workforce. The successful demonstration of approaches used in this project will serve to increase feasibility of new projects employing similar approaches thereby reducing risk.							
DP200103583 Begg, Prof Rezaul K	This project addresses a critical problem in gait rehabilitation; predicting unstable locomotion and designing interventions to augment limb-joint function. The project will develop an autonomous ankle-foot assistive device to actively increase ground clearance when high-risk foot trajectory is detected. Using wearable sensor data, machine learning algorithms will predict high-risk gait and compute an actuator-induced ankle torque to maintain safe foot-ground clearance. A wearable autonomous joint-actuation system will contribute significantly to rehabilitation across a range of gait-impaired populations. The project's scientific and technological innovations will provide the opportunity for future developments in assistive technologies.	95,008.50	182,517.00	175,017.00	87,508.50	0.00	0.00	540,051.00
	National Interest Test Statement Physical injuries cost the Australian health care system over $3billion per annum and falls during locomotion account for 54% of injury-related hospital admissions. Tripping and stumbling account for 34% of all falls-related hospital admissions in elderly people, with tripping causing the majority of hip injuries. Approximately 30% of people 65 years or older and approximately half of those over 70 years, sustain a fall at least once a year. Australia's population is ageing and is projected to be 22% by 2035. The gait correction technology developed in this research project will improve the quality of life for individuals with gait impairments and contribute significantly to the estimated $32 million per annum in medical cost savings to Australia for every 1% reduction in falls.							
	Victoria University	299,508.50	776,517.00	857,017.00	397,008.50	17,000.00	0.00	2,347,051.00
	Victoria	13,965,057.50	28,894,847.50	29,091,841.50	14,733,188.00	571,136.50	0.00	87,256,071.00

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Western Australia								
Curtin University								
DP200100075 Fraser, Prof Suzanne M	This project aims to support uptake of new hepatitis C treatments. With the introduction of new treatments in 2016, the Australian Government adopted the WHO's goal of eliminating the disease by 2030. While early treatment rates were high, they have since plateaued, with stigma and poor information considered key obstacles. This project will generate new knowledge on treatment decisions and experiences, using a proven qualitative methodology. In doing so, it will produce a website covering personal experiences of treatment, issues in treatment decision-making, and advice on enhancing life on treatment and after. It will tackle hepatitis C-related stigma, and inform and benefit potential treatment users, families and relevant professionals.	83,787.00	177,750.50	93,963.50	0.00	0.00	0.00	355,501.00
	National Interest Test Statement In 2016, new, more effective treatments for hepatitis C were introduced in Australia. Following this change, the Federal Government adopted the WHO's goal of eliminating the disease by 2030. Early uptake of treatment was high but has since plateaued, with stigma and poor information considered key obstacles. Cures have slowed while new infections continue to occur, and as of the end of 2017 182,144 Australians continue to live with hepatitis C. As a result, Australia's ability to meet its elimination goal is now being questioned. This project will explore personal experiences of new treatments, identifying the issues those who have completed treatment considered in their decision-making, and any advice they have for enhancing life on treatment and after. The findings will be used to create a website aiming to inform potential treatment users, families, health workers and other professionals about the new treatments. In doing so, the project aims to support treatment uptake, tackle hepatitis C-related stigma, improve the health of Australians and reduce the burden of hepatitis C on the public health system.							
DP200101104 Johnson, Dr Timothy E	This project aims to decipher how and why plate tectonics emerged, and how any precursor tectonic system modulated planetary heat loss. The project expects to generate new knowledge regarding the tectonic record of the early Earth using pressure–temperature–age constraints from truly ancient (2.8–4.0 billion year old) metamorphosed rocks worldwide. Expected outcomes of this collaborative international project include the development of a conceptual geodynamic model for the early Earth. This should provide significant benefits in permitting a better understanding of the where and why of Australia's natural resources, in training a new generation of Earth system scientists, and in broadening public awareness of fundamental Earth science.	50,000.00	115,000.00	109,494.00	44,494.00	0.00	0.00	318,988.00
	National Interest Test Statement Understanding how the Earth worked in the Archean Eon (4.0–2.5 billion years ago) has fundamental implications, not least for the formation of major mineral deposits. For example, the distribution of gold, copper and platinum is likely controlled by processes at convergent margins, narrow belts in which the rigid tectonic plates that cover the Earth are colliding. Such processes are the result of plate tectonics, which has been the modus operandi on Earth for the past 2 to 3 billion years. However, whether or not these processes were active more than 3 billion years ago is fiercely debated, due largely to the scarcity of rocks of such antiquity. Australia has some of the best exposed areas of truly ancient rocks (greater than 2.8 billion years old), and is a key area of investigation if we are to answer some of the foremost outstanding questions in Earth Science. This knowledge gleaned from the project will permit a better understanding of the where and why of Australia's natural resources, as well as helping educate Australians about our planet in its youth.							

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DP200101555 Ntoumanis, Prof Nikolaos	Being persistent in pursuing an important goal is glorified in society. People, however, often need to be strategic in their goal pursuits. A series of lab and field studies will aim to test how helping individuals to realise early in their goal striving whether their goal is attainable or not, can support them in making the right decision (persist with, abandon, or change the goal). The project will make novel contributions to theories of motivation and goal regulation. It will also have significant public benefit as it will provide the necessary evidence for the development of brief interventions that maximise the efficient use of individuals' limited resources, facilitating individual and societal productivity and well-being. **National Interest Test Statement** We ask: "Can people become strategic by deciding early in their goal pursuits whether to persist with a difficult goal or give up and strive for a compatible goal"? We address a significant problem, as research shows that appropriate responses to goal striving difficulties can enhance personal and social well-being, health, and productivity. We study life domains where effective goal management is often problematic, setbacks are common, and effective goal management strategies are needed. For example, we will recruit new parents with work commitments; women and men with a variety of family and work circumstances often report interference between work and family goals. In another study, we will examine money saving goals. Over 2m Australians make a New Year's resolution to save money, but 3 in 5 break it because their goal is "unachievable", potentially making themselves financially vulnerable. We will work with key stakeholders (parental and community groups, banks and agencies that offer free financial counselling) to outline ways in which our methods can be implemented (e.g., mobile apps, online advice).	59,757.50	122,926.00	122,776.50	59,608.00	0.00	0.00	365,068.00
DP200102073 Bland, Prof Philip A	Virtually everything we know about the origin and evolution of our solar system comes from analysis of meteorites. But reading the record they contain has proven to be difficult: we have almost no constraint on where they come from. With ARC LIEF support, Australian planetary scientists are leading a consortium of 14 international teams to build a Global Fireball Observatory. The facility, with a unique global footprint, will be complete by end-2019. It will track 100s of meteorite falls, and for each one, pinpoint its origin in the solar system. A NASA partnership will provide administrative support. Curtin University will fund its operation. The proposal here is for a researcher and student who can drive the science program. **National Interest Test Statement** The Global Fireball Observatory (GFO) builds on a facility - the Desert Fireball Network (DFN) - that has materially enhanced Australian research capability. It was a driver behind a formal partnership between NASA and Australia that is enabling mission development and cooperation in advanced instrumentation. We have a track record of technical innovation, engagement with industry, and outreach for STEM, that will grow exponentially with the GFO. We have patented innovations in optical sensor technology from earlier iterations of sensor hardware. DFN tracking of satellites, debris re-entry, and overseas rocket launches led to a partnership with Lockheed Martin Australia in space situational awareness (SSA). The Curtin / Lockheed project - FireOPAL - builds on six years engineering heritage from the DFN. It directly benefits Australian national security: SSA is a key priority area for the Australian Defence Force. The GFO will be the perfect testbed for further innovation in SSA sensor technology. Finally, the NASA / GFO partnership will provide a global footprint for our multi-award winning STEM program.	86,500.00	176,500.00	176,500.00	86,500.00	0.00	0.00	526,000.00
DP200102301 Buckley, Prof Craig E	This project will investigate new high temperature (> 600 degrees Celsius) metal hydrides and carbonates suitable for thermochemical energy storage in dish-Stirling Concentrated Solar Power systems. The intended outcome is to discover cost effective, energy dense materials that are capable of operating over a 30 year life span in a solar power plant. This will enable 24/7 electricity production from renewable sources in a dispatchable solar platform, ideal for remote locations. The successful development of high temperature metal hydrides and carbonates will finally provide an energy storage solution to dish-Stirling Concentrated Solar Power systems, which will greatly reduce our reliance on fossil fuels to produce electricity.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00

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	National Interest Test Statement This research project will significantly contribute to the Australian Scientific and Research Priorities for Energy of which the targets are to face the challenges of new clean energy sources and storage technologies that are efficient, cost effective and reliable. Specifically, the project will target the development of new materials to store energy for dispatchable concentrating solar thermal power plants. This would enable dish-Stirling systems to provide 24/7 power, solely from the sun. This technology is ideal for Australia, especially for remote, off-grid locations, where they could provide small to large scale base-load power generation. As such, the development of this technology offers the possibility of providing national and international commercial and economic benefit. Further, the environmental benefits would be even more dramatic due to the ability to shift away from fossil fuels to a next generation base-load renewable power source.							
DP200102471 Miller-Jones, A/Prof James C	The release of gravitational energy as mass is dumped onto a black hole powers some of the most extreme phenomena in the Universe. This project aims to use a new X-ray telescope to find the most disruptive stellar-mass and supermassive black holes in the Universe, and characterise their outflows with some of the world's most sensitive radio telescopes. This research will answer fundamental questions identified by the astronomical community regarding how black holes grow, how they generate powerful outflows, and how much energy they can deposit into the surrounding environment. It will forge strong links with international partners, strengthen Australian expertise in this high-impact area of science, and stimulate public outreach work.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement Using radio and X-ray observations to probe how the most extreme black holes grow, this project will answer fundamental questions identified by the Australian astronomical community in their most recent Decadal Plan. By leveraging Australia's existing investments in radio astronomy, it will provide access to the unrivalled capabilities of some of the world's newest space-based and ground-based telescopes, and develop strong international collaborations. Building on prior agreements and partnerships supported by the ARC, this project will develop and test observing strategies for conducting transient science with the future Square Kilometre Array (SKA) radio telescope, which will be partly hosted in Australia. It will thereby position Australian researchers to take full advantage of the significant national investment in SKA. Finally, black hole astronomy is able to excite the public like few other fields of science, which gives the project the potential to generate widespread community interest and significant media coverage, inspiring increased engagement with science, particularly among young people.							
DP200102643 James, Dr Clancy W	This project's aim is to identify the source of the highest-energy particles in nature, cosmic rays, and discover new physical processes at energies unreachable by the Large Hadron Collider. It will do this by using the Murchison Widefield Array radio telescope to detect the sub-microsecond pulses from cosmic ray interactions in the Earth's atmosphere. The project's intended outcome is a sample of thousands of cosmic ray events, and a new technique to analyse the structure within them. The anticipated benefits are the establishment of the Murchison Widefield Array as a world-leading instrument for astroparticle physics, new knowledge of high-energy astro and particle physics, and advances and training in fast signal processing methods.	62,500.00	126,500.00	126,500.00	62,500.00	0.00	0.00	378,000.00
	National Interest Test Statement Particle physics and astronomy have been at the forefront of scientific breakthroughs and technological development in the 20th century. Discoveries such as the Higgs boson at the European Centre for Nuclear Research (CERN), and the expansion of the Universe by two teams of researchers in the USA, have captured the public imagination. They have also changed our way of life - the World Wide Web was invented at the European Centre for Nuclear Research (CERN) as a method for physicists to communicate, while CSIRO astronomers looking for exploding black holes developed technology key to enabling WiFi. This project combines existing Australian expertise in both particle physics and astronomy to push the bounds of what a radio telescope can do. It will develop fast signal processing techniques to enable the Murchison Widefield Array to study the highest-energy particles in Nature. This will cement Australia as a world leader in the emerging discipline of multi-messenger astrophysics, and pave the way for future projects with the Square Kilometre Array.							

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DP200102784 Shaikh, A/Prof Faiz	This project aims to investigate the potential use of lithium refinery residue as a partial replacement for cement in concrete. This project expects to generate new knowledge in the area of green concrete through fundamental investigation of its properties and to incorporate this residue as a new supplementary cementitious material in existing Australian standard. The expected outcomes of the project include characterisation and benchmarking of lithium residue as an alternative supplementary cementitious material in concrete. This will provide significant environmental benefits in both a reduction in lithium waste and reduction of CO2 emission of cement in high-performance green concrete.	50,000.00	95,000.00	70,000.00	25,000.00	0.00	0.00	240,000.00
	National Interest Test Statement About 1.4 M tonnes lithium residue per year is expected to be generated in lithium refinery plants in Australia due to demand of lithium ion batteries in the world. This volume of residue will require significant land area for disposal, and will lead to environmental problems with the potential for leaching of this residue into the groundwater. It is estimated about 1.3 M tonnes of CO2 emission per year in Australia associated with cement use in the construction industry could be reduced by using lithium residue as a partial replacement of cement in concrete. The construction industry in Australia could also save about A$500 Million in cement cost per year using lithium residue in concrete. Therefore, through this research the lithium residue can be recycled in concrete as a partial replacement of cement, which will provide significant economic, environmental and commercial benefit to the lithium refinery and construction industries in Australia.							
DP200103315 Shao, Prof Dr Zongping	This project aims to design an innovative high-energy portable power source based on a hybrid direct hydrocarbon-carbon fuel cell concept, in which the deposited carbon in the anode of a fuel cell during operation with liquid hydrocarbon fuels can be used as a fuel by subsequent operation in the direct carbon fuel cell mode. The key concept in this project is the controlled deposition and utilization of carbon over the anode of the fuel cell by systematic modelling and experimental development. A continuous power output will be realized via an intelligent cycling mode with an intermittent supply of pure liquid hydrocarbon fuels, thereby achieving an extremely high fuel utilization efficiency in a hybrid electrochemical system.	75,000.00	150,000.00	110,000.00	35,000.00	0.00	0.00	370,000.00
	National Interest Test Statement The proposed green portable power sources with high energy density and minimum impact to the environment in this project can contribute significantly to the sustainable development of Australia. The fuel cells are ideal electrochemical conversion devices for the highly efficient conversion of the chemical energy of hydrocarbon and carbon fuels to electric power, which are particularly suitable for Australia because of the abundant natural resources of Australia. The highly effective use of fossil fuels and biomass will enhance the long-term viability of Australia’s resources. Furthermore, the application of this novel system will lead to new breakthroughs in the commercial viability of fuel cell industries.							
DP200103332 Shao, Prof Dr Zongping	This project aims to develop high-performance solid-state lithium batteries by engineering the design of grain boundaries within the oxide electrolyte and interfaces between the electrolyte and both anode and cathode. This project expects to propose a novel cation exsolution strategy for comprehensively engineering the interfaces and boundaries. This project should provide significant benefits on energy safety and sustainable development of Australia. The successful completion of this project can lead to the development of battery technologies that may lift Australia to a better position in the international market and may also help boost the prosperity of Australia’s world-leading lithium mining industry.	75,000.00	150,000.00	118,094.00	43,094.00	0.00	0.00	386,188.00

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	National Interest Test Statement							
	In recent years, concerns have been expressed on the possible shortage of fossil fuels and environmental issues resulting from low-efficiency, unsustainable electricity generation by fuel combustion. To better utilise the electricity generated by the fluctuating renewable energies, electrochemical storage devices are required. Lithium battery is a promising candidate, but its safety issue related to the flammable organic electrolytes has aroused worldwide attention. This project addresses the problem by developing solid-state lithium batteries via material engineering. The project falls into the Science and Research Priority of Energy. Successful completion of this project should contribute significantly to energy safety and sustainable development of Australia. The project may benefit the development of battery technologies that can lift Australia to a better position in the international market and may help boost the prosperity of Australia's world-leading lithium mining industry. The project involves the participation of renowned researchers and is expected to promote international collaborations.							
DP200103404 Chrulew, Dr Matthew	This project aims to transform our understanding of the captive management of wild animals by examining the histories, effects and potential futures of zoo biology. It expects to clarify, synthesise and generate knowledge in the history and philosophy of zoo biology using interdisciplinary approaches to the intersection of human and animal lives. Expected outcomes of this project include international and interdisciplinary collaborations that will develop sophisticated methods and conceptual resources for understanding and improving human-wildlife relations. This will provide significant environmental and social benefits, protecting threatened biological communities and helping them to flourish alongside people in changing conditions.	32,389.50	68,576.00	68,503.50	32,317.00	0.00	0.00	201,786.00
	National Interest Test Statement							
	This research contributes to Australia's national interest through its potential environmental, social and cultural benefits. It will increase knowledge of the ways human activities impact on wildlife, protecting diverse threatened biological communities and helping them to flourish alongside people in changing conditions. It will expand our environmental literacy and develop interdisciplinary methods more adequate to the complex intersections of wildlife with human communities.							
	Curtin University	704,934.00	1,442,252.50	1,255,831.50	518,513.00	0.00	0.00	3,921,531.00
Edith Cowan University								
DP200103448 Suter, Prof David	This proposal will put an important class of clustering (extracting data that should fit a geometric model) on a more solid theoretical foundation. This will lead to better understanding of how to certify outcomes, efficiency, reliability etc. The type of clustering under consideration is relevant to many problems in machine learning and computer vision, as well as data mining and a wide variety of other settings.	60,000.00	125,000.00	130,000.00	65,000.00	0.00	0.00	380,000.00
	National Interest Test Statement							
	Autonomous cars and mobile robotics have unlimited potential to improve the lives of Australians. Autonomous vehicles alone are projected to prevent more than 1,000 deaths and 30,000 hospitalisations each year in Australia and save the economy more than A$16 billion a year in crash-related costs once fully implemented. This project will improve the functionality of detection mechanisms within these machines by improving their capability to automatically analyse data from camera input and decide how many structures and obstacles there are in a scene. It will also more precisely determine the physical characteristics of structures (precise shape and/or motion). The applications of this research are not limited to robotics: for example mobile phone apps that can analyse a scene and prosthetic aids for the vision impaired could all benefit from such enhanced capabilities.							
	Edith Cowan University	60,000.00	125,000.00	130,000.00	65,000.00	0.00	0.00	380,000.00

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Murdoch University								
DP200101026 Wilson, Prof Sandra S	This project aims to investigate the perception of Japan's continuing guilt for atrocities committed during the Second World War. Until the 1970s, it was widely believed that Japan had resolved its guilt by accepting punishment, paying recompense and apologising, and could move on. The project expects to generate new knowledge about the process by which the idea of Japan's guilt was revived to become a major issue in East Asian and world affairs. Expected outcomes include enhanced understanding of how historical grievance is constructed and why it has come to be considered always open to review. Anticipated benefits include a greater understanding of the changing ways in which historical grievance is used, both politically and ethically.	36,118.50	73,052.50	67,917.00	30,983.00	0.00	0.00	208,071.00
	National Interest Test Statement The issue of Japan's historical responsibility for atrocities committed by its military during the Second World War – and the sense that this responsibility has not been properly addressed in Japan – is a major source of strained relations among nations in our region. Post-war negotiation between Japan and its former enemies appeared to have settled the question of how Japan should express contrition and enact reform, yet the issue of war guilt flared up again from the 1970s onwards. In investigating the original settlement and analysing why war guilt again became a politically volatile issue, this project will assist Australian policy-makers in managing the delicate strategic balance in our region. Responding appropriately to historical grievance has become a matter of acute political importance in many countries, including Australia. In examining the process by which a previously settled historical grievance was re-opened, this project can inform Australian government policies on how best to devise effective and lasting reconciliation measures.							
DP200102284 Xia, Dr Fang	This project aims to investigate the role of hydrothermal fluids in the creation and decay of porosity and permeability in minerals. By developing new experimental techniques and undertaking experimental studies mimicking natural conditions, this project expects to generate knowledge of the fundamental relationships between fluid-mineral reactions, pore creation and decay, pore geometry and connectivity, and the mechanism for the formation of fluid inclusions. This should provide significant benefits such as a deeper understanding of the hydrothermal fluids flowing through tight rocks in the Earth's crust to form orebodies, and provide a scientific basis to underpin the development of greener technologies for recovering natural resources.	90,000.00	157,000.00	130,500.00	63,500.00	0.00	0.00	441,000.00
	National Interest Test Statement This project will extend Australia's leadership in research in sustainable mineral industry and will bring economic and environmental benefits to Australia. The minerals industry is contributing greater than $200 billion per year to Australia's economy, and this project will enhance its sustainability. Firstly, new knowledge of rock porosity and permeability for metal-carrying fluid traveling within the Earth's crust and of the formation of fluid inclusions in minerals will lead to a better understanding of the formation of orebodies and hence will guide mineral exploration to discover new deposits. Secondly, a clearer understanding of the factors for sustaining rock porosity and permeability during fluid-rock reactions is vital information for the development of efficient and environmentally benign technologies for mineral resource extraction directly from sub-surface orebodies.							
DP200102593 Schroeder-Turk, A/Prof Gerd E	Several butterfly species grow a complex nano-sculptured matrix whose chiral network structure confers remarkable optical properties, including jewel-like reflections. The formation process remains mysterious and a spectacular case of bottom-up self-assembly at far larger scales than accessible in the lab. The project aims to decipher this process, by (a) tomography of a species where arrested growth sites represent time-frozen snapshots of the development, and (b) by a combination of micron-resolved in-vivo microscopy of a developing butterfly wing with a growth model to infer nanometer-scale information. This insight will lead to blueprints for self-assembly strategies and shed light on function and form of inner-cellular membranes.	82,000.00	144,500.00	102,500.00	40,000.00	0.00	0.00	369,000.00

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	National Interest Test Statement							
	This proposal's impact is the development of our understanding of a unique class of biological nanostructured materials. Using a green butterfly as a model system, we aim to unlock the secrets of nature's nanotechnology toolbox which could lead to bio-inspired design of functional nanomaterials with novel optical, mechanical strength and durability properties. The long-term beneficiaries of nanomaterials science research are Australian and global nanotechnology and biotechnology industries whose technological breakthroughs are based on foundation knowledge. Deciphering the formation of nature's nanostructures is a crucial step towards advancing their use in medicine, engineering, manufacturing and food security. This, in turn, can benefit a broad range of Australian and global initiatives, including the development of lipid-based drug delivery systems, diagnostic imaging, energy storage solutions and optical communications.							
	Murdoch University	208,118.50	374,552.50	300,917.00	134,483.00	0.00	0.00	1,018,071.00
The University of Western Australia								
DP200100080 Devillers, Dr Alice	Advances in digital technologies are underpinned by powerful mathematics; use of symmetry greatly simplifies complex problems. This project aims to exploit the mathematical theory of groups to advance our understanding of combinatorial designs with exceptional symmetry. New designs have become prominent through links with networks and error correcting codes. The project expects to generate constructions and classifications in these areas by utilising powerful group theory. As well as innovative methods for studying designs with symmetry based on group actions, expected outcomes include enhanced international collaboration, and highly trained combinatorial mathematicians to strengthen Australia's research standing in fundamental science.	65,000.00	135,000.00	140,000.00	70,000.00	0.00	0.00	410,000.00
	National Interest Test Statement							
	Combinatorial designs underpin modern technological tasks such as web searches, and error-correcting codes for data transmission and data compression, as well as structured scientific experiments. Designs with high symmetry guarantee additional balance and regularity yielding greater power and efficiency in these applications. The theory of symmetry which this project aims to strengthen and exploit has broad applications in the mathematical and physical sciences and there is potential for far reaching economic, commercial and scientific benefits. Project goals include improved methods for studying designs with symmetry, as well as new constructions and design classifications. The project aims to enhance Australia's international reputation and standing in research by anticipated fundamental conceptual advances in design theory. The supportive and high quality research environment at UWA is known globally for producing highly trained and internationally award-winning mathematicians to contribute to Australia's research efforts and maintain a vibrant mathematical sciences research community in Australia.							
DP200100088 Lydon, Prof Jane	This project aims to investigate the ways that visual images have defined, contested and advanced ideas of Australian citizenship and rights from European settlement to the present. Responding to the lack of a shared mainstream understanding of Australian citizenship, it looks beyond legal definitions to explore cultural and especially visual views of citizenship over time. Through collaboration with museum, media and education sectors, it will provide a forward-looking and accessible public history, and utilise the potential of images to broaden contemporary debates about citizenship. Expected outcomes include a better public understanding of the pathways to citizenship, and enhanced engagement with Australian values and identity.	75,500.00	159,500.00	175,000.00	91,000.00	0.00	0.00	501,000.00
	National Interest Test Statement							
	Following new Australian citizenship laws, this project aims to support the Australian Government's commitment to strengthen the integrity and effectiveness of the citizenship program. It aims to create a better historical and contemporary understanding of the pathways to citizenship, and to enhance public engagement with shared civic values and identity. The project will contribute to building a healthy and resilient community, and to maintaining social cohesion and security, by promoting public understanding of the meaning and value of citizenship. Visual images are a powerful and accessible way of sharing ideas about Australian identity and culture, so by providing a visual history of citizenship, this project will build new foundations for debating these issues in the present. The project includes a substantial public program of collaboration with museums, media organisations and communities to communicate our findings. It aims to produce innovative public and policy outcomes in media and policy to guide contemporary debates about citizenship in the media, law and politics.							

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DP200100094 Lydon, Prof Jane	This project aims to bring Australia into the global history of slavery by exploring the legacies of British slavery in Western Australia. Through developing innovative methods for biographical research and digital mapping, it will trace the movement of capital, people and culture from slave-owning Britain to WA, and produce a new history of the continuing impact of slavery wealth in shaping colonial immigration, investment, and law. Expected outcomes of this project include enhanced capacity to build international disciplinary collaborations, new research methods, and a major national online exhibition. Benefits include a radically new perspective on Australian history and abolition in the present, with major public outcomes. **National Interest Test Statement** The project will re-write Australian history by revealing the hidden story of our links to British slavery. By exploring the movement of capital, people and attitudes from slave-owning Britain to Western Australia before and after the time of abolition (1833), the project aims to reveal slavery's Australian legacies. Through an innovative digital mapping tool, new biographical methods (developed in collaboration with the Australian Dictionary of Biography), archival research and analysis by an international team, it aims to produce a new history of WA leading up to its bicentenary. It will communicate this new history to a broad mainstream audience via major public outcomes including an online exhibition at the Australian National Maritime Museum. By advancing new research methods, it will have considerable benefit in research training and development and increase Australia's capacity to build international disciplinary collaborations. It will provide depth and context for current global campaigns against human trafficking involving Australia as a destination and in commercial supply chains.	95,000.00	215,000.00	235,000.00	115,000.00	0.00	0.00	660,000.00
DP200100201 Wernberg, A/Prof Thomas	This project aims to unravel where and when marine heatwaves drive loss of genetic diversity and rapid directional selection in kelp forests. Although the devastating ecological impacts of marine heatwaves are well studied, empirical understanding of how marine heatwaves impact underlying evolutionary processes including adaptive capacity and resilience is lacking. This research will use a powerful combination of innovative heatwave analyses, cutting-edge genomics and physiological experiments to fill these knowledge gaps and represents a step change in our understanding of how kelp respond and adapt in multi-stressor seascapes. Results will pave the way for development of novel mitigation strategies to future-proof marine management. **National Interest Test Statement** Kelp forests are among the most ecologically and socio-economically important marine habitats covering over ~71,000km2 of the Australian coast, yet are rapidly declining with the value of lost ecosystem services estimated at ~ $1,000,000 per km of coastline per year. This research will provide the first knowledge of how devastating marine heatwaves impact resilience and adaptability of kelp forests and improve capacity to predict heatwave impacts and kelp forest vulnerability. Such knowledge will help mitigate and alleviate the socio-economic impacts of extreme events and pave the way for development of novel and future-proof mitigation, conservation and management strategies to ensure the long term persistence of underwater forests and their values in multi-stressor seascapes. Moreover, this research falls within the Australian government priority areas of assessing environmental change and will significantly build national research capacity.	73,818.00	186,046.00	189,468.50	77,240.50	0.00	0.00	526,573.00
DP200100566 Ridley, A/Prof Amanda R	The evolution of cognition is a fundamentally important yet poorly researched area. It has recently become clear that rather than measuring cognitive performance between species, understanding the causes of intraspecific variation in cognitive performance is vital to accurately measure the selective benefits of cognition. Recent groundbreaking research on Australian magpies has revealed individual differences in cognitive performance are influenced by differences in sociality. This proposal will determine the causality of these results by examining the developmental and fitness consequences of individual differences in cognitive performance in relation to social interactions, thus directly addressing the sociality-cognition debate.	73,104.00	140,413.00	134,643.00	67,334.00	0.00	0.00	415,494.00

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	National Interest Test Statement							
	This research investigates the factors influencing individual variation in cognition. In particular, it looks at how living socially influences cognition, and thus has direct relevance for the evolution of human society - from simple tribes to complex multilevel societies. The social intelligence hypothesis predicts that sociality has a key influence on the evolution of cognition, but thus far little empirical evidence exists. Recent research on social magpies provided detailed information about variation in cognition WITHIN a species sharing the SAME environment and thus significantly advanced support for the social intelligence hypothesis. However, what remains unknown is what ASPECT of sociality influences cognition. This is a question of significant national benefit, since cognition, defined as the way an animal processes information from its environment - is essential to all animals. Understanding the causal social factors influencing cognitive ability will therefore provide significant insight into the relationship between the evolution of societies and cognition.							
DP200100762 Edwards, Prof David	As many more plant genomes are sequenced, the bottleneck is being able to interrogate and translate this data into applications for crop improvement. This project will develop and apply a population graph database, hosting genome data for the world's major crops and their wild relatives, allowing the characterisation of gene diversity on an unparalleled scale. Analysis of this data will reveal the presence/absence and sequence diversity for classes of genes for important agronomic traits including disease resistance, flowering time and legume nitrogen fixation which will enable plant breeders to identify and apply novel genes and allelic variants for use in breeding programmes, accelerating the production of improved crop varieties.	59,500.00	115,000.00	118,000.00	62,500.00	0.00	0.00	355,000.00
	National Interest Test Statement							
	Genome sequencing technology is changing our understanding of biology and evolution, with implications for health and agriculture. Australia remains an international leader in crop genomics and applied bioinformatics, relatively new fields of research which contribute to knowledge and the big data economy. As more plant genomes are sequenced, we need to find new ways to interrogate this data and translate it for improved crop production. This project builds on the CIs expertise in big data genomics, to collate the rapidly expanding plant genomic data being produced by the CIs and international collaborators within a population graph database. We will query the data to estimate how many genes are in major plant groups and which genes are conserved or differentiate between species. We will focus on genes of agronomic importance including those associated with flowering time, nodulation and disease resistance. Knowledge of the diversity of these gene classes will inform the breeding of improved crop varieties, supporting Australian agriculture, rural communities and the national economy.							
DP200101013 Lambers, Em/Prof Johannes (Hans) T	This project aims to determine the link between high phosphorus use efficiency and nitrogen metabolism in the Fabaceae, Myrtaceae and Proteaceace, the three families of plants that co-dominate the flora on the extremely phosphorus-impoverished soils of south-western Australia, a Global Biodiversity Hotspot. It is expected that the extremely high phosphorus use efficiency in these plants is inextricably linked to a low capacity for nitrogen uptake. An anticipated outcome is new insight into how these plants achieve highly efficient phosphorus and nitrogen use, providing new understanding into the functioning of plants in an exceptionally biodiverse ecosystem and into traits that may lead to to crops with higher fertilizer use efficiency.	105,000.00	212,000.00	212,000.00	105,000.00	0.00	0.00	634,000.00
	National Interest Test Statement							
	The intensive agricultural systems that are central to the economic and social well-being of Australia rely on enormous inputs of phosphorus and nitrogen fertilizers that are expensive to produce and to apply. This research seeks to understand the interactions of phosphorus and nitrogen in plants that have evolved on the extremely nutrient-poor soils of southwest Australia. Due to their evolutionary history, these plants are highly efficient in the use of both phosphorus and nitrogen. This research aims to identify traits and metabolic concepts that are transferable to crop plants to make them less reliant on limited and expensive fertilizers. The goal of decreasing fertilizer use has direct economic benefits by decreasing production and application costs, has environmental benefits by decreasing the degradation of land and waterways by eutrophication and decreasing pollution and other environmental damage from manufacturing processes; and has societal benefits from making farming systems more productive, sustainable and economically viable.							

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DP200101293 Liu, Prof Jishan	There is a degree of public anxiety on how unconventional gases is extracted. Horizontal drilling and hydraulic fracturing are two key enabling technologies to extract unconventional gases. But, the current study reveals well and field productivities exhibit steep declines. This implies that current practice may not be sustainable. The successful completion of this project will provide a scientific approach to look at the sustainability issue through testing a hypothesis that the properties of rock blocks between hydraulic fractures determine the sustainability of gas production instead of hydraulic fracturing.	55,000.00	120,000.00	130,000.00	65,000.00	0.00	0.00	370,000.00
	National Interest Test Statement According to Australian Energy Update 2018, natural gas production grew by 23 per cent in 2016–17, underpinned by increased coal seam gas production in Queensland. An Australian Council of Learned Academies report in 2013 found that Australia could have more than 1000 trillion cubic feet in recoverable shale gas. The parts of most likely commercial shale gas deposits are in Northern South Australia, Western Australia (the Canning Basin and the northern Perth Basin), The Northern Territory, and Western Queensland. Australia's gas supply is growing as new technology allows companies to produce from large reserves that were too difficult to access until recently. The successful completion of this project will provide a scientific approach to look at the sustainability issue of both coal seam gas and shale gas through testing a research hypothesis that the evolution of rock matrix properties determines the sustainability of gas production instead of hydraulic fracking. This theory may also lead to a set of new technology on the modification of rock blocks between hydraulic fractures.							
DP200101545 Lowe, Prof Ryan J	This project aims to develop a new framework to accurately predict how a diverse range of coastal ecosystems (seagrasses, corals, mangroves) act to reduce coastal flooding. The project aspires to develop novel theory and models to quantify how the large, complex roughness of these ecosystems interacts with coastal flows to attenuate extreme water levels at coastlines. Expected outcomes include new predictive models and guidelines that can be immediately incorporated into coastal hazard forecasts and engineering practice. This will allow greatly-improved predictions of how coastal ecosystems support the safety and resilience of coastal communities worldwide, and new design guidelines to boost nature-based coastal defence projects.	132,904.50	207,129.00	149,349.00	75,124.50	0.00	0.00	564,507.00
	National Interest Test Statement Coastal flooding presents a significant threat to public safety and property in Australia, one that will only worsen with rising sea levels and increasing extreme events. Australia is particularly vulnerable to coastal flooding, with its cities, towns & critical infrastructure disproportionately located in a thin coastal strip. Coastal zones that will be prone to flooding by the end of this century currently support over $220 billion of Australian infrastructure and assets. This project aims to quantify the capacity of coastal ecosystems (such as seagrasses, coral reefs and mangroves) to prevent coastal flooding. With our coastline recognised for its abundance of such ecosystems, Australia is uniquely placed to develop novel 'win-win' coastal defence strategies, whereby these ecosystems (and the services & economic benefits they generate) can be preserved, while providing critical defence against coastal flooding. As a leader in the Indo-Pacific region (surrounded by many particularly vulnerable countries), this project can help Australia develop transformative solutions to the threats of coastal flooding.							
DP200101659 Koutsantonis, Prof George A	This project aims to develop molecular rectifiers incorporating organometallic complexes for future electronics applications. The organometallic molecules will be an integral part of the electronic device to ameliorate the technological problems arising from miniaturisation of semiconductors. Expected outcomes are a new approach to molecular designs that provide a rectifying response in single molecules and large area molecular junctions. This should build manufacturing capacity in Australia and enhance international collaboration and reputation by addressing significant challenges in molecular electronics. Benefits arising include skilled researchers, internationalisation of Australian research and contributions to fundamental science.	100,000.00	175,000.00	120,000.00	45,000.00	0.00	0.00	440,000.00
	National Interest Test Statement The work here will impact on the very design of new electronic components providing a rectifying response through clever molecular design. Our efforts will be assisted by regional collaboration providing global impact. In addition to the fundamental science, the project will build national capacity in molecular electronics and measurement capabilities, providing training and advances in chemical science. Importantly, building capacity in electronics will help transition Australia to a skills based economy.							

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DP200101842 Loft, A/Prof Shayne D	This project aims to explain how human operators make decisions in complex work environments that require multiple tasks to be completed under time pressure. This project expects to achieve a significant theoretical and practical advance by developing and testing a computational model of the psychological processes that allow operators to adapt to the types of workplace task demands that can increase human error and the risk of accidents. The expected outcome is a model that can explain operator decision-making and predict the conditions where operators are more likely to make delayed responses or errors. This should provide significant benefits by informing psychological theory and potentially reducing workplace incidents and accidents. **National Interest Test Statement** As the modern workplace become more complex it is increasingly important to understand how human operators make safe and effective decisions to ensure the safety of the Australian public. The key outcome of the project will be a comprehensive computational model of the psychological processes by which operators strategically adapt to changes in task demand in safety critical work contexts such as aviation and defence. The computational model can potentially be used for a range of purposes, including the design of decision support tools, management of operator workload, redesign of operational procedures, and the training of staff. The project outcomes should deliver a competitive advantage to critical Australian work sectors and further Australia's reputation for cutting edge research that extends basic science to complex work systems. The project will provide first-class research training for early career researchers and thereby expand Australia's future research capability in applying mathematical psychology to human factors issues in the workplace.	47,638.00	91,416.00	87,156.00	43,378.00	0.00	0.00	269,588.00
DP200101880 Chooi, Dr Yit-Heng	Fungi produce an array of molecules called secondary metabolites (SMs) that impact on everyday life (e.g. penicillin). This project aims to investigate a new class of fungal peptide SMs called RiPPs which are structurally unique from existing molecules and offer the exciting prospect of harbouring new and novel biological activities. This project expects to discover the mechanisms of RiPP synthesis and their biological roles in plant pathogenic fungi, and uncover and engineer novel RiPPs with desired bioactivities. The expected outcome from this project will be a seminal advance in fungal SM biology which should provide significant benefits through the generation of exciting new lead molecules for the agricultural and medical industries. **National Interest Test Statement** Fungi have an extraordinary ability to produce molecules that have impacted on the course of human history. For example, Penicillin and Lovastatin are two classic examples of fungal molecules that have saved millions of human lives. These molecules are called secondary metabolites and display a wide array of novel biological activities. Very recently, a completely new class of secondary metabolites was discovered in fungi (called RiPPs) that offer significant potential as novel lead molecules for the medicinal and agricultural industries. To date, only a handful of RiPP molecules have been discovered in fungi. This proposal aims to discover and characterise RiPPs in important Australian plant pathogenic fungi, determine the mechanism by which they are synthesised and engineer new molecules with desired activities. Achieving these outcomes could provide significant economic benefits to Australia via the implementation of improved plant disease management strategies as well as through the generation of medical products, such as antibiotics, and new herbicides that are desperately needed by Australian farmers.	99,431.50	190,775.50	185,318.00	93,974.00	0.00	0.00	569,499.00
DP200101922 Murcha, Dr Monika W	Plant growth, productivity and seed yield all depend on organelle function which requires metabolites and proteins to be transported across membranes. This mechanism of transport is carried out by specific transporters that have the ability to transport macromolecules, and regulate organelle function. We have identified new transporters that are involved in amino acid and protein transport in the mitochondria, chloroplast and peroxisomes. We will assign function to each protein and investigate the importance in regulating organelle biogenesis. This will allow us to modulate plant energy production for optimal growth and to withstand abiotic stress, all of which have agriculturally beneficial consequences.	68,787.00	131,736.50	124,899.00	61,949.50	0.00	0.00	387,372.00

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	National Interest Test Statement							
	This project will investigate key biological processes in plant cells that can regulate plant growth, development and responses to external factors such as the environment. This project will provide knowledge of intracellular transport of proteins and amino acids which is of particular interest to Australia's biotechnological and agricultural sectors. We will increase our fundamental knowledge on essential pathways that will contribute to the development of new strategies in crop research to provide more sustainable solutions for improving crop productivity and improve plants resistance to environmental stress.							
DP200101944 Kuzenko, Prof Sergei M	This project aims to develop novel methods to formulate conformal field theories with extended symmetry that are important in variety of applications ranging from pure mathematics to phenomenology of elementary particles. The project expects to advance our knowledge in the most challenging areas of modern theoretical physics - Quantum Gravity and physics beyond the Standard Model of particle physics. Its expected outcomes will include conceptual results of major significance for modern theoretical and mathematical physics, thus placing Australia at the forefront of this research. A rich intellectual environment will be provided for training Australian PhD students by internationally recognised experts.	72,500.00	140,000.00	145,000.00	77,500.00	0.00	0.00	435,000.00
	National Interest Test Statement							
	Conformal field theory is a branch of modern theoretical physics. Conformal field theories with extended symmetry have been the focus of enormous interest worldwide in the last two decades, in particular in the framework of Quantum Gravity and extensions of the Standard Model of particle physics. In addition to important scientific outcomes, further research in this direction will establish deeper interactions with world leading universities and scientists, thus raising Australia to a more prominent position in theoretical physics on the world stage. It is important for the scientific and cultural profile of Australia to be involved and be widely represented in modern fundamental science. Moreover, carrying out fundamental research at high level is necessary to keep high educational standards and attract international students. This research project will allow the team of well-known experts in the field to establish an outstanding educational environment for a young generation of Australian based researchers.							
DP200101951 Bamberg, A/Prof John	This project aims to make significant advances in understanding finite primitive permutation groups, which are the basic building blocks of the mathematical study of symmetry. A recently-developed perspective, inspired by the notion of a synchronising automaton, has revealed that these groups fall into a natural hierarchy. While the outline of this synchronisation hierarchy is known, many questions remain about exactly which primitive groups lie in which layers. Answering these questions using techniques from group theory, graph theory and finite geometry will substantially deepen our understanding. The benefits of this include new knowledge and enhanced insight into this fundamental class of groups and new tools for their analysis.	65,000.00	132,500.00	135,000.00	67,500.00	0.00	0.00	400,000.00
	National Interest Test Statement							
	Advances in science and technology are usually underpinned by earlier advances in mathematics. This project will make progress in an exciting new topic in pure mathematics that combines group theory, graph theory and geometry. It will enhance Australia's international reputation in these areas by producing publications in leading international journals and by maintaining a thriving research community through the training of young mathematicians and collaboration with leading international mathematicians.							
DP200102574 Bekki, Prof Kenji	For decades astronomers have puzzled over the connection between the structure and evolution of galaxies and the role played by host environments. This project aims to resolve this problem by combining multi-wavelength observations, multi-component simulations, and pioneering data analysis using artificial intelligence. In particular, we target the nearby Fornax galaxy cluster as a laboratory for studying galaxy formation in dense environments. Using our novel machine learning techniques, we will elucidate the physical mechanisms that drive the rapid evolution of star formation, galactic nuclei, and gas and dust content within Fornax. Our predictions will benefit ongoing and future surveys at the national and international level.	85,000.00	170,000.00	170,000.00	85,000.00	0.00	0.00	510,000.00

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	National Interest Test Statement This project will dramatically improve our understanding of the physical processes of galaxy evolution through a new combination of multi-wavelength observations, state-of-the-art multi-component supercomputer simulations, and artificial intelligence (AI). Our project will provide the theoretical basis for interpreting observations from ongoing national facilities and thereby enhance their scientific impact. Our pioneering methods will serve as a template for scientists in fields beyond astronomy to use AI as a powerful tool to analyse big data for scientific purposes. The novel strategy and the key AI elements in this project will also be a compelling reference for those in industry to use the same technology to bring commercial benefits to their companies. Furthermore, we will conduct outreach activities to convey our scientific breakthroughs and novel AI methods to young Australians. We hope to inspire Australian students to pursue diverse STEM careers across academia and industry. Thus, this project will have economic, commercial, educational, and social benefits to the Australian community.							
DP200102642 Hemmi, Dr Jan M	This project aims to use new techniques in wireless neural recording to reveal how small neural networks process visual information to make fast, accurate decisions. The project is designed to generate new knowledge about biological solutions to contextual information processing and how tiny, simple biological neural systems control critical animal behaviours such as predator avoidance. Expected outcomes will be new biological insights with which to develop novel bio-inspired decision-making processing systems as required in small, autonomous robots. The anticipated benefits of this project will be advances in fundamental neuroscience and animal behaviour and is expected to provide significant value to a fast-developing industrial sector.	87,500.00	162,500.00	150,000.00	75,000.00	0.00	0.00	475,000.00
	National Interest Test Statement The miniaturization of autonomous sensors and agents, as used by industry, the military, and the general public, requires increasingly sophisticated on-board information processing. Biologically-inspired engineering has high potential to leverage evolutionary solutions to miniaturize decision making systems with low power, low data transfer rates, and limited processing that are crucial for robotics and autonomous vehicles. By developing, for the first time in Australia, a unique, miniature, wireless neural recording device, weighing not much more than a grain of rice, this project will allow measurements to be made of neural activity in freely moving animals. Discovering how neural function changes when animals are no longer restricted to laboratory conditions will demonstrate how biological systems have found solutions to information processing without the need for large, power-hungry hardware. The project aims to bring findings from biology directly to the attention of relevant Australian industries to develop future applied projects in this fast advancing, and crucial new sector of the economy.							
DP200102804 Cheng, Prof Liang	This project aims at advancing knowledge in flow/structure interactions and developing improved methodology for predicting wave and current loading on marine structures, which are vital in many practical applications such as extraction of oil and gas resources and renewable energy from the ocean. The improved methodology and much-needed database of hydrodynamic force coefficients developed through this project for estimating hydrodynamic loading on marine structures will significantly reduce the high, costly uncertainly levels that are being experienced in the design, construction and maintenance of marine structures (and facilities) and increase the competiveness of Australian relevant industries.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
	National Interest Test Statement Australian energy industries are moving into relatively deep waters and remote fields, requiring development of new concepts to design the infrastructure. However, present design approaches are very approximate and conservative in their treatment of multiple ocean flows and structural movements. The knowledge advancement in fluid dynamics from this project will enable Australian offshore industry to improve design, reduce project costs and increase efficiency. This is not only limited for the offshore oil and gas industry, where Australia is set to become the world's biggest natural gas exporter, but also to the ocean renewable energy industry, adding diversity to the available Australian energy sources. Both of these industries rely on safe and economical design tools to design infrastructure to withstand environmental loading and to stay competitive globally.							

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DP200102877 Pannell, Prof David J	Benefits from environmental policies are often unpriced “non-market values” (NMVs). Environmental agencies struggle to know how best to measure these relatively intangible benefits, but doing so is important to ensure value for money from public investments. Environmental economists have developed and applied a wide range of methods for estimating NMVs. The methods vary in their comprehensiveness, accuracy and cost. Yet no rigorous tool is available to assess (a) which NMV method is best to implement, accounting for its cost and its potential to improve decisions, or (b) whether any NMV method improves decisions enough to warrant its cost. In creating such a tool, this project will deliver a key breakthrough in environmental economics.	83,639.00	183,719.50	184,919.50	84,839.00	0.00	0.00	537,117.00
	National Interest Test Statement Environmental policies and programs in Australia cost billions of dollars per year. Decision making about these policies often lacks sophistication regarding the role of community preferences and values. This research will help managers make better decisions about how best to capture community values for the environment. For the various available methods for quantifying community values, the project will allow a sophisticated comparison of the benefits of the information (due to improved decision making) versus the costs of obtaining the information. This will support a cost-effective approach to decision making about which method to use. Given the scale of environmental programs, the potential benefits from improved decision making about their design and implementation are very large. There is a ready audience for the study. The research team collaborates closely with environmental managers and policy makers across Australia and internationally. In a range of environmental bodies, there is growing demand for quantitative information about the community’s environmental preferences and values.							
DP200102894 Simmons, Prof Leigh W	Insects secrete onto their surface a cocktail of high melting-point waxes. These biological compounds have been found to be involved in communication but are also thought to protect the insect from water loss and pathogen invasion. Insects represent the most abundant group of animals on Earth. It has been suggested that the dual role of surface waxes in ecological adaptation and reproduction may be key to their remarkable divergence. However, little is known of the function of individual compounds within mixtures of insect waxes. Using chemical analysis, neurophysiology and whole animal performance, the aim of this project is to provide a detailed understanding of the function of insect surface wax with potential for bioinspired products.	50,000.00	100,000.00	100,000.00	50,000.00	0.00	0.00	300,000.00
	National Interest Test Statement This research will examine the function of a class of lipids, insect surface waxes, their ability to prevent desiccation, to act as a barrier to pathogens, and to encode information. The research will determine whether these compounds respond to natural selection and so assess the vulnerability of insects to environmental change. Such knowledge is critical given catastrophic declines in insect species globally, with over 40% threatened with extinction due to habitat modification and changing climate. Yet insects play critical roles in agriculture and the environment, from pollination to nutrient recycling, and feed animals higher in the food chain. The economic value of insect pollination alone has been estimated as > $28 bn in Australia and ~$200 bn globally. Research on the function of natural compounds also underpins the development of innovative solutions to problems in engineering and medicine. The development of self-cleaning surfaces arose directly from research on the hydrophobic properties of insect wings. The discoveries made in this project may have the potential for new bioinspired products.							
DP200102961 Small, Prof Michael	Our proposal is motivated by and based upon the successful representation of time series as a network (or graph). We construct an abstract representation of a system from measurements of its changing behaviour over time. Properties of that structure (the network) then allow us to infer diagnostic information of the system. Specifically, we propose to apply this to livestock welfare during transport. By measuring the biological and environment condition of the animal we construct a network representation of that system. Geometric features of that network can then be used to infer health or duress of the subject. This proposal will develop the generic mathematical machinery to connect geometric features of the network with system behaviour.	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00

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	National Interest Test Statement In enumerable applications of importance to the Australian economy, better prediction of the health of a system from data would be invaluable. For example, (as in this proposal) the well-being of livestock from biometric data; an individuals cardiovascular health inferred from routine electrocardiogram; predictive maintenance of machinery components or mine sit operations; or, the reliability of a mineral or chemical processing plant. This proposal develops generic techniques to do exactly this. As a real application, this proposal also focusses specifically on the livestock transport industry - Australia's red meat and livestock exports (including co-products) exceeds $14B per annum. A large portion of that industry relies on livestock arriving at their destination in a healthy state. The monitoring techniques developed in this proposal will allow for livestock to be accurately and efficiently monitored to ensure successful and humane transport.							
DP200102981 Small, Prof Ian D	Many plants and animals can alter their genetic information via RNA (ribonucleic acid) editing, a process that is often essential for the growth and development of the organism. This ability provides accurate control over gene expression and has great potential as a biotechnological tool in agriculture and medicine. RNA editing could be used to switch genes on or off in biotechnological production systems with an unprecedented degree of precision, or to correct genetic diseases. This project aims to understand two RNA editing pathways in plants, one of which is found nowhere else and likely to involve a novel enzymatic mechanism. We will use the understanding gained to develop novel RNA processing tools usable in any living organism.	107,764.00	215,528.00	197,671.50	89,907.50	0.00	0.00	610,871.00
	National Interest Test Statement The ability to alter the genetic information within a living cell is major step towards solving many of the challenges facing biologists, such as improving food production from crops or treating human genetic diseases. One form of this genetic information is ribonucleic acid (RNA), an essential intermediate between the heritable instructions in the genome and the proteins that carry out the functions needed in every living cell. This project aims to understand the natural process of RNA editing, by which cells modify their own RNA to achieve healthy growth and development. Our discoveries will have potential uses in biotechnology as an extremely precise method for controlling gene expression. This can be used, for example, in the production of hybrid crops or in the production of high-value products such as drugs or vaccines. RNA editing is also a potential treatment for genetic diseases such as cystic fibrosis. These technical advances will be based on highly original discoveries in the basic science of RNA processing that will reinforce Australia’s pre-eminent reputation in this area of research.							
DP200103188 Faraone, Prof Lorenzo	High quality lattice mismatched semiconductor heterostructures are core enabling technologies for next generation electronic and optoelectronic devices with new functions and features such as monolithic integration, lower production costs, larger wafer size, and better system robustness. This project will generate new science on defect generation in lattice mismatched hetero-epitaxy with the aim of developing novel strategies for their minimisation. The direct outcome will be higher quality HgCdTe materials on lattice mismatched Si or III-V substrates with defect density low enough for fabricating high performance mid-wave and long-wave infrared arrays with features of lower cost, larger array format size, and higher operating temperature.	79,000.00	163,000.00	168,000.00	84,000.00	0.00	0.00	494,000.00
	National Interest Test Statement The successful completion of this project will lead to new technologies for epitaxial growth of high quality lattice mismatched semiconductor heterostructures, and to infrared sensors and imaging focal plane arrays with the unique combination of lower cost, higher yield, larger array format, and higher operating temperature, which will have a disruptive impact on the current infrared sensor industry. This will contribute to the strategic and long-term development of core Australian industry sectors such as aerospace & defence, environmental monitoring, medical imaging, space-based earth remote sensing, mining, and oil and gas, thus benefiting the Australian economy, society, environment, and national security.							

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DP200103208 Kemp, A/Prof Anthony I	The Project aims to chart the evolution of the Earth's primordial mantle and oceans between 3.75 and 2.8 billion years ago using calcium and strontium isotopes in ancient igneous and sedimentary rocks. A novel solution to the controversy over the timing and rate of growth of the Earth's continents is expected. Anticipated outcomes include the establishment of innovative analytical tools for tracing geological and environmental processes, and stronger collaborative links with premier research institutions abroad. The significant benefits of the Project include an enhanced understanding of the environment in which early life evolved, and fresh insight into the formation of the richly mineralized nucleus of the Australian continent. **National Interest Test Statement** This project is aimed at a fundamental understanding of the oldest parts of the Australian crust, which are strongly endowed in precious and strategic ore metals, and so addresses the national Science and Research Priority: Resources. Further assessment of the resource potential of these ancient rocks is intended, particularly for nickel, chromium and vanadium. Additional benefits of the project would include establishment of collaborative links with a leading UK university, the development of innovative tools and approaches for high precision geochemical analysis that are applicable to other disciplines, such as marine geoscience and environmental science, and an increased capability for high quality research training of postgraduate students. The promotion and understanding of Australia's rich and unique geological heritage, a treasure trove that includes the most ancient terrestrial minerals and evidence for traces of the oldest life on Earth, that would stem from this Project would be considered to align closely with the National Interest.	30,000.00	115,000.00	165,000.00	80,000.00	0.00	0.00	390,000.00
DP200103466 Bienen, A/Prof Britta	This project aims to address uncertainties in the design of vibro-driven piles. This promising alternative to impact-driven piles offers faster installation and requires no noise mitigation. The project expects to generate new knowledge of the effect of the installation process in sand on in-service pile response by integrating findings from innovative experiments and numerical modelling. This is particularly important for highly sensitive structures such as offshore wind turbines, which provide a rapidly increasing share of global energy supply. Expected outcomes include practical recommendations for vibro-piles in sand. This should provide sizeable benefits by unlocking vibro-piles as a viable method to reduce offshore wind farm costs. **National Interest Test Statement** This research is in Australia's national interest as it contributes towards new clean energy sources through advances in geotechnical engineering knowledge and innovation directed at safe, economic and reliable foundation design. Foundations account for around 25% of the cost of offshore wind energy developments. Vibratory driven piles offer an economical, low ecological impact alternative to traditional impact-driven piles. This research will provide engineering recommendations based on rigorous physical and numerical modelling evidence. These will close the current gap in practical guidance identified by the industry, which stems from poorly understood behaviour of vibro-driven piles in sand. The scientific advance of this research will therefore be of economic and environmental benefit to Australia through the cost-effective development of renewable energy sources nationally and through the building of Australia's innovation capacity as well as the provision of expertise in developments internationally.	60,000.00	105,000.00	90,000.00	45,000.00	0.00	0.00	300,000.00
DP200103468 Bransby, Prof Mark F	The project aims to make deep water oil and gas developments safer and cheaper by understanding better the unique seabed 'crust' conditions that occur in Australian waters. By studying the biogenic, structural and mechanical properties of deepwater crusts in more detail than can be done in 'live' oil and gas projects, this project expects to make a step change in the understanding of these seabed crusts. Expected outcomes of this project include developing new seabed investigation and design approaches for these soils. This should provide significant benefits, by facilitating the design and installation of low-risk, yet low cost seabed infrastructure (e.g. pipelines, risers, shallow foundations etc.) in these problematical seabed types	75,000.00	160,000.00	125,000.00	40,000.00	0.00	0.00	400,000.00

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	National Interest Test Statement New Australian deep water oil and gas fields have encountered 'crusty' near-surface soils which makes design of seabed infrastructure difficult. This project will investigate the behaviour of these seabed types (which may be unique to Australia) and how they affect the performance of seabed infrastructure (e.g. pipelines, subsea developments etc.) thereby reducing the risk of future infrastructure failures and/or having to over-spend to manage risk. The work will benefit Australia by facilitating upcoming LNG developments (increasing their likelihood of proceeding by reducing cost and risk), and by instilling new geotechnical engineers with the knowledge and skills which can be used to design Australian projects and can be exported from Australian companies to upcoming international projects.							
DP200103648 Faraone, Prof Lorenzo	Type-II superlattice (T2SL) based semiconductors have emerged as a rival to well-established HgCdTe-based IR detectors, promising comparable performance at significantly lower cost. T2SLs are complex nanostructures that exhibit multiple-carrier and highly-anisotropic electronic transport properties, which renders them exceedingly challenging to study experimentally. The lack of reliable experimental data has limited optimisation and modelling efforts, and thus hampered progress. This project aims to systematically study electronic transport in T2SLs, both experimentally and theoretically, by employing world-leading mobility spectrum techniques developed at UWA and state-of-the art T2SL structures from three world leaders in T2SLs.	82,000.00	167,000.00	169,000.00	84,000.00	0.00	0.00	502,000.00
	National Interest Test Statement Infrared (IR) sensors are rapidly finding applications outside of their traditional niche in defence and aerospace applications, and are becoming increasingly important in medical and scientific instrumentation, precision agriculture and food security, mineral exploration and industrial safety, environmental monitoring, search and rescue, among many other applications. The semiconductor material technologies that will be investigated in this project, promise to deliver affordable and portable high-performance IR sensors. The research proposed in this project collaboratively leverages national and international expertise and facilities to overcome difficult experimental and theoretical challenges, and to gain new insight to fill fundamental knowledge gaps. This project will enable significant Australian research contribution in this field, and will further the development of native Australian expertise and capability in emerging infrared technologies.							
	The University of Western Australia	2,058,086.00	4,153,263.50	4,060,424.50	1,965,247.00	0.00	0.00	12,237,021.00
	Western Australia	3,031,138.50	6,095,068.50	5,747,173.00	2,683,243.00	0.00	0.00	17,556,623.00
		46,708,638.00	**95,047,953.00**	**93,774,990.00**	**47,244,509.00**	**1,992,834.00**	**184,000.00**	**284,952,924.00**

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