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Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
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Australian Capital Territory								
The Australian National University								
DP230100040	**Beyond Directional Motivated Reasoning: Social Identity and Partisan Truth**	53,712.00	125,861.00	166,816.00	163,487.00	113,820.00	45,000.00	668,696.00
Platow, Prof Michael J	This project aims to develop and test a new model of psychological processes by which people come to understand information as true or not. This project expects to generate advances in knowledge about how different groups produce opposing understandings of the world ("partisan truth"), despite equally rational and unbiased psychological processes. Expected outcomes include the development of a single framework to explain current piecemeal findings, expanding the analysis to current and socially-urgent partisan debates over truth (eg, vaccine hesitancy). Significant benefits include advancing knowledge and the development of guidelines to aid policy-makers and educators in the ultimate reduction of social discord caused by partisan truth.							
	National Interest Test Statement							
	Australians have been affected by unprecedented climate events, especially floods and bushfires. However, in an era of disinformation and denial of science, we have seen the rise of polarised beliefs within the community about the reality of climate change. Taken to an extreme, this denial of facts can risk Australian lives and divide communities. This project confronts the challenge of inaccurate and inflexible “partisan truths” by studying Australians’ beliefs, social relations and psychological biases. Through social research and community consultation, evidence-based interventions will be developed to enhance decision making and reduce polarisation of beliefs over critical issues like climate change. This will be achieved via web-based educational tools and guidelines for government, non-government and community organisations to implement positive change. These interventions will benefit current and future generations of Australians to overcome the dangers of misinformation that inhibit civil debate, divide communities, and lead to policies and practices that place Australian lives and property at risk.							
DP230100079	**Non-Canonical Amino Acids for Protein Analysis and Peptide Inhibitors**	123,407.50	246,815.00	246,815.00	123,407.50	0.00	0.00	740,445.00
Huber, Prof Thomas	This interdisciplinary project aims to establish new tools to experimentally confirm 3D structure predictions of proteins that are otherwise difficult to study. A combination of innovative biochemistry, modern spectroscopy, and high-performance computing will be applied to study protein-protein and protein-ligand interactions. The project expects to generate new techniques and to test them on established drug targets. Expected outcomes include new tools which quickly inform medicinal chemists how drugs interact with their targets and how they can be improved. The developed tools should provide significant benefit to many researchers by accelerating the early stage of drug discovery, and support Australia’s fast growing biotechnology sector.							
	National Interest Test Statement							
	Drugs are specialised, high value-add materials. However, new drugs are expensive to develop in the pharmaceutical industries and over the last decade the Therapeutic Goods Administration approved only approximately 40 new drugs per year for use in Australia. This project aims to accelerate the early stage of drug discovery. It will use innovative biochemistry, modern magnetic spectroscopy and high performance computing to develop new methods which quickly inform medicinal chemists how drug candidates interact with their targets and how they can be pharmacologically improved. Early stage drug discovery is primarily conducted in small biotech companies. This project will support Australia’s fast growing biotechnology sector by accelerating the rate with which these companies can secure intellectual property.							

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DP230100190	**Self-assembled supramolecular cages for guest binding and catalysis**	106,361.00	148,418.50	83,637.50	41,580.00	0.00	0.00	379,997.00
White, Dr Nicholas	This project aims to construct a family of supramolecular metal-containing cage-shaped molecules that possess specialised binding pockets with unique chemical properties that mimic enzymes. Many existing cage molecules contain well-defined three dimensional cavities reminiscent of enzymes' active sites. However, unlike natural systems they do not contain "active" metals with free coordination sites, and this limits their catalytic ability. This project aims to prepare a large family of robust organic cages quickly and easily, and subsequently incorporate metals containing free active sites that point into the cage cavity. It is expected that this will deliver strong and selective guest binding, and efficient and selective catalysis.							
	National Interest Test Statement							
	Australia's chemical industry contributes $11.6b to annual GDP, however it is a major producer of waste and consumer of energy. Fortunately, it is possible to make our chemical manufacturing industry more energy efficient and environmentally sustainable using catalysts. Catalysts are a type of molecule that lowers the energy barrier for chemical processes, dramatically reducing energy costs and decreasing waste production. There is an urgent need for more effective catalysts to further reduce energy costs and improve sustainability. Natural catalysts are unrivalled in terms of their efficiency and so this project aims to use a new approach to develop high performance catalysts shaped like hollow cages that are inspired by those in nature. It is expected that this work will lead to more efficient chemical manufacturing processes, with significantly reduced waste production. Implementation of these advances by the Australian chemical industry will achieve significant cost and energy savings and a lower environmental impact.							
DP230100204	**Living with Smallpox in Early Modern Britain (c.1580–1780 CE)**	28,274.00	72,649.00	63,025.00	18,650.00	0.00	0.00	182,598.00
Dawson, Dr Mark S	This project aims to examine how people in the past made sense of an acute infectious disease, including its long-term effects on individuals and their communities. Using traditional techniques and digital tools, it anticipates reconstructing how the experiences of the majority – who survived – were shaped by their socio-cultural circumstances, and tracing how those experiences changed over time, particularly in relation to advances in medical technology and public health. Expected outcomes include insight into historical responses to pandemics, as well as enhanced knowledge of the emergence of modern techniques for regulating public health, with benefits for our understanding of similar challenges in the present day.							
	National Interest Test Statement							
	Australia continues to grapple with the global COVID pandemic, with the impacts on individuals and society likely to linger for years to come. History offers important insights into how we might best respond to this next phase of the pandemic. Using archival research, this project will explore how smallpox, an acute infectious disease, impacted communities at different points in history. Through a series of public lectures, podcasts, and a book, the project will increase decision-makers' and the general public's understanding of how people experience and respond to large-scale health crises, and how social status, gender, age, ethnicity, and political allegiance affect those experiences and responses - including attitudes to vaccination. Access to such critical knowledge will help to inform and guide Australia's current and future public health responses, which in turn will support improved health outcomes for the Australian community in the post-COVID era.							
DP230100215	**Boron Nitrogen Isostere-Doped Organometallics for Molecular Electronics**	80,000.00	165,000.00	132,500.00	47,500.00	0.00	0.00	425,000.00
Hill, Prof Anthony F	The challenge of connecting two or more metals by a single chain of carbon atoms attracts intense study, thereby mimicking electronic circuitry at the molecular level. BN-Isosteric compounds involve selectively replacing (doping) carbon atoms with the elements boron (B) and nitrogen (N). These unprecedented materials should emulate and likely exceed the properties of all-carbon systems. This project aims to design and synthesise the first molecular BN-isosteric carbon-wire materials including examples based on metal-carbon multiple bonding. Expected outcomes beyond their isolation include high-level interrogation of the structure-function behaviour of their electrical and optical properties relevant to the technologies that will emerge.							

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	National Interest Test Statement Australia's Quantum Technology Roadmap relies on our advanced manufacturing industry creating increasingly small components for electronic devices that are capable of high-volume information storage and high-speed transmission. The industry's ability to push these limits depends on discoveries in molecular science, in particular, using unique materials to study molecular scale electronics. This project will design and develop new methods to create unprecedented, man-made materials. These will constitute new, high value-added materials for electro-optical, data storage and sensing applications including in future environmental detection of pollutants in the atmosphere. Shared with manufacturers in the form of immediate technology transfer, this project will enable the development of advanced onshore capabilities in the design, manufacture and commercial exploitation of these new materials, placing Australia at the forefront of this critical area of future technology demand.							
DP230100231 Bradby, Prof Jodie E	**New carbon phases synthesized under extreme conditions** This project aims to address one of the major fundamental puzzles in carbon science; how to experimentally synthesize new phases of carbon predicted by theory. This could be approached via a combination of high pressure and high-energy ion irradiation to transform novel nano-carbon precursors. The expected outcomes include new phases of carbon with unexplored properties, an understanding of the pathways for synthesis of carbon materials, and new computational tools to understand nano-carbon materials under extreme conditions. This should provide benefits for industries seeking advanced materials for modern manufacturing.	96,500.00	199,000.00	199,500.00	97,000.00	0.00	0.00	592,000.00
	National Interest Test Statement Australia's mining industry is a major contributor to the national economy and one of the world's largest exporters. Mining minerals involves the use of drills that become blunt over time, costing the industry both time and money to replace. One potential solution is to design stronger materials that can mine hard rocks without blunting as quickly. Carbon is a promising element for this task and there many new and useful carbon materials that cannot yet be made in the laboratory. This project will use high pressure and advanced experimental techniques to discover how to make new forms of carbon materials. Shared with resource technology manufacturers who will make future drilling technology, our discovery will help industry to reduce the time and cost involved in changing blunt drill components. This will benefit Australia a producer of advanced materials and contribute to the Australian Government's $1.3b Modern Manufacturing Initiative, which has prioritised resource technology innovation for its strategic importance to Australia's economic growth and comparative advantage.							
DP230100277 Miller, Prof Meghan S	**Measuring the seismic pulse of the Earth using fibre optics** Distributed acoustic sensing (DAS) is a newly emerging passive seismic technique that converts telecommunication fibre-optic cables (dark fibres) into thousands of individual ground motion sensors. This project aims to harness DAS and the big data arising from it to develop unprecedented high-resolution images of the Earth's structure, detect micro-seismicity, and thereby relate geological observations to Earth processes. Outcomes of this powerful technique include fine-scale seismic imaging of the Earth's subsurface as the best proxy for geological processes and geochemistry. Benefits include transforming exploration of mineral resources, water, changes in subsurface structure, as well as geohazard assessments for Australia and worldwide.	56,500.00	118,000.00	118,000.00	56,500.00	0.00	0.00	349,000.00
	National Interest Test Statement Seismic observations are critical for understanding many aspects of Earth processes and structure, however these observations are limited by the cost and nature of deploying traditional seismometers. Utilising fibre-optic cables can greatly increase the number of observations and decrease the cost of the experiments. Results from this project will provide technological advances that will change passive sensing capabilities using existing infrastructure. The economic, environmental and social benefits include: Contributions to resource exploration and recovery Monitor environmental changes in the subsurface and determining aquifer properties Provide hazard assessment by determining earthquake occurrence and location Generate high-resolution Earth models that are essential for estimating ground shaking, locating faults and studying environmental processes Contribute to global security via nuclear test monitoring Applicable for use of existing, extensive telecommunication cables (like NBN) across Australia and offshore The project aligns with the SRPs of Resources, Soil and Water and Environmental Change.							

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DP230100290	**A Unified Theory of 'If's**	55,000.00	110,000.00	110,000.00	55,000.00	0.00	0.00	330,000.00
Hajek, Prof Alan R	This project aims to develop a unified theory of ‘if’s. Our understanding of an uncertain and risky world requires hypothetical reasoning involving ‘if’s. They are significant theoretically: in science, history, politics, economics, psychology, computer science, linguistics, and philosophy. They are significant practically: in our planning, decision-making, policy priorities, legal judgments, environmental and medical interventions. Yet we lack a comprehensive, readily implementable theory of ‘if’s. The project expects to provide such a theory, based on probability, improving on approaches from philosophy and linguistics, and benefitting both these fields. It also promises significant benefits for artificial intelligence/machine learning.							
	National Interest Test Statement							
	Smart decisions and risk-management in politics, law, environment, technology, and medicine are crucial to Australia’s well-being, and they all rely on hypothetical reasoning involving ‘ifs’. For example, we give someone a particular COVID vaccine. If we gave them another type of vaccine, would it protect them better? Yet we lack a general understanding of ‘if’s of the kind needed to evaluate and improve such reasoning. Through interdisciplinary collaboration and workshops, this project will develop and disseminate a straightforward and implementable account of hypothetical reasoning, based on probabilities. It will offer tools that can be applied to machine learning, and to artificial intelligence more broadly, and that can inform agencies working on them. By improving the foundations of hypothetical reasoning, and thus decision-making and risk-management, the project has the potential to provide extensive benefits for governments and everyday Australians—from programming driverless cars to effectively responding to climate change and influencing medical interventions that best protect our community.							
DP230100344	**Local Remembering and National Forgetting: Memory Politics in Modern China**	25,000.00	65,000.00	65,000.00	25,000.00	0.00	0.00	180,000.00
Zhu, Dr Yujie	This project aims to explore the politics of local remembering and national forgetting, and their roles in shaping state-society relationships in modern China. The project expects to generate new insights into key narratives of China’s recent past, and how they are recast by local museums to counter official discourses that elevate certain memories and suppress others. Expected outcomes include enhancing theoretical and empirical knowledge of the roles of heritage and memory in China’s contemporary cultural politics. Significant benefits to Australia will include new knowledge towards a more nuanced and multidimensional understanding of China’s priorities in cultural politics, especially in the Asia-Pacific region.							
	National Interest Test Statement							
	Australia’s relationship with China is facing significant geopolitical tension. In order to navigate its relationship with China more effectively to improve our economic and political relations, Australia needs a stronger understanding of Chinese cultural politics. This project will investigate how the Chinese state uses stories about its past to justify its national identity and Chinese interests internationally. Through an analysis of historical narratives in three prominent cultural institutions, the project will expand knowledge of how China constructs the past for social and political ends. Policy-targeted workshops through collaborations with cultural institutions in Canberra will help support the uptake of the project’s findings within the Australian foreign affairs community, which will lead to greater operational knowledge and management of China’s geopolitical behaviour. Long term political and economic benefits to Australians include a change in dominant public stereotypes and presumptions about China; improved national capacity to build cultural sensitivity; and improved international relations.							
DP230100415	**Advances in Peptide Synthesis: Exploiting Underutilised Functional Groups**	98,866.50	189,127.50	113,428.50	23,167.50	0.00	0.00	424,590.00
Malins, A/Prof Lara R	The translation of therapeutically-relevant classes of peptides to the clinic is often limited by chemists' ability to synthesise these complex biomolecules efficiently and sustainably. This project aims to develop new tools for the preparation of designer peptides that are broadly inspired by an underutilised reactive group found in naturally-occurring peptide sequences. Expected outcomes encompass health and economic benefits for the Australian community, including: the first approach to a class of promising antibiotic peptide natural product analogues, the development of a mild electrochemical approach to peptide modification, and the production of a library of novel amino acids for incorporation into potential antibiotic leads.							

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	National Interest Test Statement Australia's biotechnology and pharmaceutical sectors rely on the discovery and preparation of 'therapeutic molecules' which are essential in fighting emerging diseases and helping overcome resistance to current treatments. Yet manufacturing therapeutic molecules is energy-intensive, expensive and often requires significant amounts of toxic chemicals. This project will explore new technologies to prepare therapeutic molecules, using more sustainable approaches in the preparation phase through the cutting-edge use of electrochemistry—an environmentally-conscious method in which small amounts of electricity, rather than a toxic reagent, produce the chemical reaction. These technologies are yet to be applied to drug discovery and therefore offer vast commercial potential for Australia's growing biotechnology and pharmaceutical sectors to use in new therapeutic treatments. By doing so, these industries will drive the development of sustainable chemical manufacturing in Australia, contributing to the national agenda for energy efficiency, and reducing the production costs of healthcare treatment for Australians.							
DP230100462 Lu, Dr Teng	**Locally structured polar-photofunctional materials for energy conversion** This project aims to develop a novel method to engineer local chemical structures for achieving the polarity in narrow bandgap oxides via advanced thin-film growth and ion beam irradiation techniques. The developed new polar-photofunctional materials will significantly improve opto-electro-mechanical coupling and energy conversion, facilitating uses in renewable energy harvesting and smart optomechanical devices. The project expects to advance material science through a new concept and innovative methodology, achieve properties forbidden/limited by conventional strategies and expand candidate pools for new generation multifunctional materials, significantly advancing Australia's capacity in advanced manufacturing and industry.	80,169.00	157,038.00	152,888.00	76,019.00	0.00	0.00	466,114.00
	National Interest Test Statement The Government's $1.3billion investment in its Modern Manufacturing Initiative has prioritised the clean energy sector for its competitive advantage and strategic importance to Australia. The sector, especially solar power, has grown almost 100-fold in the last decade. To meet demand, highly efficient and low-cost devices that harvest solar energy, called 'solar cells', are urgently required. The main materials used for solar cells cannot harvest solar energy, so they require complicated components which both increase manufacturing and disposal costs and limit the efficiency of power conversion. This project aims to solve this problem with a novel method to develop new materials that can efficiently convert solar energy. Our industry partners will directly integrate the materials we create not only in traditional solar panels but also in the cladding and windows of buildings. This uptake will contribute to boosting Australia's global competitiveness in clean energy conversion and advanced manufacturing, benefitting Australia economically as well as environmentally through mass-scale clean energy use.							
DP230100464 Travis, Prof Catherine E	**Voices of Regional Australia: The linguistic patterning of local attachment** This project aims to investigate language and social dynamics among regional Australians, who, despite representing one third of the population, have been often neglected in the research to date. The project expects to generate new knowledge around regional attachment and the impact that has on speech patterns, adapting for the first time recently developed international metrics to the Australian context. Expected outcomes include a better understanding of models of language change across urban and rural areas, and a novel dataset recording the stories of regional Australians, and in particular, their experiences facing bushfire. This should provide significant benefits as a record of life, language and community in regional Australia.	56,373.00	116,425.00	118,536.00	58,484.00	0.00	0.00	349,818.00
	National Interest Test Statement Community belonging is central to the wellbeing of Australians, especially in times of crisis such as natural disasters. Language plays a key role in people's connection to their community. With more Australians moving to regional areas, we need to know more about Australian English in regional Australia to understand community belonging better. Partnering with two regional communities in NSW and Victoria, this project will produce a collection of oral testimonials about regional Australians' experience of bushfires. These stories will form an enduring record of both modern-day regional Australian English and the lived experiences of Australians as they respond to a natural disaster. Sharing these stories through public talks and community-led sessions, the project will help bushfire-affected communities to heal and build resilience, and showcase the diversity of Australian English in regional Australia. Doing so will support regional Australian communities, emergency response agencies and policy makers to better prepare for and manage disasters.							

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DP230100853	**How do apicomplexan parasites steal amino acids from their hosts?**	148,682.00	293,184.00	282,454.00	137,952.00	0.00	0.00	862,272.00
van Dooren, A/Prof Giel G	The single-celled parasites that cause malaria and toxoplasmosis are adept at stealing nutrients from the host animals that they infect. How they do this is, however, poorly understood. This project seeks to identify the processes by which these parasites scavenge amino acids, an essential class of nutrient, from their hosts. Using innovative experimental approaches, the project aims to identify and characterise the parasite proteins that mediate the uptake of different amino acids into the parasite. The intended outcomes of the project are to provide comprehensive insights into a fundamental aspect of parasite biology, and inform strategies to treat the diseases caused by these parasites by cutting off their nutrient supply.							
	National Interest Test Statement Australia's livestock and poultry industries contribute roughly $AU25 billion to our economy each year. However, they are threatened by parasites called 'apicomplexans'. Animal deaths and reduced livestock yields caused by apicomplexan infections lead to billions of dollars in economic losses in Australia and worldwide. There are few treatments available, and parasites are continually developing resistance to existing treatments. To address this problem, this project will examine how these parasites 'steal' nutrients from their animal host in order to survive and multiply. The new knowledge we uncover will lay the groundwork for drug and vaccine manufacturers to develop new and more effective anti-parasitic treatments designed to kill the parasites, and we will provide them with new insights about how parasites develop drug resistance. Use of such future drugs and vaccines by Australian livestock farmers will safeguard their economic livelihood and their contribution to the Australian economy.							
DP230100864	**Australian Parliamentary Speech: How Deliberative? How Representative?**	46,764.50	106,029.00	96,808.50	37,544.00	0.00	0.00	287,146.00
Taflaga, Dr Marija	This project aims to assess the Australian Parliament's representativeness and quality of debate from 1901-2020. It expects to generate new tools and knowledge about the development and workings of parliament using innovative quantitative text analysis methods. Expected outcomes include analysis of the relationship between representation (class, gender etc) and policy outcomes, an information-based measure of parliamentary speech and a standardised dataset of Hansard. This should provide significant benefits to the scholarly community by removing cost and time barriers and build capacity for international collaborations. The objective information generated can contribute to public discussion about the efficacy of parliamentary debate.							
	National Interest Test Statement Parliament is the central institution of democracy yet Australians have concerns about how Parliament operates, and how representative, deliberative and accountable it is. This project uses advanced text-analysis to evaluate the representativeness and changing quality of parliamentary debate since 1901. Through doing so, the project will develop recommendations for reform, a new database for MPs and librarians as well as training for journalists and policy researchers to help them analyse parliamentary processes and its representativeness. Creating an interactive web-based dashboard, and widely sharing a detailed report and public forums, the project will foster informed public engagement and provide a pathway for Parliamentary reforms. These translational tools will provide policy makers, journalists and citizens with the capacity to examine the workings of our Parliament which in turn will enable the uptake of reform options, and benefit Australians by meeting their growing demand for changes that strengthen our democracy.							
DP230100878	**Ultra-Fast and Secure Terahertz Communications for 6G Wireless Systems**	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
Yang, A/Prof Nan	This project aims to develop new theories and signal processing solutions for the cutting-edge technology of terahertz communications to enable the revolutionary sixth-generation wireless systems, by exploring and optimising the inherent benefits of the terahertz band. Anticipated outcomes are new analytical tools and practical guidelines for designing ultra-fast and secure wireless transmission at an unprecedented speed up to terabits per second (Tbps). This enables various emerging applications, such as holographic telepresence, Tbps WiFi and Tbps wireless data centres, to drive transformation in the telecommunications sector, boost industry productivity and support our intelligent information society in the 2030s.							

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	National Interest Test Statement Sixth generation (6G) communication systems are predicted to contribute millions of dollars to Australia's future economic growth and bring unparalleled benefits to many industry sectors, including healthcare and smart manufacturing. Realising 6G requires communication technologies at terahertz frequencies, which, globally, are undeveloped. This project addresses this need: it will develop new communication theories and algorithms at terahertz frequencies that will enable 6G to offer ultra-fast data transmission and highly secure connectivity that exceed 5G capability. The technologies we develop will be shared with and adopted by industry partners such as Telstra and National Instruments, and through that uptake, support industries such as healthcare to launch innovative applications, including allowing doctors to perform remote surgeries for patients living in isolated parts of Australia without easy access to surgical care. By doing so, this project will contribute to not only future national economic benefit but also improvements in the accessibility of healthcare to remote populations in Australia.							
DP230100941 Schwessinger, Dr Benjamin	**Genome evolution & adaptation of the multinuclear wheat stripe rust fungus** Animals and plants package their genomes into a single nucleus within each cell. In contrast, millions of fungal species accommodate multiple nuclei containing individual haploid genomes. It is currently unknown what the evolutionary implications are for this unusual genome division into multiple nuclei. Here we explore the evolutionary consequences of genome division into multiple nuclei for the first time by applying cutting edge genome biology tools and algorithms. The economically significant study system is the devastating wheat stripe rust fungus. This pathogen costs Australian farmers over $100 million a year. New understanding is expected to lead to better disease management, reduced fungicide applications, and increased yields.	82,696.00	152,562.00	141,532.00	71,666.00	0.00	0.00	448,456.00
	National Interest Test Statement Wheat is Australia's largest crop, valued at around $10 billion per year. If disease takes hold, however, Australian farmers can lose up to $100 million due to increased disease control costs and wheat losses. This makes wheat disease prevention a critical problem to solve. This project will contribute to its prevention by applying cutting-edge genomic analyses to understand how the wheat stripe rust fungus – a disease that can cause up to 60% yield loss - causes disease in wheat. By passing this knowledge onto Rural Development Corporations and other specialists who advise farmers, industry partners and government, our findings will be quickly adopted by the Australian farming community and leading to better disease monitoring and breeding strategies to reduce disease in crops. Through these outcomes, this research will contribute to reducing the impact of disease, benefiting both farmers and the Australian economy, and advancing the Government's target to grow the agricultural sector to $100 billion by 2030.							
DP230101013 Lahn, Dr Julie M	**Valuing Torres Strait Knowledge through Sustainable Digital Returns** This project aims to address the sustainable return of archival materials by utilising a case study of scholarship about Torres Strait society and culture created fifty years ago by Japanese researchers. The project expects to generate new knowledge in the area of research accountability by utilising an extensive fieldwork approach to foreground Torres Strait Islander perspectives. Expected outcomes include the co-creation of high-quality digital resources and new analysis of the Japanese research and Torres Strait Islander agency in shaping research. Benefits include advances in digital methodologies for sustainable community engagement, inter-generational knowledge transfer, and grounded insights into respectful research relationships.	189,285.50	349,202.00	211,248.50	51,332.00	0.00	0.00	801,068.00
	National Interest Test Statement Indigenous peoples have long called for the return of archival research materials yet much remains inaccessible. This project aims to provide much-needed guidance to ensure returns are long-lasting and in line with First Nations priorities and protocols. To achieve these aims, the project team will work closely with Torres Strait Islander Elders and young people, communities and organisations to re-publish and digitise a unique body of Japanese research about Torres Strait society and culture that was created fifty years ago. The project expects to boost understanding of an important period in Australia's Torres Strait history and the central role that Torres Strait Islanders play in shaping research. The project will benefit Torres Strait Islanders and other First Nations peoples by building a model for the enduring digital return of cultural materials, further community research capacity, enable intergenerational knowledge transfer and enhance cultural and educational relationships internationally.							

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DP230101028	**Space for Australia on the periodic table: creating new superheavy elements**	105,718.00	218,211.00	225,211.00	112,718.00	0.00	0.00	661,858.00
Hinde, Prof David J	This project aims to apply innovative methods developed in Australia to determine the optimal nuclear fusion reactions to synthesise new superheavy elements. As part of a major international collaboration aiming to discover elements 119 and 120, the project leverages our new conceptual approach, unique detector instrumentation and Australia's Heavy Ion Accelerator Facility. Anticipated outcomes include the first direct Australian contribution to the discovery of new elements, improved understanding of nuclear fusion and fission at the limits of nuclear existence, tests of our new theoretical approach to energy dissipation in many-body quantum systems, strengthened international links, and top-level nuclear science and accelerator training.							
	National Interest Test Statement							
	Technologies based on nuclear and accelerator science are rapidly expanding in Australia and worldwide. These are found in areas of critical national interest such as cancer treatment and energy generation. Yet the underlying models of nuclear processes are incomplete. Further, in nuclear and accelerator science, Australia’s workforce is five times smaller per capita than other advanced economies. Addressing both these limitations is important for Australia to be globally competitive. This project will contribute to a major international effort to create new, undiscovered chemical elements, leading to better nuclear models. Using Australia’s own accelerator facility, we will contribute our unique detectors and new ultra-sensitive experiments. These will help to improve understanding of the nuclear fission process, allowing more efficient and safer nuclear energy technology in the future. By generating both the fundamental science, and local expertise to train the high-tech workforce needed, this project will help Australia to maximise the economic and industrial benefits offered by these technologies.							
DP230101039	**Uncovering an evolutionary advanced mechanism of gene expression control**	94,909.50	228,405.00	291,401.00	157,905.50	0.00	0.00	772,621.00
Tremethick, Prof David J	This project aims to uncover a new mechanism that activates gene expression in mammals, which involves unexpected connections between the core components of chromosomes and essential enzymatic machines required for the expression of genes. This project will generate new knowledge on the poorly understood process of how the extensive genomic information of multicellular organisms is selectively chosen to enable the expression of only the required subset of genes. This will revolutionise our understanding of the mechanisms of gene control thereby shaping the field in the future. Significantly, this will allow new ways to manipulate gene expression that will impact biotechnology by providing new efficient ways to produce proteins or RNA.							
	National Interest Test Statement							
	Post-traumatic stress disorder (PTSD) is one of the most common psychiatric disorders, affecting around 3 million Australians at some point in their life. A traumatic event can lead to permanent changes in the area of the brain linked to stress, which can have a devastating impact on how people cope with everyday life. One possible way to better treat PTSD is by looking at these changes in the brain, specifically the way certain genes associated with this condition are regulated. This project uses cutting-edge technologies in genomics, biochemistry and structural biology to better understand how living cells regulate expression of individual genes, a concept that is essential to the mental and physical health of all Australians. The knowledge generated from this project will inform psychiatrists and clinicians about how gene expression underpins certain health conditions, helping them to develop new, safe ways to treat PTSD at a molecular level. This will benefit Australians living with PTSD, especially those who have not responded to existing treatment.							
DP230101051	**Challenging colonialism: Australians who helped us embrace human equality**	17,294.50	32,589.00	31,589.00	16,294.50	0.00	0.00	97,767.00
Woollacott, Prof Angela M	This project aims to investigate how ten influential Australian thinkers, writers and activists helped the nation to embrace human equality in the mid-twentieth century, by tracing how challenges to colonialism and racial inequality circulated. It expects to produce new knowledge about decolonisation in a settler-state and is methodologically innovative in using group biography to follow how ideas spread outwards via networks. Expected outcomes include developed understanding of how activists and groups successfully explained human rights and equality to mainstream Australia. Benefits should include new insight into how ideas of equality eroded cultural acceptance of White Australia and Australians reconceptualised their society as diverse.							

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	National Interest Test Statement Between the 1940s-1960s, Australia shifted from the White Australia policy to prohibiting discrimination, giving Indigenous people equal rights, and opening up immigration. While it is a critical time in Australian history, there is limited understanding of just how this progress occurred, and the role and influence of a tight network of activists and intellectuals who fought for this change. This project uses group biography, a way of documenting shared experiences and thoughts, to trace how ideas of human rights and equality gained ground during this time. It delivers the untold stories of how the connections between ten influential thinkers and activists not only challenged social relationships based on racial inequality, but also changed popular thinking. Through widely accessible podcasts, blogs and public lectures, the Australian community will gain critical insights from this project into Australia's history that will help to inform and guide public and private debates around future constitutional change, and in turn, support national aspirations for racial equality and community social cohesion.							
DP230101055 Krumholz, Prof Mark R	**Relativistic Particles in Star-Forming Galaxies** This project aims to understand how galactic evolution is shaped by the relativistic particles known as cosmic rays that fill interstellar space. We understand only poorly how cosmic rays interact with non-relativistic interstellar matter, which in turn limits our understanding of how they affect galaxies. The project seeks to resolve this question by calculating how cosmic ray-matter interaction gives rise to light and neutrinos that we can observe using current and future telescopes, enabling us to use observations from these telescopes to solve the problem of cosmic ray-matter interaction. This would resolve the question of how cosmic rays shape galaxy evolution, and thus represent a substantial advance in the theory of galaxy formation.	62,000.00	124,000.00	124,000.00	62,000.00	0.00	0.00	372,000.00
	National Interest Test Statement The Australian Government has invested $100m in an international collaboration to build two international next-generation astronomical observatories, the Square Kilometer Array and the Cherenkov Telescope Array. Building these facilities is providing work for Australian industry and supporting a significant number of local jobs. However, our ongoing participation requires that we advance the observatories' scientific goals, one of which is to understand cosmic rays – high energy particles from space that were discovered to be bombarding the Earth in 1912 and whose nature is still not fully understood. This project will provide our international partners with models and software tools to help them interpret the measurements made by these new observatories. This will also provide training in fundamental research techniques that will prepare students for careers in a wide range of private- and public-sector professions that rely on mathematical and computer modelling, and where demand for skills is high. Students and postdocs trained by this project will be well-equipped for roles in areas such as data science, financial modelling, and aerospace and defence applications. By making this contribution, our project will help fulfil Australia's scientific commitments to the observatories and ensure their ongoing successful operation. It will also boost Australia's international reputation in science and increase our opportunities to participate in future international scientific collaborations.							
DP230101280 Lade, Dr Steven J	**A systemic environmental impact metric for companies and investors** Environmental-Social-Governance (ESG) metrics are marketed as measures of environmental performance, but they often track exposure to environmental risk rather than generation of environmental impacts. This project aims to develop and test a science-based, systemic environmental impact score for corporate activities. Expected outcomes include new knowledge of cross-scale interactions in the Earth system and tools to assess a business or investment's systemic environmental impacts from activities including water extraction, deforestation and carbon emissions. These outcomes should provide benefits including improved business decision-making on impact mitigation, environmental quality, productivity and corporate environmental reputation.	110,739.50	175,394.00	134,578.00	69,923.50	0.00	0.00	490,635.00
	National Interest Test Statement Current environmental impact scores neither accurately capture these impacts nor score them with respect to safe environmental limits. Consequently, business and investment decisions occur without appropriate information on the environmental consequences of these decisions. This project aims to quantify the environmental impacts of activities such as greenhouse gas emissions, deforestation, and water extraction, with an expected outcome of an environmental impact score that accounts for regional environmental impacts, connectivity between environmental processes across the planet, and safe environmental limits. This impact score is expected to benefit Australian industries by providing tools to assess their systemic environmental impacts and identify opportunities to mitigate these impacts. Corporate and investment decisions made using the score will positively impact Australia by mitigating degradation of the many benefits our environmental systems provide. The project establishes adoption pathways through partnerships with industry bodies and by specific companies acting as cases to test the impact score.							

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DP230101335	**The Ethics of Net Zero**	50,110.00	97,982.50	100,945.00	53,072.50	0.00	0.00	302,110.00
Cullity, Prof Garrett M	This project aims to provide the first systematic study of key ethical issues connected to the adoption of net zero targets—pledges to make no net addition to the global atmospheric concentration of greenhouse gases. It expects to fill a significant knowledge gap, by addressing the full range of ethical questions raised by the adoption, promotion, and coordination of net zero targets by national and subnational climate actors. Expected outcomes of the project include detailed guidelines for determining ethically sound net zero policy and practice. The project should provide significant benefits to stakeholders in the government, corporate and NGO sectors, including best practice advice on the setting and implementation of net zero targets.							
	National Interest Test Statement							
	Decision-makers across Australia's corporate, government, and NGO sectors are struggling to formulate net zero targets that respond adequately to public pressure for responsible climate action. Through workshops that bring together leading decision-makers from these three sectors, this project will develop the first ethical principles for Australia to guide decision makers in setting ethically sound net-zero targets. It will create and disseminate best-practice guidelines for net zero target-setting, implementation, and accounting among government, corporate and NGO stakeholders involved in the project. By helping decision-makers to create transparent and sound net zero practices, this research will contribute to climate action that is responsive to the wishes of the Australian public, and to the longer term environmental benefits that flow from that action.							
DP230101535	**Village democracy in Southeast Asia and the Pacific**	96,095.00	231,270.00	302,605.00	167,430.00	0.00	0.00	797,400.00
Aspinall, Prof Edward T	This project aims to understand variation in village politics in Indonesia, the Philippines and Papua New Guinea, and the effects of that variation on development outcomes, democratic participation, and gender equity. It will generate new knowledge on how micro-level power structures affect citizens' experience of government. Expected outcomes include a new framework for understanding how community power structures shape and constrain government action. Benefits will include strengthening Australia's position as a world leader in Asian and Pacific studies, generating a new framework for understanding the effects of village political dynamics, and guidance for Australian and other policy makers planning grassroots development interventions.							
	National Interest Test Statement							
	How does village-level politics vary across different contexts in Southeast Asia and the Pacific, who is included in decision-making, and how does this influence development outcomes? This research aims to fill a gap in understanding how variations in village democracy affect development trajectories, democratic processes and gender equity across three countries that are critical for Australia's interests: Indonesia, the Philippines, and Papua New Guinea. This project will generate new knowledge and expertise on Asia-Pacific politics and development, including a new framework to explain how power structures impact policy at the community level. As Australia invests substantially in development programs in all three countries, this framework will benefit policymakers by improving the effectiveness of how Australia provides development assistance that seeks to enhance democratic participation for all citizens in these countries. This will then benefit the broader Australian community by supporting the Australian government's goals of strengthening democracy and security in our region.							
DP230101536	**Political Representation in Indonesia**	47,070.00	216,630.00	292,800.00	123,240.00	0.00	0.00	679,740.00
Aspinall, Prof Edward T	The project aims to understand political representation in Indonesia, asking how far politicians resemble voters in both their policy views and backgrounds (gender, religion, education etc.) It will generate new knowledge on a major potential source of fragility in the world's third largest democracy, and pioneer a new multi-method approach for explaining how representation varies. Expected outcomes include a new framework that extends analysis of representation to illiberal democracies, and a tranche of public data on Indonesia for cross-national comparisons. Benefits will include a new set of analytical tools to help policy makers in Australia and the region assess sources of weakness in representative institutions in illiberal settings.							

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	National Interest Test Statement							
	Australia is deeply invested in the prosperity and stability of Southeast Asia. Yet, growing threats to democracy undermine regional stability. Against this backdrop, the project provides an in-depth study of how the region's power-holders operate, their policy priorities, and attitudes to democracy. It examines elected politicians in Indonesia, a major democratic power and Australia's most strategic regional partner, and will be the first comprehensive study of elites and democratic representation in Southeast Asia. The study will produce new knowledge on the attitudes and behaviours of regional leaders, providing a foundation for sound foreign policy, aid, and investment decisions. The project's focus on political representation and democracy also serves Australia's objective of supporting a stable, liberal regional environment in which both Australian and regional citizens can prosper. This project gives government and development practitioners new knowledge on political power-holders in our region, and provides them with innovative analytical tools to assess the fragility and strength of representative institutions in illiberal democratic settings. To achieve policy relevance, project leaders will activate their links with policy-makers and practitioners through each stage of the project.							
DP230101836	**Connecting ocean tides to the large-scale ocean circulation**	67,500.00	135,000.00	102,500.00	35,000.00	0.00	0.00	340,000.00
Shakespeare, Dr Callum J	This project aims to investigate the impact of tides on the ocean circulation and future climate change by combining new theory with next-generation numerical ocean models. The expected outcomes include ocean model configurations that will improve estimates of key processes affected by tides, such as Antarctic ice shelf melt rates, ocean warming and the ocean's overturning circulation. The project is thus anticipated to provide significant benefits in predicting future climate change, sea level rise, coastal erosion and marine heatwaves. Furthermore, it will enable the Australian and global communities to better target conservation and mitigation efforts, and thus reduce the environmental, social and economic impact of climate change.							
	National Interest Test Statement							
	Climate projections and ocean forecasting are critical for a range of Australian industries – from tourism and shipping to resources and seafood. They also underpin government resource planning on climate change. However, Australia's climate modelling capabilities are currently limited: they do not include the significant effect of ocean tides in the models used for forecasting and climate projections. This project will develop theoretical descriptions of tidal processes and integrate this knowledge into Australia's next-generation ocean and climate modelling platform. This new platform will be used by the Bureau of Meteorology, Australian Antarctic Division, CSIRO, and the Department of Defence in their operational forecasting. Through the use of the platform by these national agencies, this project will contribute to improving Australia's sovereign capability to conduct high accuracy ocean forecasting and climate projections, its climate change planning capacity, and benefit our tourism, shipping, resources and seafood industries.							
DP230101908	**Reliable and accurate statistical solutions for modern complex data**	63,000.00	131,000.00	131,000.00	63,000.00	0.00	0.00	388,000.00
Welsh, Prof Alan H	This project aims to develop novel methods for reliable and accurate statistical modelling with modern, complex correlated and error-prone data. The project expects to make significant strides towards future-proofing statistical data analysis, equipping practitioners with a suite of robust and computationally efficient methods which provide confidence in the stability and reproducibility of results obtained, while offering guarantees on their transferability over a range of populations. This will provide important benefits as they are applied in predicting endangered marine species for fisheries conservation, and in enhancing our national understanding of the relationship between education achievement and financial success.							
	National Interest Test Statement							
	The Australian Government directly manages a large amount of Australia's fisheries resources - close to a third of the total value of national fish production. The ecological and economic sustainability of its fisheries practices are therefore of great importance to the nation. Statistical science can play an important role in meeting these twin priorities, yet Australia has a widespread skills shortage in this area, making it difficult for agencies to adopt new statistical technologies and techniques. This project will develop cutting-edge statistical theories and techniques for robust and accurate data analysis, ensuring that reliable, reproducible conclusions can be drawn from datasets of varying size and complexity. Translated into software and shared via collaboration and training with domain experts and government personnel, the project will support the existing workforce to upskill and accelerate technology adoption. Their application of our techniques will contribute to improvements in both the protection of Australia's endangered marine populations and its contribution to the Australian economy.							

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DP230101940	**Resonator-enhanced quantum levitation of macroscopic systems**	63,983.00	159,079.00	161,322.00	66,226.00	0.00	0.00	450,610.00
Lam, Prof Ping Koy	This project aims to develop advanced technologies to optically levitate macroscopic (millimetre-sized) objects and nanoscopic (atomically thin) materials. Levitation platforms built by the investigatory team are based on the resonantly amplified radiation pressure of laser beams. This new type of optical levitation can provide ultimate isolation of the systems from external noise, making them extremely responsive to subtle environmental changes. These platforms could be turned into sharp instruments for measuring metrological variables of interest and probing new physics. Quantum optical techniques could be developed to optimise the sensitivity of levitated systems to levels that allow the exploration of quantum and gravitational physics.							
	National Interest Test Statement							
	Australia is rich in natural resources but also ecologically vulnerable and drought prone. To govern our resources sustainably, Australia needs to develop precision sensing capabilities that do not yet exist. These capabilities would help industry and government to extract geological information that makes it possible to capitalise on the full potential of untapped mineral resources while protecting our underground water reserves. One promising method to develop precision sensing capability is called ‘optical levitation’, which uses lasers to lift a sensor from its mechanical support. By doing so, we will design and produce technology that probes the environment at a world-first level of resolution. This technology will enable monitoring of water resources and exploration of mineral deposits with unprecedented sensitivity. These capabilities and technical expertise are of great interest to environmental and defence agencies, mining companies, and emergency services to develop to ensure the longevity and environmental sustainability of Australia’s natural resource economy into the future.							
DP230102019	**Languages of Barrier Islands, Sumatra: Description, History and Typology**	30,531.00	106,031.00	151,000.00	145,650.50	70,150.50	0.00	503,363.00
Arka, Prof I Wayan	This project aims to investigate endangered languages of the Asia-Pacific via four undocumented languages in the Barrier Islands, Indonesia. New knowledge will be generated into the languages, cultures and societies of the region on an unprecedented scale, and be made freely available to the public. New data will uncover past migration patterns in Southeast Asia, advance language theory (such as linguistic typology and language change), and support the computational modelling of Austronesian for future language technologies. Connections with Indonesian institutions will strengthen Australia’s regional engagement, and support language revitalisation and maintenance among minority communities for the preservation of their culture and history.							
	National Interest Test Statement							
	Indonesia is one of Australia’s most important regional neighbours, but a lack of understanding of its language, culture and history holds back our people-to-people relationships. This project will address this need by partnering an international team of language experts with Indonesian locals to carry out the world’s first detailed investigation of four little-understood languages and cultural history in Indonesia’s Barrier Islands near Australia's Christmas Island. In doing so, this research will uncover new insights on ancient trading routes between Australia and Southeast Asia. The project will produce a publicly accessible database that showcases the language, culture and history of these communities. Through public workshops, we will promote the database among different stakeholders in Australia to increase awareness as well as support Australian community engagement activities. The use of this database by the public, diplomats and policymakers will benefit Australians interested in the cultural diversity and history of our region and enhance Australia’s diplomatic ties with Indonesia.							
DP230102030	**Deciphering ion specificity in complex electrolytes**	76,500.00	157,500.00	153,500.00	72,500.00	0.00	0.00	460,000.00
Craig, Prof Vincent S	This project aims to understand how ions influence the behaviour and properties of complex electrolytes (solutions containing either multiple ions, solvent mixtures, high electrolyte concentrations or a variety of interfaces, solutes or polymers). Complex electrolytes are ubiquitous in colloidal and particle technologies and underpin industrial and natural processes. Our team will combine experiment, simulation and theory to deliver a universal framework for understanding and predicting specific ion effects in complex electrolytes. The project outcomes are expected to deliver new understanding for researchers, robust rules of thumb for technologists and a public resource for data-driven solutions in applications utilising salt solutions.							

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	National Interest Test Statement							
	Key sectors of Australia's economy such as medicine and mining rely on salt solutions for the products they produce for everyday consumer use such as batteries. However, their ability to optimise salt solutions in manufacturing processes is hampered by currently limited understanding of salt solutions and how to use them for best effect. Our project addresses this problem by developing a predictive framework for salt properties that makes optimisation of them possible. We will create an extensive database of the behaviours of salt solutions along with guidelines for industry to understand them. Australian industries can then use the database to accelerate product and technology developments that depend on the optimisation of salt solutions. Australian medical and mining industries will benefit directly through their creation of new technologies that support their competitive advantage in the preparation of medicines and processing of critical minerals such as those needed in smartphones and lasers.							
DP230102094 Moritz, Prof Craig C	**Hybridisation leading to lost sex: genomic and experimental insights** The project intends to apply advanced genomics to two classic Australian systems and quantitative genetics to one to address long-standing questions about why asexual reproduction is rare. It aims to test for rapid changes in genomes accompanying hybrid-origins of asexuals and whether this new diversity enables their ongoing evolution. The significance is that support for this hypothesis would challenge current theory for why sex is so common. The expected outcome is to understand how variation is generated in natural populations with different ways of reproducing. Benefits would include significant contributions to global science, evolutionary training and potential applications in using hybridisation to manage threatened species or pests.	97,632.00	174,009.00	102,912.00	26,535.00	0.00	0.00	401,088.00
	National Interest Test Statement							
	In Australian deserts, several animals and plants reproduce without sex even though this mode of reproduction is extremely rare. This study seeks to understand why, using two unique systems, a lizard and a grasshopper which both exhibit asexual (all-female) reproduction that developed millenia ago when pairs of sexual species hybridised. Sex provides a way for species to generate the genetic variation needed to adapt to changing environments, yet the Australian desert species lacking sex are highly successful. So how do they do it? The project applies new tools from genomics with experimental crosses to assess their genetic diversity and understand how they evolve. Results will challenge long held theory about benefits of sex, bolstering Australia's global reputation in evolutionary biology. The project includes a symposium on sex and biodiversity for the public, and the results will inform use of hybridisation as a tool in conservation and for control of pest species.							
DP230102184 Butterworth, Prof Peter J	**COVID-19, health and labour market marginalisation** This project aims to investigate the impact of the COVID-19 pandemic on labour market marginalisation in Australia. It seeks to generate new insights about whether the global economic shock had a disproportionately negative effect on the employment circumstances of working-age Australians with mental health and musculoskeletal/pain conditions, which are the leading causes of disability in Australia. The expected outcomes of this project include improved policy responses to direct effective support and assistance to those with the greatest need, and new resources for the research community. This should lead to significant benefits through reduced inequalities and improved social, economic and workforce outcomes for vulnerable Australians.	54,222.50	116,444.50	84,222.00	22,000.00	0.00	0.00	276,889.00
	National Interest Test Statement							
	The onset of the COVID-19 pandemic led to a sudden and dramatic increase in unemployment, underemployment and receipt of income support. By mid-2021 unemployment rates were back below pre-pandemic levels. However, the employment shock and later recovery were not experienced the same by all Australians. It is likely that working Australians with poor mental and physical health experienced worse employment outcomes during the pandemic, but there is little reliable information about this at present. This project will access and analyse new national data to build a deeper understanding of the employment and labour market circumstances of people with mental and physical health conditions throughout the pandemic. The project team will work together with policymakers and representatives of community and business groups to build new knowledge that will help to understand and then design and direct appropriate support and assistance to those who most need it. The project will help to promote Australia's economic recovery while ensuring equitable social, economic and workforce outcomes.							

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DP230102250	**Feature Learning for High-dimensional Functional Time Series**	68,500.00	122,500.00	108,000.00	54,000.00	0.00	0.00	353,000.00
Yang, Dr Yanrong	This project aims to develop new methods and theories for common features on high-dimensional functional time series observed in empirical applications. The significance includes addressing a key gap in adaptive and efficient feature learning, improving forecasting accuracy and understanding forecasting-driven factors comprehensively for empirical data. Expected outcomes involve advances in big data theory and easy-to-implement algorithms for applied researchers. This project benefits not only advanced manufacturing by finding optimal stopping time for wood panel compression, but also superior forecasting for mortality in demography, climate data in environmental science, asset returns in finance, and electricity consumption in economics.							
	National Interest Test Statement Australia’s life insurance, superannuation and pension funds industries carry significant responsibility for the financial wellbeing of Australians. Managing this responsibility and financial risk depends on accurately pricing consumers’ insurance premiums. To set those premiums, the industry analyses data to make predictions about individual mortality, yet technological advances have produced unprecedented volumes and sources of possible data to choose from and merge. This makes life expectancy forecasting and premium-setting potentially inaccurate. This project will develop new theories, methodologies and algorithms that account for complexities in merged big datasets to improve the accuracy of predictions. Translated into a purpose-built open access software program coupled with industry practitioner training, our research will build industry’s capacity to use these new methodologies leading to improvements in mortality forecasts and pricing of life insurance premiums for everyday Australians, as well as stronger financial risk management among some of Australia’s most critical financial industries.							
DP230102280	**Star Formation Through Cosmic Time**	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
Federrath, A/Prof Christoph	This project aims to determine how turbulence and magnetic fields control the formation of stars. This is crucial to understand the formation of galaxies, planets and ultimately life. The expected outcomes are the most detailed simulations of star formation in the early Universe and in galaxies today. This project has the potential to transform our understanding of cosmic structure formation, providing crucial input for Australian and international facilities and surveys, and models of galaxy, star and planet formation. Training Australia's future generation of Big Data analysts, as well as the development of interdisciplinary tools involving Chemical Modelling, Plasma Physics, Statistics and High Performance Computing are key benefits.							
	National Interest Test Statement The Australian Academy of Science's Decadal Plan for astronomy stresses the need for infrastructure and research workforce investment to power Australia's leadership in international space research. The Plan identifies areas where Australia can make its greatest 'world-leading contributions'. Our understanding of stars is central to this national research agenda: stars produce the light and chemical elements necessary for planets to form and life to exist. However, the origin of stars is still unknown. Here we will make the most detailed predictions of star formation, advancing Australian-led research into gas/fluid dynamics, radiation, and chemistry. Through application of this fundamental research to chemical modelling, high-performance computing and plasma physics, the project will support industry to adopt new methods in areas of signals analysis in defence to pollution tracking in our air and oceans. These applications will benefit Australians in areas of national security and environmental conservation, and Australia through global leadership in international astronomical discovery.							
DP230102424	**Dynamic evolution of mutation rates: causes and impacts on genomic analysis**	64,273.00	133,484.00	135,432.00	66,221.00	0.00	0.00	399,410.00
Bromham, Prof Lindell	This project aims to illuminate the role of variation in mutation rate in driving evolutionary change. Mutation rate is a core parameter in evolutionary analyses in essential applications including epidemiology, conservation and medicine, yet remains a “black box” given arbitrary universal values. This project will take a whole-of-biodiversity approach to understanding the forces shaping mutation rate, impact on evolution of biodiversity and effect on accuracy and precision of phylogenetic analyses. Using Australian case studies, the expected outcome of this project will be a greater understanding variation in mutation rate between species, providing significant benefits in developing more sophisticated and reliable phylogenetic analyses.							

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	National Interest Test Statement Policy makers and researchers are increasingly relying on DNA analysis to understand biodiversity, including planning for the survival of Australia's unique plants and animals under climate change. These analytical approaches rely on understanding the way that DNA changes over time. Understanding DNA evolution has real world consequences in planning for the future because it can influence decisions about conservation priorities. This project addresses this problem by increasing our understanding of how the rate of change in DNA varies between species, which is an essential component of analytical methods. Our new approach will give Australian scientists and software developers new ways to test and improve their analytical methods and make it possible for them to improve the accuracy of DNA analyses. Understanding DNA change will in turn allow scientists to build better methods to track changes in biodiversity and plan for the effects of climate change, thereby improving the effectiveness of protection measures for Australia's unique biodiversity into the future.							
DP230102431 Hua, Dr Xia	**Integrating theory and data to model evolution under a changing climate** This project aims to develop an innovative approach that integrates diverse data sources, from genetic sequences to geographic distributions, to improve inference of evolutionary dynamics. This will provide a powerful and efficient new method for understanding species' responses to climate change, demonstrated by inferring past, current and future climate adaptability in a diverse and ecologically important Australian plant family. Expected outcomes include enrichment of evolutionary theory and software tools to assess species' vulnerability to climate change. These outcomes will bring significant benefits to improve knowledge and protection of Australian biota and maximise returns on Australia's investment in biodiversity databases.	65,000.00	131,500.00	129,000.00	62,500.00	0.00	0.00	388,000.00
	National Interest Test Statement How resilient will our iconic Australian flora be to changing climate and shifting environmental extremes? Australia has invested in biodiversity data services, but to maximise the utility of our data resources for the benefit of conservation planning and environmental management, we need innovative and efficient ways to analyse these data. Falling within the "Environmental Change" research priority area, this project will develop new tools that integrate data from genes, fossils, species traits, distribution maps and climate models to characterise the adaptability of biological species to changing climate. This will provide conservation biologists, environmental consultants, and policy makers with more reliable and efficient software to identify the most vulnerable species under climate change. This project will demonstrate the usefulness of the software by reconstructing the past evolution, assessing the current climatic adaptability and predicting the future of the culturally and ecologically important Australian plant family Proteaceae, which includes such iconic groups as Banksia, Grevillea and Hakea.							
DP230102443 Petersen, Prof Ian R	**Fast Precision Robust Control of Resonant Flexible Systems** The project aims to produce new control system design tools to enable fast precision control of advanced engineering systems encorporating flexible structures. This should enable improved speed and accuracy in control systems for precision instruments such as atomic force microscopes along with improving control system performance in areas of precision engineering such as semiconductor manufacturing, robotics and microelectromechanical systems. The outcomes are expected to be new control system synthesis and modelling tools enabling fast and highly accurate control of industrial systems using nonlinear and switching elements and achieving high levels of robustness. This will benefit Australian precision manufacturing industries.	102,500.00	190,000.00	177,500.00	90,000.00	0.00	0.00	560,000.00
	National Interest Test Statement Australia's precision industries carry significant responsibility to produce products and technology that require highly accurate components or require exact precision in their use, such as medical technology. One of the challenges manufacturers face relates to vibrations caused during operation of precision devices, which can limit the accuracy required. Poor accuracy has any number of possible consequences depending on the product such as a missed medical diagnosis. This project addresses this problem by designing highly accurate feedback control systems. Our feedback control methods will reduce these vibrations to enable more accurate and reliable position of 'wafers' that are inserted in computer chips during the manufacturing process. They will also be applied to the vibrations in microscopes to produce more detailed and reliable images. These outcomes will enable precision device manufacturers to achieve greater precision with their products and technology, which in turn will improve the quality and safety of such devices for Australian consumers.							

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DP230102553	**Judicial Loyalties and Resistance in Southeast Asia**	56,163.00	112,069.00	81,702.00	25,796.00	0.00	0.00	275,730.00
Dressel, A/Prof Björn N	This project is designed to stimulate new insights, for both theory and practice, into how courts in Southeast Asia are responding to growing politicization, interference by other branches, and political backlash. The study will advance understanding of the rule of law, democratic governance, and judicial politics and launch a new database on how high court justices defend judicial institutions and constitutional practice. The findings should help both academics and policymakers to better understand how political, social, and ideational networks of judges can affect the ability of courts to resist threats to constitutional democracy as they arise.							
	National Interest Test Statement							
	Growing political backlash, politicisation, and court interference are undermining judicial systems in Southeast Asia. This threatens Australia's commercial interests and long-standing commitment to democracy in the region by eroding the independence of courts. By studying controversial cases, this project will reveal how judges decide to uphold the law or succumb to undue influence. It will produce the first regional high court database with socio-biographic data on high court judges and how they voted in high-profile cases. The creation of these publicly accessible data sets will provide policymakers with actionable evidence on judges, practices, and trends in Southeast Asia to strengthen legal institutions. By sharing insights with the Australian government and conducting workshops with judges and scholars in Thailand, Indonesia, Malaysia and the Philippines, the project protects Australia's strategic interests and builds networks of advocates for legal reform in the neighbourhood. The project thus strengthens Australia's capacity to support democratic governance and rules-based order.							
DP230102603	**Exciton-mediated room-temperature superconductivity**	80,161.00	160,322.00	160,322.00	80,161.00	0.00	0.00	480,966.00
Ostrovskaya, Prof Elena A	Superconductivity is the ability of an electronic material to conduct electrical current without resistance. This property underpins many existing and proposed technological applications, ranging from medical imaging to low-energy electronics and quantum computing. In this project, we aim to demonstrate a highly unconventional route towards superconductivity at room temperature and atmospheric pressure, by exploiting collective behaviour of excitons (electron-hole pairs in a semiconductor) strongly coupled to photons. This research should help to overcome the biggest challenge for the widespread applications of superconductors: the very low temperature or extreme pressure that the superconducting materials need to function.							
	National Interest Test Statement							
	Energy affordability is a serious challenge both for Australia and globally. Electronic devices that consume energy in Australian households and businesses rely on materials that carry electricity. 'Superconducting' materials carry electricity without wasting energy, which could enable lower-energy technologies. Superconductors are already used in advanced technologies, such as next-generation computing and medical imaging and have the potential to revolutionise energy storage and transport. However, they only work at very low temperatures or extreme pressures which makes further technology development difficult, and manufacturing expensive. Addressing these barriers, this project will focus on fabricating complex structures of novel, one-atom-thin electronic materials and exposing them to light with the aim to make room-temperature superconductivity possible. The knowledge and techniques created will be actively shared with industry to enable future development of energy-efficient, low-cost electronics that could reduce Australians' energy consumption and costs.							
DP230103122	**Revealing the impacts of super-charged photosynthesis on leaf respiration**	90,044.50	192,597.00	211,829.00	109,276.50	0.00	0.00	603,747.00
Atkin, Prof Owen K	This project aims to use state-of-the-art technologies to develop a novel framework that links a super-charged version of photosynthesis (known as C4 photosynthesis) to changes in nocturnal leaf respiration. A quarter of global land photosynthesis occurs in C4 plants that include several important cereal crops. Although advances have been made in modelling C4 photosynthesis, these advances are unable to model variations in nocturnal respiration. Expected outcomes include equations that predict respiration in C4 plants growing in current/future climates. Benefits to include knowledge needed to engineer faster-growing crops and providing climate modelers the ability to more accurately predict carbon exchange in C4-dominated ecosystems.							

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	National Interest Test Statement To predict the impacts of climate change on productivity of crops and native vegetation in northern Australia, we need to be able to model plant-atmosphere carbon exchange by two metabolic processes in leaves: daytime photosynthesis and nocturnal respiratory carbon release. However, in contrast to photosynthesis, our ability to model nocturnal leaf respiration is limited, particularly in northern Australian crops (e.g. sugarcane, sorghum) and native grasses that use a supercharged form of photosynthesis. The proposed research will use state-of-the-art technologies to understand how this supercharged type of photosynthesis alters carbon release by leaf respiration, both in current and future climate regimes. In doing so, the research will help accelerate development of new crops that are more tolerant of dry, hot conditions, with associated socio-economic and environmental benefits for cropping communities. The research will also provide the tools modellers need to predict how future changes in Australia's climate will affect the growth of plants in tropical and sub-tropical regions of northern Australia.							
	The Australian National University	3,031,537.50	6,240,328.00	5,975,559.00	2,905,739.00	183,970.50	45,000.00	18,382,134.00
University of Canberra								
DP230100328 Lowrie, Prof Thomas J	**Spatial intervention: An enduring model to build mathematics achievement** Strong evidence links spatial skills with mathematics achievement but the reasons remain theoretical. The aim of this project is to empirically establish the mechanisms connecting spatial reasoning with mathematics performance, including longitudinal interventions to provide evidence for long-term impact. The project is significant given the heightened concern surrounding Australian students' performance on national and international assessments. Expected outcomes are a detailed understanding of the ways enhanced spatial skills improve mathematics performance, and empirically tested intervention programs. Anticipated benefits include improved accessibility of mathematics education and sustained mathematics performance for all students.	62,675.00	115,268.50	109,668.50	57,075.00	0.00	0.00	344,687.00
	National Interest Test Statement There is clear evidence that success in school-level mathematics supports ongoing engagement with mathematics, and STEM more broadly in the workforce. Critical for Australia's ongoing STEM capability is the pipeline from school-based STEM subjects and entry into higher level STEM education and professions. This research project will use innovative teaching and learning techniques to engage primary-school children in mathematics. These techniques are founded on the well-established evidence that spatial skills training leads to higher achievement in mathematics. By developing students' critical spatial reasoning skills (which align directly to the Australian Curriculum), the project will provide opportunities for rapid increases in mathematics understanding and confidence. This project will maximise outcomes for all students, including those from marginalised groups and regional areas. The scale and scope of this project has the potential to impact mathematics education in meaningful ways across equity groups.							
	University of Canberra	62,675.00	115,268.50	109,668.50	57,075.00	0.00	0.00	344,687.00
	Australian Capital Territory	3,094,212.50	6,355,596.50	6,085,227.50	2,962,814.00	183,970.50	45,000.00	18,726,821.00

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New South Wales								
Australian Catholic University								
DP230100001	**Populism’s Heartlands: Place, Identity, and Localism in Populist Politics**	59,504.50	139,889.50	96,628.00	16,243.00	0.00	0.00	312,265.00
Moffitt, A/Prof Benjamin	This project aims to investigate how populism intersects with localism through systematic, comparative, and in-depth empirical study of three populist parties inextricably associated with ‘heartlands’ in Australia, Germany and Spain. This project expects to generate new knowledge about how populists utilise the language of localism and how people’s attachment to place shapes their support for populists. Expected outcomes of the project include a new understanding of how populism and localism affect one another; and identification of how right and left populist support are differently affected by community engagement and participation. Benefits include the identification of local interventions to lessen the appeal of exclusionary populisms.							
	National Interest Test Statement							
	It is often acknowledged that populism poses a threat to social cohesion in liberal democracies like Australia, but we know very little about how it operates, or what to do about it, on the local and regional level. This project examines how populists build strong links in regional communities; identifies local initiatives that can contest or alternatively bolster populism in these areas; and offers policymakers, governmental bodies and community leaders a comparative best-practice evidence base for designing programmes that build strength in diversity and community participation – a core goal of the Australian Government’s Countering Violent Extremism program – in regional settings. This will benefit Australia socially and culturally by providing practical ways to improve inclusion in regional Australia, which will have flow-on effects for these regional economies by increasing their attractiveness as places to live, work and raise families.							
DP230100135	**Identifying how cortical bone microstructure deteriorates with age**	127,000.00	212,000.00	172,500.00	87,500.00	0.00	0.00	599,000.00
Sims, Prof Natalie A	This project aims to define the disruptions responsible for the gradual weakening of the skeleton in ageing by integrating a range of high-resolution imaging, biomechanical, and computational methods. The expected significance of this project includes a full definition and comparison of the cellular and subcellular organisation of bone from young and elderly individuals. Expected outcomes of this international project include the establishment of a new multidisciplinary research team, and the development of a new data-driven theoretical framework for understanding the nature and the causes of age-related bone fragility. Potential long-term benefits include new ways to treat age-related osteoporosis.							
	National Interest Test Statement							
	This project will provide a new data-driven understanding of age-related loss of bone by describing changes in bone cell activity, connectedness, and material strength and quality of cortical bone across the adult lifespan. It utilises a unique Australian resource (Melbourne Femur Collection), the largest collection of healthy human bone samples in the world. It will increase Australia’s expertise in bone research by learning unique methods not available here from European experts. Applying this knowledge to human health, while not an immediate goal, may ultimately lead to new ways to prevent age-related osteoporosis, which costs >AUD$3.44 billion / year to treat, and thereby improve health and well-being of Australia’s ageing population. To enable adoption, we will communicate our findings (1) to scientific and medical researchers and clinicians through conference presentations, method-based workshops, and research papers (2) to the public (including school children) through social media, news-media (paper, television, radio), public science media, presentations to community groups, and art exhibitions.							

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DP230101905	**Improving disadvantaged students' writing engagement and achievement**	51,000.00	106,000.00	116,000.00	105,500.00	44,500.00	0.00	423,000.00
Ng, Prof Clarence	Economically disadvantaged students are disproportionally represented among those who fail to attain minimum benchmarks in writing in successive rounds of national testing. Our knowledge, however, is limited on why, how and under what circumstances disadvantaged students engage in or disengage from writing. Addressing this knowledge gap, this project examines how disadvantaged students experience and engage in writing, and how their writer identities and knowledge about writing develop, as they participate in writing events in different communities in school, out of school and online. The project promotes writing engagement and enhances achievement by making writing personally meaningful and by developing enabling writing communities.							
	National Interest Test Statement							
	It is costly for Australia when a large proportion of economically disadvantaged students falls behind in writing development, as shown in successive rounds of national tests. Low writing levels impact negatively on individual life chances and national competitiveness. Addressing this national challenge, the project will produce a rich dataset to inform education policy and teaching practices regarding disadvantaged students' engagement in writing in school, out of school and online. It will engage students and teachers as co-researchers to develop new teaching practices to enhance students' writing engagement and achievement. Evidence derived from longitudinal case studies, longitudinal surveys and design-based research will assist policymakers, researchers and practitioners to better understand the enabling and constraining factors on disadvantaged students' writing engagement and performance. This project will produce theoretically-informed pedagogical models that are purposeful, attainable and relevant for teachers to follow and adapt to their own pedagogical contexts.							
	Australian Catholic University	237,504.50	457,889.50	385,128.00	209,243.00	44,500.00	0.00	1,334,265.00
Macquarie University								
DP230100006	**Action selection in insects: how a microbrain knows what to do**	68,884.50	212,303.00	227,090.50	83,672.00	0.00	0.00	591,950.00
Barron, Prof Andrew B	Identifying what to do demands integrating sensory information with our current physiological state and memory of past experience to select the best possible action. This is the action selection problem. Our project aims to discover how tiny insect brains solve this fundamental problem. The project combines neural recordings from animals exploring virtual reality, behavioural analyses and computational modelling. The expected outcome is a new understanding of the brain as an effective behavioural control system. This will benefit systems and comparative neuroscience. Our findings may also inspire solutions for robotic systems that must operate autonomously in remote and challenging environments such as disaster relief or exploration.							
	National Interest Test Statement							
	The most important function of an animal's brain is the ability to select the most appropriate action in any situation from all the possible options. The decision involves gathering information about the world and the state of the animal and reflecting on learned experiences and memory to transform that information into the most appropriate response. The project will investigate the action selection process of the brain in highly visual insects that have sophisticated and complex behaviours. This will deliver a new understanding of how nervous systems transform information into action. The biological discoveries will provide solutions in autonomous robotics with opportunities for technology translation with the US Air Force and industrial robotics partners. Innovations in robotic autonomy will enable their use in challenging remote Australian environments, like disaster relief, mining and environmental monitoring. With a focus on honeybee and hoverflies, two of Australia's most important pollinators, the project will advance knowledge of insect behaviour that will benefit the country's food security.							

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DP230100148	**Hello, Mr America: Americans on R&R Leave in Australia in the Vietnam War**	26,500.00	48,000.00	49,000.00	27,500.00	0.00	0.00	151,000.00
Dixon, Prof Chris F	This project will provide the first comprehensive history of an important but neglected aspect of Australia's relationship with the United States. From 1967 until 1971 nearly 300,000 American servicemen - one tenth of the total number of Americans who served in Vietnam - travelled to Australia for their R&R Leave. What began as a matter of military expediency became an exercise in cultural diplomacy that left lasting economic, social and political legacies in Australia. Outcomes include a deeper understanding of the history of the US-Australian alliance, the international history of the Vietnam War, and Australian history during a period of dramatic transformation. Outputs will include a book, journal articles, and a symposium.							
	National Interest Test Statement							
	This project will provide the first comprehensive history of the American presence in Australia during the Vietnam War, an important but neglected aspect of Australia's relationship with the United States. American servicemen travelling to Australia on Rest and Recreation leave shaped social, cultural, and economic change. The innovative combination of military and diplomatic history with cultural, tourism and memory studies will provide Australians with relevant historical context to the ongoing relationship between Australia and the United States, reflected in recent comments from US President Biden of an enhanced Australia-US alliance and greater American presence in the region during the ‘Asia-Pacific Century’. At a time when the US-Australian relationship is under increasing scrutiny, project outputs including the book and public symposium will provide government agencies, business, education and not-for-profit stakeholders with key insights into the history of Australian-US military and cultural relations, the shifting geo-politics of the region, and Australia's security and future within it.							
DP230100408	**Creating coolspots: eco-engineering heat-resistant intertidal communities**	79,902.00	159,555.50	117,785.50	38,132.00	0.00	0.00	395,375.00
Bishop, A/Prof Melanie J	This project aims to identify structural characteristics of marine intertidal habitat patches, formed by seaweeds and shellfish, that protect associated species from thermal extremes. This project will generate new knowledge about how thermally sensitive intertidal species can persist in stressful environments. Expected outcomes of this project include new approaches for building heat-tolerant ecological communities on coastal infrastructure, and improved tools for predicting the response of intertidal seaweeds and animals to environmental change. The results of this project will benefit coastal management by identifying conservation and rehabilitation strategies that maximise the resilience of coastal ecosystems to environmental change.							
	National Interest Test Statement							
	This project will identify geometries and configurations of marine intertidal habitats, formed by seaweeds and shellfish, that protect other intertidal species from increasing thermal extremes under climate change. This knowledge will enable the development of conservation and rehabilitation strategies for sensitive species and will build heat-tolerant ecological communities. The results generated by this study will assist in climate-proofing Australia’s coastal ecosystems, worth over $895 billion to the economy every year, which include species important to recreational and commercial fishing. This directly aligns with the government priority of adapting to the impacts of environmental change on biological systems. The results will provide evidence-based support to be used by coastal managers and policy makers to decide which types of habitat to conserve and rehabilitate to provide thermal resilience. They will also be used to develop strategies with developers and environmental managers for building heat-resistant habitats into marine constructions to benefit both humans and nature.							

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DP230100440	**Dispersing myths; Characterising human migration through Asia**	81,661.00	172,426.00	144,713.00	53,948.00	0.00	0.00	452,748.00
Westaway, A/Prof Kira E	The human journey across the globe is one of our greatest achievements, yet the archaeological evidence for the earliest migrations is poorly dated, plagued by uncertainty and often overlooked. This project aims to characterise the nature of early human dispersals across Asia en route to Australasia by going beyond the timing and identification of human evidence to explore their behaviour, health and adaptability. Reconsidering early migrations within their environmental context will allow an assessment of their feasibility and address the disparity between the genetic and physical evidence. By elucidating the story of the greatest human journey we will develop a new understanding and appreciation of our survival and adaption capabilities.							
	National Interest Test Statement							
	Human migration across the globe is one of our greatest achievements but the archaeological evidence for early human migration is poorly dated and does not tell us the full story of how our ancestors came to Australia via Asia. This project will reconsider the earliest known journeys of our ancestors to better understand how they travelled and why they were so successful at reaching our shores. By uncovering new human fossil evidence and applying new scientific dating techniques to bone, teeth and sediments, this project will build new knowledge of the human story and document human survival, migration and adaption capabilities. This project will have social and cultural benefits for First Nation communities in Australia reinforcing their connection to country through a deeper understanding of their ancestor's genetic and cultural heritage and adaptability and installing a deeper pride in their achievements. By documenting human adaptability and survival during past changing climates, this project will provide benefits to Australian policy makers who shape our responses to future climate change challenges.							
DP230100617	**Seeing the light: high-power visible-light generation using silicate fibre**	85,000.00	172,000.00	177,000.00	90,000.00	0.00	0.00	524,000.00
Jackson, Prof Stuart D	Unlike their near-infrared counterparts, visible-light-emitting lasers are inefficient and complicated, impacting their broader deployment in industry, medicine, and telecommunications. To address this, we will create a new class of laser and amplifier based on an entirely new doped silicate glass fibre that will display low background loss and resilience to photodegradation from high-power visible light. This will solve one of the last important problems in fibre laser research. The primary outcome will be a series of high-power continuous-wave, ultrashort-pulse, all-fibre lasers emitting at yellow and red wavelengths, with significant benefits for space, defence, manufacturing, and human health.							
	National Interest Test Statement							
	Unlike their near-infrared counterparts, visible-light-emitting lasers are inefficient which limits broader use in industry, medicine, and telecomms. We aim to create a new class of laser that emits intense visible light using silicate glass optical fibre, which is stronger, crystal clear, and able to channel high optical power. Silicate fibre is used across many sectors, for example telecomms, where it supports faster moving data into our homes and businesses. The use of innovative visible light emitting lasers coupled with silicate glass optical fibre is a modern boost that will enhance our ability to send complex, large information across distances without signal disruption or distortion. This innovation will aid in more efficient and reliable communications and will also level-up Australia's contribution to telecommunications, defence, and medical treatments (such as ophthalmology and tattoo removal). On completion of this project, we will work with Australian companies to introduce these innovative lasers to our high-tech sector, boosting Australia's economy and global competitive advantage.							
DP230100676	**Trust-Oriented Data Analytics in Online Social Networks**	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
Wang, Prof Yan	Trust-oriented data analytics is essential in online social networks for reducing deceitful interactions and enhancing trust between users. This project aims to systematically devise innovative solutions by considering rich social contextual information as an important source of trust. The expected outcomes of this project include innovative solutions from a fundamental perspective to the challenges of context-aware trust propagation, trust network searching/matching, and trustworthy/malicious user prediction in online social networks. This project is significant as it will advance the knowledge base for enabling a trustworthy social networking environment, benefiting billions of Australian and worldwide online social network users.							

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	National Interest Test Statement							
	Online Social Networks reflect the culture of online users and such networks have proven critical for sourcing public perceptions and shaping policies. The misuse of such networks, however, leaves online users vulnerable to cyber-attacks and threats to data and personal safety. This project will devise innovative solutions to evaluate and predict trust relations among users of Online Social Networks and assist users in their decision making on whom to trust. The strategies and models generated by the project will inform government and businesses on how to tap into the online culture in a way that builds public trust and confidence, and resources to increase the digital literacy of Australians. Project outcomes will also advise social media platforms and cybersecurity developers on cultural strategies and empower them with innovative techniques to recognise harmful online behaviours and deter misinformation, scams, and data theft.							
DP230100899 Wu, Dr Jia	**New Graph Mining Technologies to Enable Timely Exploration of Social Events** This project aims to develop scalable and effective graph mining techniques for the timely exploration of social events that are the hottest happenings in online information networks. The research will primarily exploit the complex network structures and non-structural properties of streaming social data to report what is happening in a timely fashion. This project will lay the theoretical foundations of this emerging field to strengthen Australia's world leadership role in data science. Practically, the novel theories and data analytics technologies developed will benefit the Australian economy and society by monitoring emergencies, tracking prevailing sentiments, and spotting investment opportunities through timely event responses.	60,935.00	124,370.00	129,370.00	65,935.00	0.00	0.00	380,610.00
	National Interest Test Statement							
	Discovering, monitoring, and analysing events on social media platforms have proven to be critical during the pandemic. However, the sheer overload of information makes it difficult for the public to recognise relevant from irrelevant information, or information that is recent or not. The project will develop advanced data mining tools which investigate in large-scale and in real-time the relationship between trends sourced accurately from those that are irrelevant. The outcomes will place Australia on the map as having world class capability in communicating through official channels across government sectors to reach their intended audience in a timely manner, providing for example, a quick and cost-effective means to communicate with Australians during emergencies. It will also guide marketing firms on strategies to promote Australian goods to a global audience providing economic benefits. It is anticipated that future initiatives will include automating this process so that critical trends are picked up instantly with automated responses aligned with predictive trends.							
DP230100948 Velayutham, A/Prof Selvaraj	**Survival & Wellbeing among Migrant Precariat in Australia's Gig Economy** The food and parcel delivery industry is now a structural feature of the Australian labour market. Little is known about the social consequences of this development for the workforce. especially temporary and long-term migrant workers involved in this industry. This project aims to investigate the risks to safety and wellbeing to migrant cohorts who undertake this work, interrogating the intersecting impact of age, gender, class, and ethnicity and particularly migration status. The project produces major national benefits, such as an enhanced capacity to inform future labour market policies and regulation as well as conceptual innovation in describing the 'everyday survival' strategies of migrant workers in Australia.	67,500.00	154,500.00	134,500.00	47,500.00	0.00	0.00	404,000.00
	National Interest Test Statement							
	The Gig economy is rapidly expanding in Australia and elsewhere. It has opened new employment opportunities for many, and delivery work (food, courier and parcel services) has become increasingly popular since the COVID lockdowns. However, increasing reports of the exploitation including the deaths of delivery workers call for urgent responses to unfair and insecure employment practices that citizens and non-citizens disproportionally experience. This study situates gig workers in the context of their lives, hopes, and struggles and advances understandings of how the 'citizen' and 'non-citizen' migrants among Australia's working poor absorb the 'everyday' risks and social consequences of gig work. This research has national benefits related to the health of Australians working in the Gig economy. It will offer further insights into how insecure gig employment affects individual and community well-being as well as contribute to current national and corporate policy development to improve gig employment and work.							

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DP230101261	**Mitonuclear incompatibility, speciation, and the Z sex chromosome**	56,642.50	94,129.50	62,347.50	24,860.50	0.00	0.00	237,980.00
Griffith, Prof Simon C	This project will characterise the interaction between the mitochondrial and nuclear genome in several species and its contribution to the divergence of species. This interaction is at the heart of energy transformation and storage in all animals and its importance to evolution is yet to be fully understood. The research will provide insight into speciation processes by focusing on recent divergence in Australian finch species. We will integrate genomics, bioenergetics, and whole organismal performance in growth, mobility and reproduction by studying birds in the wild and the laboratory. An overarching aim is to unite data from genomics, phenotype and physiology to understand the forces underlying the evolution of species, and biodiversity							
	National Interest Test Statement							
	Mitochondria are the powerhouses of cells in animals and are a fundamental building block of complex life forms. The project will address the yet to be answered question of how the genes of the mitochondria interact with the genes of the animal itself, and how 'mismatches' may make life for certain animals unviable. The research will deliver new knowledge about cellular genetics that will contribute to our understanding of animal physiology and evolution. Beyond new knowledge, the practical applications are vast and include developing more robust endangered animal breeding programs to ensure the cellular genetics will match and thus slow or stop the extinction of endangered species. Additionally, the outcomes of this research can advance human medical treatments and the gene-targeted therapies to cure mitochondrial diseases. The research team will ensure the research findings are available to medical and biological researchers to dovetail new understandings of mitochondrial genes with human-centric genomic medical innovations and accelerate the end-user impacts.							
DP230101282	**Supporting dynamic multidimensional entrepreneurial resilience in Australia**	22,498.00	54,061.50	64,470.00	32,906.50	0.00	0.00	173,936.00
Sinha, A/Prof Kompal	This project aims to model entrepreneurial resilience, its formation and its influence on how creative transformation occurs, and whether ex ante adaptive capacity is in turn enhanced by having mastered crises. The project proposes a theoretical model to holistically measure resilience across the life course. Using longitudinal data for self-employed individuals in Australia the project analyses the impact of crisis and economic policy on entrepreneur's behaviour and SMEs entry exit decisions. The project informs policy making through employing discrete choice experiments to elicit entrepreneur's preferences for government policy and support post crisis.							
	National Interest Test Statement							
	Small and Medium Enterprises constitute the backbone of the Australian economy and support Australia's economic success and social cohesion. Times of unprecedented challenges involving climate change, supply chain disruptions and recovery from a global pandemic require SMEs' resilience. With a compelling focus on SMEs' entrepreneurs, this project will unpack the notion of resilience to identify its key managerial traits and the drivers of firms' successful adaptation to change in the face of large shocks. By relying on strong and ongoing communication with SME groups, associations and government departments, this project will capture entrepreneurs' voice on their resilience and analyse their strategies that support resilient businesses. With the purpose of creating an evidence-base for decision-making, the project delivers a new approach to measure entrepreneurial resilience. The project also develops a web-based tool to measure entrepreneurial resilience to facilitates discussion among stakeholders, and benefit Australia's policy makers and business associations in supporting owners of small business.							

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DP230101607	**Situational Assessment as a Marker of Cognitive Skill Decay**	78,500.00	162,500.00	173,000.00	89,000.00	0.00	0.00	503,000.00
Wiggins, Prof Mark W	The aim of this study is to test how differences in exposure to complex tasks change the capacity for situational assessment. Amongst drivers, pilots and electricity controllers, the capacity to assess and respond effectively to changes in the operational environment are critical in sustaining performance and ensuring the safety and security of the public. Establishing the nature of this relationship will enable, for the first time, objective measures of cognitive skill decay. In evaluating cognitive skill decay more accurately, we will provide a cost-effective, easily administered tool, enabling practitioners to identify and address areas of development and providing data to anticipate when cognitive skill decay is most likely to occur.							
	National Interest Test Statement							
	The performance of trained professionals, such as airline pilots and electricity workers is dependent on a set of specific, trained skills. These skills must be maintained in a range of situations and on a regular basis to prevent skill loss and the subsequent impact on safety. COVID-19 and the resultant lockdowns has increased skill loss, impacted performance, increased errors, and reduced productivity in the workplace. This project will develop the first online assessment tool for assessing safety-critical skills, such as flying passenger airplanes and operating electrical equipment, and provide accurate and reliable feedback on performance. In evaluating skill loss more accurately, this project will deliver a cost-effective, easily administered tool, to identify and address areas for development and provide data to anticipate when skill loss is likely to occur. This will help Australian workplaces manage skill loss and the requirements for improving productivity. Applications also include the military, healthcare and other high-risk environments with safety outcomes beneficial to all Australians.							
DP230102252	**Enabling wide area mm-wave mobile broadband networks**	79,000.00	160,500.00	167,500.00	86,000.00	0.00	0.00	493,000.00
Hanly, Prof Stephen V	This project will define a new architecture and algorithms based around a network of access points with overlapping coverage that will support broadband, wide-area services to mobile users in mm-wave bands. The project will develop tools to characterise the information carrying capacity of this network, and tradeoffs between key parameters. The outcomes will be used by Mobile Network Operators in planning their deployments and developing their operations software to deliver diverse and flexible data services. The benefit will be an unlocking of radio spectrum beyond isolated hot spots, supporting vastly greater traffic densities and data rates worth billions of dollars to the economy.							
	National Interest Test Statement							
	This project aims to deliver faster, farther reaching, and more reliable mobile broadband services to the Australian public and industry. Australian mobile service providers have adopted the use of higher-frequency mm-wave spectrum as a critical element to meeting future data demands over their 5G networks, however they are currently not able to support seamless, wide-area broadband coverage in this spectrum. Only local hotspot services are possible for mobiles in very close proximity to access points. This project will design a radically new way of providing wide area mobile broadband connectivity. It will overcome the signal blockage that is characteristic of the mm-wave frequency bands which is currently the main obstacle for network operators. It will enable vastly greater traffic densities and data rates than is currently possible. We will collaborate with Australian mobile network providers to deliver this innovation that will put Australia at the vanguard of mm-wave mobile network deployment.							
DP230102432	**Can cyanobacteria use organic nutrients to thrive in future oceans?**	80,611.00	163,903.50	169,260.50	85,968.00	0.00	0.00	499,743.00
Paulsen, Prof Ian T	Marine cyanobacteria are central to regulating the global climate and underpin entire marine food webs. Though they possess genes necessary to uptake diverse organic nutrients, we know very little about whether and how organic nutrients shape the physiology and ecology of cyanobacteria. Using our innovative high-throughput approach, this project aims to systematically characterise organic nutrient uptake in picocyanobacteria. Our molecules-to-ecosystems approach expects to transform our understanding of alternate nutrient acquisition in cyanobacteria and how it may shape populations of these important photosynthetic organisms in a rapidly-changing ocean landscape.							

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	National Interest Test Statement							
	Blue-green algae are the most abundant photosynthetic organisms in oceans. They play a key role in marine ecosystems by providing oxygen and nutrients at the base of the food chain, which in turn supplies protein for >1 billion people. Evidence suggests in addition to carrying out photosynthesis, they can utilise other nutrient sources, which enables them to cope and live in changing ocean conditions. Understanding this novel nutrient uptake strategy will provide crucial insights into how blue-green algae can adapt to climate change-driven ocean warming and low oxygen conditions. Changes in their abundance and distribution will significantly impact the productivity of Australia's valuable fisheries and the livelihoods of people who depend on them. The discoveries from this project will be shared with government agencies responsible for safeguarding Australia's oceans from extreme climate events and, by working with industry, will build sensors to detect environmental change and monitor the health of Australian marine ecosystems.							
DP230102459	**Seeing the Bio-Nano "Talk" in the brain via real-time multiplex tracking**	120,000.00	230,000.00	182,500.00	72,500.00	0.00	0.00	605,000.00
SHI, A/Prof Bingyang	This project aims to develop new knowledge and smart tools that have the potential to greatly improve brain research. The blood-brain-barrier is the major physiological barrier that protects the brain from environmental toxins, bacteria and viruses, but limits the effectiveness of nanoparticle-based brain imaging agents. Expected outcomes of this project include a better understanding of the mechanisms that allow nanoparticles to penetrate the blood-brain-barrier, as well as improving brain imaging. Benefits of the project include the commercialisation of technologies and smarl tools developed in this projetct, and establishment of a new Australian biotechnology company that exports brain-imaging technologies to the world.							
	National Interest Test Statement							
	This project will unlock the application potentials of new microscopic smart tools, known as nanoparticles, in basic and translational brain research as disease sensors, imaging tracers and drug carriers. Today's poor understanding of nanoparticle penetration to the brain has greatly hindered their application in diagnosing and treating brain diseases. This project will uncover the fundamental mechanisms underlying the nanoparticle journey in the brain by visualising the key steps in real-time. The discoveries will enable the design of new next-generation nanoparticles that are smarter and safer, that can be used in futuristic brain imaging and drug delivery, opening a new era for this field, and delivering improved health and better quality of life for Australians. The commercialisation of the nanoparticles and imaging technologies developed in this project will see the establishment of a new Australian biotechnology company that exports brain-imaging technologies to the world.							
DP230102577	**Energy-efficient liquid-flow system for electroreduction of carbon dioxide**	80,000.00	162,500.00	167,500.00	85,000.00	0.00	0.00	495,000.00
Jiang, A/Prof Yijiao	Concerns about fossil fuel depletion and rising carbon emissions have brought about an urgent demand for carbon dioxide (CO2) capture and utilisation technologies. Facilitated by the mechanism-driven catalyst development and engineering innovation, this project aims to deliver a durable and cost-effective approach to electrochemical transformation of CO2 into the valuable products. The proposed automatic liquid-flow reactor system is expected to enable an energy efficient and practical viable CO2 reduction in benign aqueous electrolytes. The resulting innovations will not only reduce the environmental impact of atmospheric CO2 but also generate highly concentrated industrial feedstocks for the sustainable production of commodity chemicals.							
	National Interest Test Statement							
	Global concerns about fossil fuel depletion and rising carbon emissions have brought about an urgent demand for carbon dioxide (CO2) capture and utilisation technologies. This project aims to design an energy-efficient liquid-flow system that could transform CO2 into a key building block for advanced manufacturing, such as in the chemical production industry, as well as addressing the need to reduce excess carbon in our environment. This research will provide real-world solutions to turning reclaimed CO2 as a carbon feedstock into a usable product by using the latest scientific innovations to build an energy-efficient liquid-flow reactor system, enabling sustainable chemical manufacturing. By investing in this innovative technology, the Australian public will seed the global response to the time critical issue of finding real-world solutions to global rising carbon emissions. The new technology developed through this research means that we can move towards our zero-emissions targets and provide usable carbon for advanced manufacturing in Australia.							
	Macquarie University	1,057,634.00	2,210,749.00	2,106,037.00	952,922.00	0.00	0.00	6,327,342.00

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The University of New England								
DP230101348	**Cartoon Nation: Australian Editorial Cartooning - Past, Present, and Future**	71,754.00	127,006.50	129,864.50	145,956.00	71,344.00	0.00	545,925.00
Scully, A/Prof Richard J	This landmark study aims to facilitate a new scholarly and public appreciation of Australian editorial cartooning: something often celebrated, but seldom studied seriously. At a moment when the art-form is transitioning, the study will elucidate its enduring democratic and cultural significance, revealing diverse stories told through cartoons. Expected project outcomes include: pioneering new scholarship; the enhancement of cross-institutional networks; and improved capacity for collaboration between academia and industry (professional bodies and collecting institutions). The project will benefit the nation, providing a truer understanding of the defining Australian sense of humour, press, and political culture, across more than 200 years.							
	National Interest Test Statement Editorial cartoons are of vital importance to Australian social and political culture, and are markers of the health of Australian democracy and a free press. They offer a visible space in which national identities, values and priorities are communicated and contested. Understanding their enduring influence, and the challenges faced by cartoonists in the digital era, helps us understand who we are. This project, with its explicit focus on a key component of the Australian news media, cultural and political heritage, and outward-facing plan of communication of results, will be of clear benefit to the nation. Most directly, there are social and cultural benefits to the Australian community that loves cartoons and cartooning, and which will have an opportunity to better appreciate and understand their importance. There are also economic and commercial benefits, specifically to the cartooning profession and media industry, in the form of greater awareness of cartoons' commercial value, the tracing of intellectual property, and potential for collaboration across industry and academia, and the broader community.							
	The University of New England	71,754.00	127,006.50	129,864.50	145,956.00	71,344.00	0.00	545,925.00
The University of New South Wales								
DP230100048	**The secret of tiny hand movements to feel and manipulate objects**	78,326.50	146,882.00	131,025.00	62,469.50	0.00	0.00	418,703.00
Birznieks, A/Prof Ingvars	This study aims to reveal some of the fundamental sensory mechanisms underlying the uniquely human ability to manipulate objects and use tools. Signals from touch receptors are crucial for controlling grip forces so that delicate objects are held without slipping, or being crushed by excessive force. Yet we know little about how such sensory information is obtained and how it is used for the motor control. By analysing hand movements during object manipulation and recording sensory signals from single human nerve fibres we will investigate how certain types of movement shape richness of available sensory information. This knowledge will facilitate the development of next generation sensory-controlled prosthetics and robotic manipulators.							
	National Interest Test Statement This project will investigate the sophisticated sensory and movement control mechanisms underlying the unique human ability to manipulate objects and use tools with our hands, which still remains unmatched by the most advanced robotic manipulators and hand prostheses. The proposed study will reveal how the nervous system obtains and interprets information about objects gripped in the hand, and how this information is used to control hand actions. This critical information can be used to develop a new generation of artificial touch sensors and robotic hand controllers. Research findings will be communicated to our engineering network and showcased to industry and will help drive technical advances related to robotics, prosthetics, virtual reality, and teleoperated devices deployable in hazardous environments and rescue. Such technologies are aligned with Australia's strength in robotics automation increasing Australia's local advanced manufacturing capacity and defence capabilities.							

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DP230100233	**Towards Generalisable and Unbiased Dynamic Recommender Systems**	72,500.00	147,500.00	152,500.00	77,500.00	0.00	0.00	450,000.00
Yao, A/Prof Lina	This project aims to develop the foundations, including models, methodology, and algorithms for building generalisable and unbiased dynamic recommender systems to facilitate intelligent decision-making, prompt contextualised and personalised strategic plans, and support context-aware action recourse. To ensure that fundamental principles, such as fairness and transparency, are respected, a set of algorithms and techniques are proposed to develop recommender systems in a more responsible manner. The result of this project will not only maintain Australia's leadership in this frontier research area, but also serve as an excellent vehicle for the education and training of Australia's next generation of scholars and engineers.							
	National Interest Test Statement							
	‘Recommender systems’ – a type of information filtering system that provide suggestions for items tailored to a particular user - are a powerful machine learning tool for various human decision-making activities from healthcare, cyberattack defence, prison sentence recommendation to personalised shopping and music recommendation. Existing recommender systems are constrained by inadequate data, biased algorithms, and a lack of transparency and ‘explainability’, causing concerns about their robustness, trustiness, and fairness. This project will address these challenges and develop new models, methodologies, and algorithms to establish ‘responsible’ recommender systems with boosted decision-making capacity. Through partnerships with industry and policymakers, outcomes of this research have potential to deliver significant commercial and social benefits, such as expediting demand and supply analyses to drive manufacture automation, increasing cyber security capabilities, and optimising medical resource allocation amid pandemics.							
DP230100303	**Enhancing sensory perception and balance control in HMD-based VR**	40,500.00	84,500.00	89,000.00	45,000.00	0.00	0.00	259,000.00
Kim, A/Prof Juno	This project seeks to test a revolutionary new theoretical framework for understanding how we perceive our self-motion and maintain postural control when immersed in head-mounted display (HMD) virtual reality (VR). Photorealistic graphical simulations and artificial vestibular stimulation will be used to investigate how visual and non-visual information concerning self-motion is integrated in the brain. The outcomes will reveal how multisensory interaction influences our sensory perception and postural control during HMD VR. The knowledge gained is expected to generate new economic benefits by inspiring next-generation technologies that will optimise users' immersive experiences (e.g., virtual exploration and immersive gaming).							
	National Interest Test Statement							
	Virtual Reality (VR) devices using head-mounted displays (HMDs) are not just becoming more abundant, they are a future way of working in the modern world. These technologies are rapidly being applied to everyday activities, including interactive platforms for remote communication, virtual exercise, remote tourism, and learning to perform tasks in dangerous environments (e.g., coal mines or nuclear reactors). Despite the huge potential for VR to enrich many aspects of human life, consumer uptake of these technologies is still limited due to unwanted experiences that prevent the benefits of VR being realised (e.g., cybersickness). The project provides direct insight into how the adverse effects of VR can be eliminated and how immersive experiences can be safely optimised. The publication of a white paper will assist with dissemination of outcomes to local hardware and software developers creating next-gen VR technologies, and lead to improved simulations used by Australia’s advanced manufacturing, education, and defence industries.							

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DP230100434	**A Functional Analysis of the Hypoelliptic Laplacian**	67,500.00	137,500.00	140,000.00	70,000.00	0.00	0.00	415,000.00
Zanin, Dr Dmitriy	Strike a bell, a sphere, or any geometrical object, and it rings. The frequencies of ringing are the mathematical spectrum, which encodes deep secrets about the shape of the object. The spectrum of the hypoelliptic laplacian is known to carry deep truths in mathematics and physics, but it remains difficult to understand. We propose a new analytic foundation, which will replace the so far non-analytical ad hoc approach, and make accessible many new results. It is key to better understanding differential equations which lie at the boundary between quantum mechanics and the classical world. This will pave the way for Australian leadership in a new century of differential equations and geometry, and training of young mathematicians.							
	National Interest Test Statement							
	Modern mathematics holds incredible power to describe the characteristics of the world around us, such as understanding patterns, quantifying relationships, and predicting the future. Pure mathematics builds the theoretical frameworks or language from which a clearer understanding of real-world scenarios may emerge and underpins all fundamental physical sciences and their application. This fundamental research project is focussed on the development of a new mathematical theory of the structure of objects. These novel theories will have future applications across a broad spectrum of sectors, including the emerging quantum computing industry, in which Australia is at the forefront, as well as in materials science, theoretical mathematics, physics and structural engineering. Potential benefits to Australia through quantum computing, include making smarter investment decisions, developing drugs and vaccines faster and revolutionizing transportation.							
DP230100505	**Understanding multi-scale dynamics of eddies in the East Australian Current**	92,500.00	219,000.00	254,000.00	127,500.00	0.00	0.00	693,000.00
Roughan, Prof Moninya	This project aims to provide the first rigorous quantification of the complex dynamics of rotating eddies (the weather systems of the ocean) and fronts on scales ranging from metres to 100s of kilometres and hours to weeks in the East Australian Current System. This project is at the frontier of oceanographic research and will provide significant new understanding of the physical and biogeochemical dynamics of eddies and their interactions across multiple spatio-temporal scales, revealing their impacts on productivity along Australia's most populous coastline. This will provide significant benefits such as improved ocean forecasting and sustainable management of Australian marine industries and seafood sector, supporting economic growth.							
	National Interest Test Statement							
	Ocean 'eddies' are large whirlpools of water – up to hundreds of kilometres in diameter – which can significantly affect the weather systems of the ocean through shifting warm and cold water around and influencing other ocean currents. Accurate ocean weather forecasts are crucial for the safe operation and sustainable growth of Australia's marine industries, including the fishing and seafood sector, presently valued at $81B per year. Our understanding of how eddies develop and interact is currently lacking, which means current ocean weather forecasts and climate models do not factor in eddy interactions, significantly reducing their accuracy and utility. This project will use novel technology to characterise these complex eddy processes and determine their impact along Australia's most populous coastline. Dissemination of this new information to key stakeholders, including the Bureau of Meteorology, will help inform improvements to ocean weather forecasts, enabling better management of our marine environment, including a more prosperous and sustainable seafood sector at a time of rapid environmental change.							

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DP230100530	**Pseudorandomness in Number Theory, Dynamics and Cryptography**	80,610.50	163,524.50	132,889.50	49,975.50	0.00	0.00	427,000.00
Ostafe, Dr Alina	The aim of the project is to investigate various aspects of randomness, design new and analyse previously known constructions of randomness extractors of practical use. As a dual aim, we will also investigate the pseudorandomness of some classical number-theoretic objects. The significance of this project is in a large number of theoretical and practical applications and in new methods which will be developed. Expected outcomes include new cryptographically strong hash functions and progress towards several famous open conjectures such as Sarnak's conjecture. These new results and methods will be highly beneficial for both theoretical mathematics and also for such practical areas as cryptography and information security.							
	National Interest Test Statement							
	Numbers, major mathematical functions and processes in nature intrinsically contain some randomness. This randomness is, however, not easy to access and use, it is also often biased. A classical example is tossing a coin, which never produces a perfectly random sequence of heads and tails, getting affected by asymmetry of the coin. Algorithms for extracting this randomness are called 'randomness generators'. Such generators are important in a range of areas, including development of encryption methods to keep digital data secure, and the application of mathematical methods to financial markets. This project aims to improve the quality and effectiveness of known randomness generators and design new, more efficient ones. Outcomes of this research could be applied in cybersecurity and across financial, banking and insurance sectors. Computer scientists could use improved randomness generators to increase the security, privacy and efficiency of telecommunication networks; and economists can apply these generators to create more reliable economical and financial forecasts for Australia.							
DP230100534	**Ubiquity of Kloosterman sums in Number Theory and Beyond**	63,000.00	131,500.00	131,500.00	63,000.00	0.00	0.00	389,000.00
Shparlinski, Prof Igor	This project aims to seek new methods of investigating Kloosterman sums by combining an algebraic geometry approach with an analytic approach to develop one powerful, unified method. Its significance lies in expected pivotal advances towards several fundamental problems which lie at the heart of number theory such as the Dirichlet Divisor Problem and asymptotic formulas for moments of L-functions. The expected outcome of the project is to provide a deeper understanding of the intriguing nature of Kloosterman sums and thus open new perspectives for applications in analytic number theory. This will provide substantial benefits for other areas such as cryptography by deepening our understanding of pseudorandom sequences.							
	National Interest Test Statement							
	A 'Kloosterman sum' is a mathematical concept that has a broad range of applications, including in everyday electronic data encryption, coding and quantum physics. Despite almost 100 years of intense investigation of Kloosterman sums, there are still many deep, open questions about them. This project aims to answer some of these questions using novel theoretical approaches. New information about Kloosterman sums has the potential to enhance design of 'hash functions' which are used to make data storage and retrieval more efficient and 'scrambling' algorithms which are crucial for any electronic information exchange applying privacy and security. Dissemination and application of research outcomes through existing and new partnerships, will enable computer scientists and engineers to advance cybersecurity approaches, particularly in Australian defence, communications, and on-line banking.							

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DP230100596	**Metal-on-Metal Single Atom Catalysts**	86,500.00	155,000.00	134,000.00	65,500.00	0.00	0.00	441,000.00
Tilley, Prof Richard	Forming active sites with precise positioning of individual atoms is an ultimate goal in catalysis. This project aims to chemically synthesise single metal atoms positioned on metal nanoparticle supports with precise atomic configurations. This enables the single metal atom and support metal to act synergistically for enhanced catalysis. The single atom sites will be understood by the very latest theoretical modelling, in situ electron microscopy and synchrotron spectroscopy techniques. These materials will be used for hydrogen evolution electrocatalysis, a reaction where having an active site with two metals greatly influences activity. The intended outcomes include high performance water splitting electrolysers to generate hydrogen fuel.							
	National Interest Test Statement							
	The use of hydrogen will help shift Australia's dependence away from fossil fuels to clean, renewable energy resources. One of the major barriers to the efficient and sustainable production of hydrogen as a fuel is a lack of materials, called catalysts, that can make hydrogen by an efficient and cost-effective process. By designing catalysts with atomic scale precision, this project will develop innovative catalysts that convert water into hydrogen using renewable energy resources. This will enable a pathway for Australian hydrogen producers to manufacture hydrogen on an industrial scale. Working together with our industry partners, the catalysts developed will help establish an economically viable national hydrogen industry, enabling affordable hydrogen fuel cell powered vehicles and transportation, and providing economic benefits to Australia. The application of these catalysts will help reduce our dependence on fossil fuels, bringing environmental benefits and help Australia meet its CO2 emissions targets.							
DP230100603	**Intelligent Reflecting Surface-enabled High-speed 6G Wireless Networks**	78,000.00	158,000.00	162,500.00	82,500.00	0.00	0.00	481,000.00
Ng, A/Prof Derrick Wing Kwan	Intelligent reflecting surface (IRS) is a ground-breaking wireless technology essential for the development of future sixth-generation (6G) wireless communication networks. This project aims to develop fundamental communication theories and practical solutions to characterise and optimise IRS-based communication. The project expects to design novel channel estimation, robust beamforming, resource allocation and analytical framework to address the significant scientific challenges for the development of IRS for enabling high-speed 6G networks. These outcomes are expected to contribute to a new type of wireless infrastructure which paves the way for building and transforming the Australian information and communications technology industries.							
	National Interest Test Statement							
	The mobile broadband sector has provided over 10 billion AUD to the Australian economy per year. Yet, the associated skyrocketing wireless data traffic volume has imposed unprecedented challenges on service providers even with the state-of-the-art 5G communication systems. The problem is more severe in the roll-out of the Internet-of-Everything (IoE) with a massive deployment of wireless networks and data-hungry devices that prevent sustainable digital society development. So, investigating IRS-assisted communication for the upcoming 6G is crucial for the ongoing productivity growth of Australia, as it can offer a highly flexible and cost-effective deployment of high-speed and efficient communication infrastructures. Hence, the outcomes of this project will offer a new technology to embrace future 6G communication networks in the next decade which will equip Australian companies to seize the technology opportunity for business. Furthermore, the high-quality research conducted by this project can sharpen the global competitive edge of Australian-based research.							

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DP230100605 Lee, Dr Juhyun	**Architectural Design Across Spaces and Cultures: Technology and Language** This project addresses two significant productivity barriers facing Australia's architectural practices; designing in spatially distributed and culturally diverse teams. While design practices are central to sustaining Australia's creative export sector, growing concerns associated with online, multilingual design teams have been identified. Directly responding to Australia's COVID-19 recovery plans, this research seeks to develop new knowledge about the cognitive, social and technical factors that shape the effectiveness of online international design teamwork. Its goal is to leverage the opportunities provided through technological advances and multicultural practices, to remove barriers to design productivity and enhance creativity.	26,597.50	75,090.00	92,023.00	80,120.50	36,590.00	0.00	310,421.00
	National Interest Test Statement This project addresses two related challenges facing Australia's architectural sector: how teams can work productively in an online setting and managing the complexity of designing with international partners. Industry reports argue that poor use of technology and misunderstandings in online, multicultural and multilingual teams are responsible for costly delays across the sector. This project will investigate the impacts of designing in online, diverse teams and provide insights—through a resource guide—into how Australian architects can better identify communication breakdowns, work productively across borders and recognise and stimulate innovation. The resource guide will be made available through national architectural forums and continuing professional development programs. With over $50 trillion expected to be invested in new buildings in the Asia-Pacific region in the next 20 years, this project will strengthen the ability of Australia's architects to participate in and earn a share of this work—important for Australia's economic sustainability and growth.							
DP230100651 Parameswaran, Prof Sridevan	**Custom Computing for DNA Analysis of Third Generation Sequencers** The project aims to create a Domain Specific Computing System to analyse data emerging from third-generation DNA sequencers. The significance is that such a system will enable in-situ analysis, facilitating far wider deployment of modern DNA technologies. The expected outcome will be a portable low-power computing system containing custom instructions, custom cache configurations, and custom architectures. Benefits include: 1. deployment of DNA analysis techniques in remote areas and in places without large servers and access to high-speed networks connecting to cloud servers; 2. quicker analysis enabling rapid response, cheaper, portable systems; and, 3. training for a cohort of research and honours students.	72,685.00	146,120.00	146,870.00	73,435.00	0.00	0.00	439,110.00
	National Interest Test Statement This project will research methods to create a portable, fast, and low-power custom computer system to analyse the large amount of data emanating from third-generation DNA sequencers. The current need for significant computing infrastructure limits the use of these sequencers to laboratories for species with large DNA sequences (such as human genome and wheat - 3.2 Gbases and 17 Gbases respectively) allowing field deployment only for species with short DNA sequences (such as viruses etc.). The domain-specific computing system from this project will allow field deployment for species with long DNA sequences, permitting wider deployment in remote and clinical settings. The outcome of this project will reduce this cost significantly, enable far greater access along with possible commercialisation, and train future generations of researchers. We will be trailing this system within Garvan Medical Research Institute.							

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DP230100702	**Sustainable fiscal federalism and reform of the GST distribution system**	22,445.50	68,711.00	74,958.00	28,692.50	0.00	0.00	194,807.00
Xu, A/Prof Yan	The primary source of funds for Australian States and Territories is GST revenue distributed by the Commonwealth using an equalisation formula that has proved to be politically unsustainable and in recent times manifestly inadequate to provide the revenue needed in response to crises and natural disasters. A tipping point has been reached and reform is urgently needed. Drawing on international experience with GST distributions specifically and fiscal federalism more generally, the project aims to develop a reform blueprint for a sustainable and equitable fiscal federalism regime in Australia that best aligns with Australia's current and long-term fiscal needs.							
	National Interest Test Statement							
	GST revenue transfers from the Commonwealth to States is the largest source of revenue for the States to provide public services and infrastructure. The revenue is distributed using a "fiscal equalisation" formula that has proved highly problematic, yielding windfall gains to some and leading to unanticipated gaps in revenue for others. It creates disincentives for States to pursue new revenue sources and its inadequacies are greatly amplified in times of severe economic dislocation associated with recurring crises and natural disasters. Drawing on lessons from abroad, the project explores alternatives to the current arrangements, with a full analysis of the benefits and costs of each alternative. Policymakers in Australia will be able to use the research findings to design a more efficient and fairer revenue distribution system that provides a robust and sustainable foundation for national development and removes a cause of conflict between different States and between States and Commonwealth.							
DP230100769	**Asgard archaea: the first eukaryotic cells?**	97,545.00	198,791.50	204,696.00	103,449.50	0.00	0.00	604,482.00
Burns, A/Prof Brendan P	This project aims to uncover the role of unique microorganisms (Asgard archaea) in the origin of eukaryotes. These archaea may represent a 'missing-link' in eukaryotic evolution and are in abundance in the stromatolites in Shark Bay, Western Australia. Employing an innovative and interdisciplinary approach of cutting-edge molecular biology and high-resolution microscopy, this project expects to generate insights into fundamental aspects of evolution and cell biology. Expected outcomes include the discovery of unique branches of life and the proposal of new models for the emergence of eukaryotes. This research should allow for benefits across a spectrum of environmental and social gains, including improved ties with Indigenous communities.							
	National Interest Test Statement							
	This project contributes to Australia's Science and Research Priorities of 'Environmental Change'. A greater understanding of how complex life arose on Earth is vital for improving conservation and management practices in areas currently endangered and impacted by environmental change. This project aims to uncover the unique nature of microorganisms directly linked to the emergence of higher life forms (animals, plants), found in abundance in ancient rock ecosystems in Shark Bay, WA - a World Heritage Site under threat of environmental change. This project will deliver a leap in knowledge by identifying the transition between simple and complex cells which is a pivotal but mysterious event in evolution. It will foster collaboration with Indigenous rangers in the field in Shark Bay as a genuine two-way exchange of knowledge and best practices with First Nations communities. The outcomes of this project will also inform assessments of the sensitivity of these irreplaceable marine environments and support educational programs that promote appropriate management, and stimulate Australian tourism.							
DP230100801	**Stability Analysis of Power System with Massive Power Electronic Devices**	65,000.00	132,500.00	137,500.00	70,000.00	0.00	0.00	405,000.00
Chen, Dr Guo	The decarbonization of Australia's power systems is to integrate massive renewable energy sources which are interfaced with many power electronic devices (PEDs). The fast and complex dynamics of PEDs have significantly changed the nature of the power system, which limits the applicability of existing tools and methods to assess its stability. The goal of this project is to gain a comprehensive insight into the stability of a futuristic power system with high penetration of PEDs. The intended outcomes will be a model and data jointly driven methodology for high-efficient and real-time stability assessment. The methodology developed in this project will support Australia's transition to a stable, secure, and low-carbon power grid.							

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	National Interest Test Statement							
	The electrical power industry in Australia is undergoing a vital revolution to a low-carbon environment by integrating huge amounts of renewable sources which are interfaced to the power system through massive power electronic devices. These devices have very complicated dynamic characteristics resulting in emerging instability of power system. Lack of efficient and timely stability assessment will increase the probability of power outage or even large-scale blackout. This project will provide new methodology to assess the stability of power system considering massive power electronic devices integration. The outcomes can provide useful guidelines for the Australian power industry transforming to a more robust and sustainable power grid.							
DP230101040	**Bioinspired Nanoionic Materials for Watt-scale Nano-Hydroelectric Generator**	86,000.00	172,000.00	172,000.00	86,000.00	0.00	0.00	516,000.00
Chu, Prof Dewei	Inspired by electric eels, this project aims to develop next generation flexible and eco-friendly power sources that can directly generate electricity from water droplets for self-powered, light-weight wearable electronics. The goal will be achieved by designing a new class of nanoionic materials for nano-hydroelectric generators, through optimizing the ion diffusion channel, interfacial architecture, electrode configuration, and power management systems. The expected outcomes will be new nanoionic materials for a wide range of end uses in portable power supply with much higher capacity compared with conventional thin film batteries, significant advances in wearable electronics, and advancing knowledge in energy conversion sector.							
	National Interest Test Statement							
	The wearable electronics market is currently valued at US$37 billion, and is forecast to hit 1 billion connected wearable devices by 2022. In particular, the wearable market in Australia is expected to register a CAGR of 17.65% during the forecast period from 2022-2027. The major limiting factor to the growth of this market is the absence of a reliable, efficient and safe power supply that can be easily worn without compromising on the compactness and ease of use. The project seeks to resolve fundamental issues in current portable power sources and to develop highly efficient, wearable, and eco-friendly power supply technology which can directly generate electricity from water droplet. By integrating energy harvesting and power management systems, this project will generate significant benefits to Australian economy and community: Development and commercialization of a range of new technologies, including wearable and printable self-powered devices for healthcare monitoring; Designed and manufactured in Australia for the rapidly growing global market.							
DP230101053	**Effects of offshored advanced manufacturing on productivity, and growth**	38,570.00	92,710.50	123,860.50	69,720.00	0.00	0.00	324,861.00
Sojli, A/Prof Elvira	Offshoring can reduce production costs, but it can also reduce cutting-edge advanced manufacturing capability and skilled manufacturing workforce, and reduce future growth. Lack of appropriate data has made it difficult to measure these effects for firms and industries. Using uniquely available data from the Australian Bureau of Statistics and newly developed methods, this project aims to provide new measures of firm level offshoring activity and advanced manufacturing capability onshore and offshore. The project expects to generate new knowledge on the impact of offshored advanced manufacturing on productivity, growth, product innovation, and skilled labour. The findings should provide significant new industry and policy relevant insights							
	National Interest Test Statement							
	The development of innovative advanced manufacturing industries in areas of competitive advantage is argued to be important for Australia to improve its position in global supply chains. Evaluating and restoring advanced manufacturing is one of the top five societal challenges identified by the Australian Chief Scientist. Yet the costs and benefits of offshoring advanced manufacturing are little understood. This project will quantify advanced manufacturing in Australia and the degree to which it has been offshored. It will examine the effect of offshoring on the development of advanced manufacturing, and how this affects productivity, growth and employment. Using these measures, we will evaluate the impact of free trade agreements and advanced manufacturing initiatives ($1.6 billion invested through the Modern Manufacturing Strategy). The results will inform the design of effective policies that can raise productivity -- a key issue of policy concern. The measures will be of direct use to IP Australia, the Australian Bureau of Statistics, and the Australian Government for future use in resource allocation.							

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DP230101058	**Violation of fundamental symmetries in atoms, molecules and nuclei**	55,970.00	116,940.00	126,940.00	65,970.00	0.00	0.00	365,820.00
Flambaum, Prof Victor	This theoretical project aims to predict enhanced effects of parity (P), time reversal (T), CP and Lorentz invariance violation, which may be measured using atomic spectroscopy and nuclear physics methods. This project expects to contribute to search for physics beyond standard model, including standard model extensions predicting axion, dark matter and T,P-violating electric dipole moments. Expected outcomes include predictions of new enhanced effects in nuclei, atoms and molecules. By-products and benefits include development of high precision computer codes for atomic calculations, which are expected to have numerous applications including photon and electron processes, properties of superheavy elements and atomic clocks.							
	National Interest Test Statement							
	One of the main aims of science is to create unified theory explaining physical and cosmological phenomena from subatomic scale to the size of the Universe. The methods to test unification theories include search for violations of the fundamental symmetries of Nature, such as time reversal invariance and symmetry between particles and antiparticles. Our project is theoretical with the aim to guide and support the efforts of overseas and Australian scientific communities in the search for the violation of the fundamental symmetries by predicting and calculating new enhanced effects. Additionally, through this project we will establish collaboration with the world's leading scientific centres, and develop high precision computer codes for atomic calculations useful for many applications, including development of high precision atomic clocks, needed for navigation (GPS) at all levels from cars to airplanes, missiles and satellites, communication, prediction of earthquakes and search for oil, gas, water and mineral resources.							
DP230101061	**Romanticism and the Poetics of First World War Literature**	16,581.50	48,302.00	76,340.50	44,620.00	0.00	0.00	185,844.00
Ramsey, Dr Neil D	This project asks how the poetics of nineteenth-century Romanticism informed the literature of the First World War. We build on recent research into the history of war and Romanticism to challenge the common view that the literature of the First World War marked a radical break with the past. We examine how this literature adapted and re-invented traditions of war literature. We probe critical questions of periodisation and war representation. The project will help inform understanding of the cultural memory of war in Australia. How we understand our war traditions are of critical importance as the nation undertakes its largest peace-time expansion of the Australian Defence Force (2022-) and redevelops the Australia War Memorial (2019-).							
	National Interest Test Statement							
	This project is about how past narratives and images of war continue to shape our contemporary understanding of war. It examines this issue by looking at the role of tradition in the most significant literature of war, the literature of the First World War that has profoundly shaped cultural memories of war in Australia (and is taught in schools across Australia). This question of how we remember and revise our traditions of war is of critical importance today as the nation undertakes its largest ever peace-time expansion of the Australian Defence Force (2022-) and redevelops the Australia War Memorial (2019-). These developments require that we continue to update the nation's ANZAC heritage in ways that are responsive to war today, whether of new kinds of wars, a more diverse nation, or to emergent security issues and complex political issues. The benefit to Australia of our project is that it allows: a better understanding of the long traditions of war memory and representation; a more inclusive approach to war memory; insight into how memories of war continues to shape our understanding of war.							

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DP230101063	**In-situ grain boundary engineering via metal additive manufacturing**	69,460.00	141,045.00	141,420.00	69,835.00	0.00	0.00	421,760.00
Primig, A/Prof Sophie	We aim to develop a capability for targeted specialty alloy microstructure design via metal 3D printing. Our approach to generate customised grain boundary networks in stainless steels and superalloys will unlock superior mechanical, corrosion and technological properties, without subsequent thermomechanical treatments. Scientific outcomes are new physical metallurgy knowledge on the targeted selection of desirable interfaces via recrystallisation and coupled segregation-precipitation phenomena. Technological outcomes are processing maps for printing parts with customised microstructures. This will diminish anisotropy, residual stress and defects, benefitting defence, aerospace and energy applications, all vital to the Australian economy.							
	National Interest Test Statement							
	This project aims to develop new advanced manufacturing methods for metal 3D printing to improve the performance of engineered parts for aerospace, defence, and energy applications. Although offering unique design flexibility, 3D printed parts still exhibit inferior properties (mechanical, corrosion) and performance compared to traditional manufacturing, limiting their widespread adoption. This is largely due to the presence of inner defects formed during the multi-layering process (‘deposition’) of printing. We will develop capabilities to improve printing parameters and the deposition process, enabling 3D printing of parts with superior properties and performance using current 3D printers. Commercial benefits will be realised via technology licensing to current and new industry partners, including aerospace, defence and energy suppliers. Expected benefits for Australia include new industrial capacity, export opportunities, and reduced dependency on international trade.							
DP230101184	**Automatic detection and modelling of acoustic markers of speech timing**	82,520.50	167,344.50	122,124.50	37,300.50	0.00	0.00	409,290.00
Epps, Prof Julien R	This project aims to create new automatic sensing, analysis and assessment of cognitive, affective, mental and physical state from voice for mobile and computing devices. This project expects to generate new understanding of the effects of these states on detailed timing indicators of speech motor control, and new signal processing and machine learning methods that best exploit it. Expected outcomes from this project include a new and accurate deep neural network framework for learning, analysing and detecting human states from speech automatically using articulatory timing markers. This should provide significant benefits, such as individually-tailored, frequent and low-cost automatic detection, monitoring and analytics for adverse states.							
	National Interest Test Statement							
	This project aims to develop new digital speech analysis and timing detection software that will enable us to automatically detect changes to ordinary speech due to effects like intoxication, stress, cognitive load, emotion or disorders. Findings from this project will improve our understanding of how speech is produced, speech disorders, and develop skills and capacity within Australia in automatic speech recognition and artificial intelligence. It will be suitable for mobile devices, allowing people wherever they are to download apps to self-manage their wellbeing. Australia has a gap in terms of cheap, accessible and personalised early detection, referral and day-to-day monitoring of individual and community wellbeing, that can be bridged by artificial intelligence-enabled technologies such as this. Through existing and new industry partnerships and licensing of IP, software created by this research will stimulate critical technology startup companies which are growing in importance and contributing thousands of new high-value jobs to the economy.							

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DP230101204	**Hybrid Toughening of Carbon Fibre Composites for Liquid Hydrogen Storage**	87,500.00	180,500.00	151,500.00	58,500.00	0.00	0.00	478,000.00
Wang, Prof Chun H	This project aims to develop hybrid toughening technologies to overcome the major problem of transverse matrix cracking and splitting in existing carbon fibre composites when subjected to thermal-mechanical loading at the ultracold liquid hydrogen temperature. Nano-toughened thin-ply carbon fibre layers will be hybridised with standard-ply laminates to sustain internal pressure and external impact loading at cryogenic temperatures without leaks. The hybrid composites are expected to enable Australian companies to engineer, manufacture and export lightweight carbon fibre tanks for storing and exporting liquid hydrogen, which is emerging as a transformational opportunity for Australia to become a global supplier of green energy.							
	National Interest Test Statement							
	Safe and cost-effective storage and transport of liquid hydrogen (LH2) at a large scale is critical to Australia's National Hydrogen Stratgy. This project will advance new hybrid toughening technologies to solve the critical problem of through-thickness matrix cracking and gas leakage of carbon fibre composites. The hybrid carbon fibre composites will be able to safely operate under internal pressure and external dynamic loads at cryogenic temperatures without hydrogen loss. With a density of around 20% of stainless steel, the new hybrid composites offer a potential weight saving of 80% over metal tanks and enable Australian companies to design, manufacture, and export lightweight all-composite tanks for storage and export of liquid hydrogen globally. The research team will partner with Australian companies to translate the technology to large-scale hydrogen storage tanks for long-term storage and long-distance transport at an affordable cost, thus strengthening Australia's clean hydrogen export pathways and reducing costs in the storage and transport stage of the hydrogen value chain.							
DP230101248	**Sex Differences in Trait Associations & Shapes: Analysis beyond Average**	78,505.50	160,804.50	131,949.00	49,650.00	0.00	0.00	420,909.00
Lagisz, Dr Malgorzata M	This project aims to identify and address current knowledge gaps in research on sex differences by employing different methodologies (bibliometrics, systematic mapping) and developing novel methods of meta-analysis. This project expects to generate a more holistic and complete view of sex differences than currently appreciated, by (meta-)analyzing the shapes of traits and associations between traits. Expected outcomes of the project include taking the field of sex differences to the next level, and creating new and powerful meta-analytic methods, opening new avenues for research synthesis. This should provide significant benefits by directing future research in related fields and inspiring new kinds of (meta-)analyses across disciplines.							
	National Interest Test Statement							
	This project supports two of the Australian Government's national scientific priorities in 'Environmental Change' and 'Health'. Traditional approaches to study sex differences commonly used across a variety of different disciplines, rely on the concept of 'average' males and females. For example, recommendations for diet and exercise are based on the requirements of average, not individual, men and women. This project aims to develop novel statistical methods which focus on comparing how males and females differ, not only from the 'average', but will enable analysis of variation within the sexes. These new techniques could be used to synthesise more meaningful evidence in the medical, social and biological sciences, and to inform more equitable and effective policy and evidence-based decision making by government and industry. Potential applications could include the development of animal conservation approaches that better accommodate known sex differences in environmental vulnerability, or in the development of more effective diet, exercise, and health programs.							

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DP230101312	**Engineering nanomembranes for Long-term Implanted Flexible Electronics**	70,000.00	142,500.00	145,000.00	72,500.00	0.00	0.00	430,000.00
Phan, Dr Hoang Phuong	This project aims to investigate the key technologies of inorganic semiconductor nanomembranes for long-lived bio-integrated electronics. Taking advantage of the well-established silicon carbide (SiC) synthesis and fabrication technology, the project expects to elucidate a new understanding of the SiC-on-polymer platform, establishing a foundational guideline for the development of chemically inert and mechanically flexible devices. These findings will offer innovative solutions for daunting challenges in bio-integrated electronics, leveraging their safety, reliability, and long-term performance. The project expects to offer Australia cutting edge technologies and an impact profile in the fast-growing flexible bio-electronics market.							
	National Interest Test Statement							
	This project aims to discover the physics and manufacturing processes of nanometre-thin biobarriers for long-lived bioimplanted electronics. Material degradation of soft biomedical devices in biofluids has been a daunting challenge, as it causes device failures, and poses high risks associated with additional surgeries to remove implanted components. Built on our solid background in inorganic semiconductors, this project is expected to generate a new class of biobarrier and biointerface that have great potential for long-life, active, implantable devices. These novel flexible electronics will offer continuous and reliable health monitoring that can enhance quality of life and reduce the cost of biomedical treatment. Novel manufacturing technologies and training of high skilled engineers in Australia through this project will offer our nation a strong profile and competitiveness for the fast-growing personalised healthcare market. The technological innovations of this project will be licensed under the strong support of the UNSW 2025 strategy plan to translate fundamental research into practical applications.							
DP230101445	**Big temporal graph processing in the Cloud**	80,000.00	162,500.00	167,500.00	85,000.00	0.00	0.00	495,000.00
Zhang, Prof Wenjie	This project aims to develop efficient and scalable algorithms to process big temporal graphs in the Cloud. In particular, we will investigate three most representative types of queries over big temporal graphs including vertex-based queries, path-based queries, and subgraph-based queries. Expected outcomes of this project include theoretical foundations and scalable algorithms to process big temporal graphs as well as a system prototype for evaluation and to demonstrate the practical value. Success in this project should see significant benefits for many important applications such as cybersecurity, e-commerce, health and road networks.							
	National Interest Test Statement							
	Temporal graphs' are powerful tools to expressively model time-evolving relationships among different entities, underpinning a wide spectrum of applications from e-commerce to public health. The volume of temporal graph data in real-world applications can be very large. However, existing techniques for temporal graph processing mainly focus on single-machine solutions. This project will bridge this important gap by developing novel techniques for scalable and efficient temporal graph processing in the cloud. The success of this project will bring technological advances in the processing of big graphs, positioning Australia as a leader of the research field of graph processing and analytics. Through partnership and the licensing of IP, the enhanced graph processing capability from this project will deliver significant commercial and social benefits for key Australian industry sectors, including financial frauds detection in e-commerce, network attacks and malware detection in cyber-security systems, contact tracing in public health, and terrorist detection from social network analysis in defence.							
DP230101463	**How the brain learns and uses inhibitory predictions.**	81,000.00	151,500.00	131,500.00	129,500.00	68,500.00	0.00	562,000.00
Laurent, Dr Vincent	Humans and other animals readily learn about cues and actions that predict the absence of important events. Yet, how and where such inhibitory predictions are processed in the mammalian brain remains unclear. This project aims to demonstrate that inhibitory predictions are generally encoded and retrieved in the medial prefrontal cortex, without any detailed information about the absent events. It combines a unique behavioural approach with the latest tools for manipulation of brain activity in behaving rodents. The project expects to generate new insights into how the mammalian brain extracts inhibitory predictions from the environment to guide our behaviours and decisions in the most optimal way.							

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	National Interest Test Statement							
	Inhibitory learning' describes our capacity to detect opposing relationships between events: a blue sky signals the absence of rain. This learning coordinates our everyday life, enabling us to understand relationships between events, aiding decision-making and ensuring our health and wellbeing. Yet the mechanisms underlying this capacity, or what happens when it is lost, remain elusive. This project aims to address this gap by exploring how a single brain region supports inhibitory learning. Characterisation of the brain mechanisms underlying inhibitory learning will inform the development of a new framework which could be used by educators, psychologists and occupational therapists to inform more effective teaching strategies and behavioural approaches. The new knowledge generated by this research may also have implications for the health and pharmaceutical industries, laying the foundation for new treatments for neuropsychiatric disorders characterised by a chronic loss of inhibitory control.							
DP230101489	**Local climate changes caused by large bushfire burnt areas**	56,500.00	113,000.00	112,500.00	56,000.00	0.00	0.00	338,000.00
Evans, Prof Jason P	This project aims to quantify the impact on local climate produced by large burnt areas after extreme bushfires. This project expects to generate new knowledge on these previously unexplored fire-scar induced changes to local climate. It will extend an innovative approach that combines satellite based earth observation with very high resolution regional climate modelling to quantify the impacts on land-atmosphere feedbacks and local climate. Expected outcomes of this project include enhanced methods to quantify local climate changes after extreme fires and their effect on vegetation recovery. This should provide significant benefits to the planning for, and management of, vegetation recovery after extreme fires.							
	National Interest Test Statement							
	Extreme bushfires have become more common in Australia with over 5 million hectares burned in the 2019/20 summer. Fires leave behind large burnt areas that are blackened, have exposed soil, with little to no vegetation. This changes the amount of sunlight absorbed by the land, rainfall that infiltrates the soil, soil moisture that evaporates back to the atmosphere, and how friction impacts the wind near the soil surface, altering the atmosphere, and, over time, the local climate. Recovery from such fires depends on the local climate, and determines the time taken for the environment to return to normal. This research will quantify these local changes to climate. Outcomes will be shared with fire agencies, national parks, and private industry in regions that experience extreme fires to improve the planning and management of the post-fire recovery. By better understanding and predicting the post-fire local climate this research will address the environmental change research priority.							
DP230101676	**Nitride materials: In the “bond ionicity Goldilocks zone” for solar energy**	55,000.00	108,500.00	108,000.00	54,500.00	0.00	0.00	326,000.00
Green, Prof Martin A	Progress towards commercial devices for solar-driven hydrogen generation as well as in-situ electricity generation for vehicles is currently hampered by a lack of earth-abundant, stable, non-toxic semiconductor materials that can be fabricated by scalable methods. This project aims to develop the first scalable solution synthesis methods for a new class of earth-abundant Zn-based nitride semiconductor nanocrystals that have favourable bond ionicity and establish their optoelectronic properties for renewable energy devices for the first time. Flexible solution processing methods will be exploited to tune surface composition, remove defects and create devices to achieve optimised performance in these challenging new nitride material systems.							
	National Interest Test Statement							
	To better utilise Australia's abundant solar resource and accelerate the much-needed transition to renewable energy, improvements to the affordability, performance and versatility of solar-powered technologies are required. This project aims to develop and optimise methods to manufacture nitrogen-based semiconductors at large-scale. These semiconductors have the potential to outperform existing materials for solar technologies, boasting enhanced durability and cost-effectiveness without using toxic materials. These advantages will enable high-efficiency thin film solar cells and hydrogen generators to be made, ultimately lowering the cost of clean fuels, expanding applications of solar cells to electric vehicles with curved surfaces and improving energy accessibility globally. Through our existing industry partnerships and licensing of IP, manufacture of these new materials will be upscaled to place Australia at the forefront of advanced manufacturing and solar energy technologies in markets worth over $100 billion (such as automotive and personal electronics), and expand Australia’s export of clean fuels.							

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(Columns 1 and 2)	(Column 3)	2022-23 (Column 4)	2023-24 (Column 5)	2024-25 (Column 6)	2025-26* (Column 7)	2026-27* (Column 8)	2027-28* (Column 9)	(Column 10)
DP230101739 Setterlund, Prof Per B	**Advanced Materials from Automated Synthesis of Sequence-Defined Polymers** The project aims to develop industrially scalable and environmentally friendly methods for synthesis of sequence-defined multiblock copolymers (polymer chains containing segments of different polymer types) using automated synthesis methods. The materials to be explored will be largely based on renewable biomass-derived monomeric building blocks. Such polymers are able to undergo microphase separation into spatially periodic compositional patterns, thereby providing access to a vast range of nano-engineered materials. This would enable design and synthesis of new advanced materials, making use of renewable resources and supporting the circular economy, with diverse potential applications ranging from nanomedicine to materials science.	75,500.00	153,000.00	157,500.00	80,000.00	0.00	0.00	466,000.00
	National Interest Test Statement ‘Polymeric’ materials (formed from chains of small molecules or polymers) play an important role in society with applications from bulk plastics to advanced technologies, such as electronics and medical devices. Design of new polymeric materials is constrained by current methods that do not allow for the combination of different types of polymers (e.g. bio-based vs petroleum-based) or variation to the order of molecules within a polymer chain. This limits the development of new materials with improved properties, for example, flexibility/softness combined with strength. This research aims to develop novel methods for creating polymeric materials that address both a functional purpose and societal demand for sustainability, reducing reliance on the petrochemical industry as the primary source of materials. This will expedite the discovery of new, renewable polymer materials which, through partnerships and the licensing of IP, will have potential applications in the manufacturing industry for food packaging, paints and medical devices.							
DP230101797 Olubas, Prof Brigitta	**Reading Writing Lives: Publishing & Preserving Australian Literary Archives** In the last decades of the twentieth century, it became possible for Australian writers to have significant careers thanks to the establishment of the Literature Board of the Australia Council for the Arts. This project will bring to light the correspondence between Australian authors Shirley Hazzard and Elizabeth Harrower and between Hazzard and US scholar Donald Keene through these years. It will throw light on this historical period and how writers’ careers flourished, as it accesses this new information for the first time. It will produce two books of writers' correspondence, two exhibitions of writers' archives and libraries, and several scholarly and public-facing essays to make this new knowledge accessible to a broad audience.	17,056.00	33,414.00	16,358.00	0.00	0.00	0.00	66,828.00
	National Interest Test Statement Australians must have access to the stories that have defined our nation. Two of Australia's most acclaimed novelists, Shirley Hazzard and Elizabeth Harrower, were writing during the great flowering of Australian literary culture that ran from the 1970s to the end of the century. In addition to their fiction, they wrote letters chronicling and examining the dramatic social, artistic, and political changes of this period, when modern Australia was being formed. These letters have never been published before. By editing, analysing and publishing this correspondence, this project will bring to light for the first time the hidden history of Hazzard and Harrower's writing lives and the world in which they wrote. It will benefit Australians culturally and socially by making our history more accessible and lively and by offering new perspectives on key events. Through published books, exhibitions, and online resources, the project will provide access for writers, students, and general readers for the first time to an important body of writing.							

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DP230101804	**Biofabricated tissue mimics for nanoparticle design and development**	91,345.50	185,759.50	188,629.50	94,215.50	0.00	0.00	559,950.00
Kilian, A/Prof Kristopher A	Nanoparticles are widely used in commercial applications spanning biotechnology, health and environmental monitoring, and drug delivery. Materials scientists can generate large libraries of nanoparticles, but the toolbox available to test these nanoparticles is limited. We will use biofabrication to comprehensively evaluate the fate of polymer grafted nanocellulose across simulated tissue barriers. Model blood vessels with recirculating flow will help understand permeation; tunable matrices will establish 'matrix structure—nanoparticle diffusion' criteria. The outcome from this project will be an understanding of how plastic nanoparticles penetrate tissue, to guide nanomaterials design and mitigate risk associated with toxicity.							
	National Interest Test Statement							
	Nanoparticles are naturally occurring or manmade submicroscopic particles that can freely circulate around the human body, readily moving in and out of cells and tissues. Due to these properties, they have numerous applications in medicine, engineering, catalysis etc. Current techniques for testing the properties of nanoparticles involve using human cells grown in the lab or in live animals, both of which fail to adequately mimic the environment in vivo. This research will develop a new approach to study nanoparticles in living tissue, which will help advance nanoparticle design and reduce/replace the use of animals for testing. This research will yield an increased understanding of how nanoparticle properties relate to tissue distribution, which will guide industrial and clinical stakeholders in the design of safe and effective nanoparticle-based technologies. Results will be disseminated through public forums and through collaborations with stakeholders towards integration of new nanoparticles and testing models to benefit clinical procedures and industrial product development pipelines.							
DP230101847	**Mixed-Dimensional 2D/0D Heterostructures for Infrared Detection**	92,414.00	189,629.50	126,825.50	29,610.00	0.00	0.00	438,479.00
Wu, Prof Tom T	The aim of this proposal is to develop novel mixed-dimensional 2D/0D heterostructures based on halide and chalcogenide nanomaterials to construct a highly efficient solution-processing platform for short wave infrared detection. Moreover, innovative low-dose transmission electron microscopy and spectroscopy will be applied to unveil the fundamental structure-property relationship and fill the gap of knowledge for these materials. Such mixed-dimensional nano-heterostructures combining 2D halide perovskites with 0D quantum dots with complementary physical properties and atomically resolved interfaces will significantly enhance the performance, thereby enabling breakthroughs in a broad range of disruptive optoelectronic technologies.							
	National Interest Test Statement							
	Commonly used light detection technologies have applications covering nearly every aspect of our daily lives from consumer electronics, and medical diagnostics, to security surveillance. However, light detection technologies often suffer from limitations of visibility, which can be overcome by using light in the short-wave infrared (SWIR) range. Existing SWIR detectors are very costly to make and poor in performance. This project will generate fundamental knowledge in infrared science and a feasible and cost-effective manufacturing approach by integrating 'nanoparticles' with extremely thin layers of materials to realise significantly improved SWIR technologies. Such products will enable exceptionally high-fidelity detection, with potential application in improved surveillance, disaster monitoring, and medical diagnostics. Through industry partnerships and licensing of IP, outcomes from this research can be adopted by the Australian electronics, biomedical and defence industry with a low-cost, simpler, high-performance, and potentially large-scale route for manufacturing SWIR products.							
DP230101861	**Tandem Photocatalytic Conversion of CO2 to High Value Hydrocarbon Products**	96,079.50	189,162.50	183,083.00	90,000.00	0.00	0.00	558,325.00
Scott, A/Prof Jason A	Converting carbon dioxide (CO2) into hydrocarbon products is ideal for combating anthropogenic emissions whilst reducing our reliance on fossil fuels. Despite the significant advantages, CO2 valorisation is hindered by barriers such as high energy requirements and low-value products (methane and carbon monoxide). This project will establish a sustainable approach to CO2 valorisation using a unique tandem solar-driven hierarchical catalyst array to offset energy requirements and directly yield high-value hydrocarbon products, such as ethane (C2H6) and ethanol (CH3CH2OH), from captured CO2.							

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	National Interest Test Statement Australia's Long-Term Emissions Reduction Plan aims for a 54% reduction in CO2 emissions by 2050. A key strategy to achieve this reduction involves 'capturing' and converting CO2 emissions into useable, synthetic fuel and chemical products. The project expects to develop a novel photocatalytic reactor to drive tandem reverse water gas shift – Fischer Tropsch reaction to high value products such as jet fuel. This project aims to develop new technologies to not only improve the efficiency of this conversion process, but to harness renewable solar energy to power it, thereby further supporting the National Science and Research Priority area of 'Energy and Resources'. The discovery of cost efficient photocatalysts will be pivotal towards cutting carbon emissions by 75% before 2030 and reach net zero carbon emissions by 2050. Existing and new industry partnerships and licensing of IP will enable the new technologies developed as a result of this research to be rapidly scaled up and commercialised. Establishing this technology will support the ongoing drive by Australia to be a leader and innovator in the global pursuit of net zero carbon emissions, increase national energy self-sufficiency and security, and offer new local manufacturing opportunities.							
DP230101990 Green, Prof Melissa J	**Breaking the cycle of intergenerational child maltreatment using 'big data'** This project aims to provide the first comprehensive investigation of inter-generational child maltreatment using over 50 years of linked data for a population cohort of children and their parents in New South Wales. The project will generate new knowledge about the prevalence and characteristics of families in which child maltreatment is initiated, maintained across generations, or in which the trauma cycle is broken, using innovative statistical techniques. Expected outcomes include new knowledge of the true prevalence of inter-generational family trauma that can only be known from combining inter-agency data, and enhanced capacity to identify cross-agency levers in an effort to break the cycle of inter-generational disadvantage.	97,839.00	195,479.50	124,500.50	26,860.00	0.00	0.00	444,679.00
	National Interest Test Statement Australia has a high rate of family violence that is often transmitted across generations, continuing a cycle of disadvantage and trauma for which the impacts are profound. across the life course. This project will provide the first comprehensive evidence of the pattern and extent of inter-generational child maltreatment using over 50 years of Australian population data linked between parents and children, from multiple government agencies beyond child protection services. Most of the current knowledge about the cycle of violence in families comes from small convenience samples, or population data limited to child protection services. New knowledge of the true prevalence of inter-generational family trauma can only be gleaned via multi-agency, inter-generational data, with unique power to inform cross-agency levers that can break the cycle of inter-generational disadvantage. Direct translation of findings to inform policy and practice will be achieved via partner investigators working in the NSW Department of Communities and Justice, and via Aboriginal cultural safety training and resource development.							
DP230102463 Hao, Prof Xiaojing	**Enabling technology unlocking full potential of high bandgap chalcopyrite** This project is aimed at solving the fundamental challenges of high bandgap chalcopyrite light-harvesting material to unlock its full potential as the top cell for photovoltaic tandem cell and the photocathode for photoelectrochemical applications. This will be realised by dynamic optimisation of its performance in photovoltaic solar cell device through understanding of its defects origins, enabling defects controlling technologies, and microscopic carrier loss mechanism analysis via systematic macro-to-micro characterisations combined with 3D device simulation. The project completion will reinforce the next-generation tandem cell and photoelectrochemical technologies with the efficient, stable, RoHS-compliant and thin chalcopyrite devices.	99,738.50	198,071.50	187,388.50	89,055.50	0.00	0.00	574,254.00
	National Interest Test Statement Solar electricity and solar fuels are critical renewable energy sources for ensuring Australia's effective transition to 100% clean energy. This project aims to design novel, 'wide bandgap' light harvesting materials which are critical for the production of efficient, durable and sustainable next-generation solar cells and solar fuel devices. These new materials will overcome current issues with device performance, including durability and energy conversion efficiency. Through our existing industry partnerships and the licensing of project IP, the developed materials and devices will be upscaled enabling widespread use of these novel solar energy devices across the residential, commercial, and solar farm sectors. This new technology will allow Australia to access the trillion-dollar global renewable energy market by 2030, and ensure Australia is at the forefront of renewable energy R&D, commercialisation and transition.							

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DP230102623 Pettigrew, Prof Simone F	**Community Self-determination in the Era of Automated Home Delivery Systems** Urban environments in Australia and internationally are on the cusp of major disruption resulting from impending proliferation of home delivery services using autonomous vehicles in the form of trucks, shuttles, bots, and drones. As witnessed in the case of ride-share services, socio-technical changes can permeate society before effective regulation is introduced unless swift anticipatory action is taken. The aim of this project is to deliver the critical information inputs required to empower and protect communities in a future characterised by the widespread use of automated product deliveries. Outputs will include modelled scenarios and negotiated policy recommendations that reflect meaningful community consultation.	90,000.00	170,000.00	167,500.00	87,500.00	0.00	0.00	515,000.00
	National Interest Test Statement Autonomous vehicles, such as driverless vans, trucks, shuttles, bots, and drones, are emerging as the delivery systems of the future. While these technologies will improve access and connectivity for people with mobility challenges, liveability and wellbeing are likely to be negatively affected through exacerbated road congestion, compromised privacy, and the promotion of unhealthy lifestyle behaviours. It is estimated that around a quarter of e-commerce deliveries will use autonomous vehicles within the next decade, highlighting the urgent need to introduce policies and regulations to safeguard communities. Through extensive consultation, the aim of the project is to understand the needs and expectations of community members and key stakeholders (e.g., representatives from urban planning, transport, law, and commercial sectors) and develop recommendations for appropriate regulatory frameworks. Outcomes will inform and guide urban planning and transport policymakers in their efforts to accommodate the use of autonomous vehicles while preserving community wellbeing.							
DP230102641 Mao, Prof Guangzhao	**Synthesis and Characterisation of Tracer-Functionalised Nanoparticles** This project aims to engineer nanomaterials by utilising gold nanochemistry and neural tracing capabilities of plant-based, nontoxic proteins. In a significant departure from current nanomaterials being developed, functionalising nanoparticles with the tracers enable them to undergo path-specific axonal retrograde transport, transneuronal transport, and anatomical tract flow to bypass the blood-brain barrier. Microfluidics will be used to characterise the neuronal activities of the synthesised nanoconjugates of different sizes and compositions to understand their bio-interactions with axons, synapses, and neuromuscular junctions. The results will lead to a new class of functional nanomaterials as well as cell-based functional assays.	85,000.00	170,000.00	170,000.00	85,000.00	0.00	0.00	510,000.00
	National Interest Test Statement Understanding how molecules are transported to parts of the body such as the brain is crucial for engineering advanced materials to achieve a desired biological outcome. This project will create tiny, ‘smart’ devices capable of transporting molecules to targeted areas of the body. This will address multiple unsolved problems in global therapeutic development by generating new materials with improved solubility, efficacy and ability to penetrate biological barriers, and less side effects. We will create new materials for drug delivery and devices to evaluate the efficacy of these materials in the biological environment. The project aligns with Australia’s national priority in advanced manufacturing and will create cross-cutting technologies to de-risk the adoption of new materials and add value to our manufactured products. Through industry partnerships and licensing of IP, these new materials have potential to lead to industrial adoption for the manufacturing of pharmaceutical products, supporting growth of our manufacturing industry and export of pharmaceutical goods.							

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DP230102655	**Reading the sequence of a single molecule of DNA**	82,000.00	164,000.00	164,000.00	82,000.00	0.00	0.00	492,000.00
Lee, Dr Lawrence	This project seeks to develop technology capable of accurately reading the sequence of a single DNA molecule for the first time. This is possible by combining state-of-the-art methods in DNA self-assembly, single-molecule fluorescence microscopy and bioelectronics, to overcome fundamental limits in current technologies. The outcome of accurate DNA sequencing at single molecule resolution, promises ground-breaking biological insight from a more fine-grained view of the genetic world, game-changing technologies such as point-of-care genomics and in turn a substantial impact on the rapidly growing multi-billion-dollar DNA sequencing market.							
	National Interest Test Statement							
	The DNA sequencing industry has revolutionised the biological sciences with a rapidly growing impact on industries from agriculture to medicine, and an annual turnover projected to reach $22 billion by 2025. However, current technologies cannot accurately determine the sequence of a single DNA molecule - DNA molecules need to be artificially copied many times or samples manipulated in other ways to generate enough material to enable analysis, which serves to introduce time, cost, bias and error. This project will develop a new system, capable of accurately sequencing a single molecule of DNA, thus removing a major source of cost and error and enabling the DNA sequence of all organisms within a sample to be read rapidly and without bias. The resulting technology will have many applications, including accelerated and more detailed diagnostics of agricultural disease and determining conditions in the microenvironment that yield optimal crop quality. Through partnerships and licensing of IP, outcomes have potential to seed new commercial ventures with the Australian biotechnology industry.							
DP230102813	**Accessing Liquid Noble Metals for Low Temperature Chemical Reactions**	103,028.50	205,014.00	201,477.50	99,492.00	0.00	0.00	609,012.00
Kalantar-Zadeh, Prof Kourosh	We will explore noble metals in liquid form at low temperatures. We will show that while noble metals melting points are above 1000°C, a gallium matrix will allow their existence in liquid form at low temperatures (<75°C). A variety of noble metal gallium alloy combinations will be investigated for their catalytic activities which are expected to show very high kinetics. We will study both bulk and low dimensional analogues to understand the atomic dispersion of noble metals on interface and in the core of the alloys, for discoveries regarding the liquid state catalytic properties of the mixes. Subsequently, model chemical reactions will reveal the enhancement of the kinetics and what the project can offer to industrial innovations.							
	National Interest Test Statement							
	Precious metals including gold, palladium and platinum, are the cornerstones of Australian minerals and chemical industries. Their role as catalysts, which make chemical processes faster, is pivotal for agrochemical and plastic industries and for reducing environmental pollution. Precious metals are typically used in solid forms, yet when melted, their performance is substantially enhanced. As these metals only melt at very high temperatures, their practical utilisation in melted form appears impossible. However, our recent discovery shows the possibility to access the marvel of melted precious metals at low temperatures. Here, we explore gallium, a low melting-point metal, as the solvent for precious metals to obtain near room temperature liquid catalysts. The resulting liquid metals can produce high-value chemicals at low energy and therefore, address some of our manufacturing partners' most significant challenges, including the low-cost production of fertilisers and polymers. Outcomes will provide benefit to the chemical, energy, and pharmaceutical industries in Australia and internationally.							
DP230102874	**Pile foundations in unsaturated soils: a mechanistic framework**	84,500.00	157,500.00	150,500.00	77,500.00	0.00	0.00	470,000.00
Khalili, Prof Nasser	This project will develop a mechanistic approach to pile foundation design in variably saturated soils through integrated expertise in the fields of unsaturated soil mechanics, material nonlinearity, numerical modelling, limit analysis and experimental investigation. It will achieve a rigorous understanding of pile behaviour in unsaturated soils subjected to monotonic loading through a comprehensive program of scaled laboratory testing, numerical and theoretical analyses. The models, theories, mechanics and predictive tools arising from this research will have direct and immediate impact on the planning, design, construction and management of many types of infrastructure involving pile foundations in industrial and residential developments.							

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	National Interest Test Statement All construction requires the engineering of foundational supports to ensure the integrity and strength of built structures. The most widely adopted support is long, column-like cylinders of reinforced concrete or steel, called piles. Several factors affect the performance of piles, including soil type and soil moisture. Little is currently known about pile behaviour in unsaturated soils (ie. soils that are not completely water-logged), thereby diminishing confidence in pile design, often necessitating costly over-and under- engineering modifications. This research aims to address that gap by characterising the behaviour of piles in soils with varying moisture, to reflect the shift in landscape from climate change, and developing tools and methodologies for their design. This will guide the work of geotechnical engineers in analysing and constructing reliable piles in real soils which are invariably unsaturated. A conservative increase in pile foundation efficiency (5%) is estimated to save Australian infrastructure owners millions of dollars each year in an industry that is worth approximately $110 billion.							
DP230103102 Cheng, Prof Mandy M	**Judgment and decision making using ESG performance information** Organisations face increasing pressure to deliver value aligned with both financial and environmental, social and governance (ESG) goals. Yet we know very little about the way in which managers within these organisations use financial and nonfinancial ESG performance information to make decisions that support their ESG goals. This project aims to examine how managers use ESG performance information to make internal business decisions, and create new knowledge on how an organisation's performance measurement system influences their decision making processes. Our project outcomes will benefit preparers and users of ESG information within organisations, who by making better ESG-related decisions can create long-term value for all stakeholders.	42,097.00	86,384.00	89,388.50	45,101.50	0.00	0.00	262,971.00
	National Interest Test Statement With sustainability becoming a critical priority for our society, organisations face the challenge of aligning their business strategies and models to meet environmental, social and governance (ESG) goals. This project adopts a judgment and decision making perspective to identify how organisations can support managers in co-creating commercial and societal value. The expected outcomes include evidence-based guidance on how to adopt a sustainability mindset, design decision-facilitating performance reports and enhance performance evaluation processes. By communicating this guidance through business forums, training and education, organisations can improve ESG reporting quality, leading to better informed capital markets. Australian managers can learn to implement new business systems and processes enabling delivery of ESG goals, including more equitable and inclusive workplaces for employees, responsible supplier interactions, enhanced corporate governance for shareholders, and reduced climate change risks for our communities. This project will contribute to building a fairer, sustainable Australian economy.							
DP230103116 Baker, Dr Kathryn D	**Social buffering of fear inhibition in adolescent rats** Adolescence is an important time when individuals learn to manage stress-related emotions like fear. Peers can help, or hinder, individuals to regulate fear. This project aims to understand how, when, and for whom social buffering of fear regulation occurs during adolescence. It uses a behavioural, pharmacological, and neural approach to explore these issues. The project aims to close the gap in understanding of how social companions affect basic learning and memory processes in an understudied population of adolescents. The expected outcomes of this project include a richer knowledge of how peers shape emotional regulation during development, which will ultimately inform social-based approaches for improving emotion regulation in youth.	55,000.00	112,500.00	125,000.00	67,500.00	0.00	0.00	360,000.00
	National Interest Test Statement Adolescence is an important time when individuals learn to manage stress-related emotions like fear. Excessive fear and worry lead to psychological distress, stress within relationships, and impairments in educational and work functioning. Currently, one in three Australian adolescents experience moderate to high psychological distress. While social companions can help manage stress there is a gap in our understanding of how social companions affect basic learning and memory processes involved in emotional regulation. Therefore, this project will determine when, how, and for whom social companions help in the regulation of fear in adolescence. Research outcomes will be disseminated to teachers, parents, and in workplaces to enable the design of novel social-based interventions to promote social connection and emotional resilience in adolescents. Such interventions will have societal and health benefits for the growing number of Australian adolescents experiencing psychological distress and, more broadly, will ease economic burden due to days off school and lost work productivity.							
	The University of New South Wales	2,912,915.50	5,932,180.00	5,746,247.00	2,832,072.50	105,090.00	0.00	17,528,505.00

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The University of Newcastle								
DP230100047	**Infrastructure on reactive soils: fundamental advances and validation**	56,000.00	132,500.00	151,500.00	92,500.00	17,500.00	0.00	450,000.00
Buzzi, Prof Olivier P	This project aims to advance fundamental knowledge on the complex behaviour of reactive soils in the context of resilient geotechnical infrastructure. This research falls within the research priority “Environmental Change”, as geotechnical infrastructure need to sustain the impact of ever more frequent and more intense climatic actions. Attention will focus on the effect of suction on volume change and shear strength of reactive soils, two poorly understood features, and will produce a swelling model and a soil-deformable structure interaction model. After validation by a case study, the models will have the potential to empower industry to produce geotechnical infrastructure that can better sustain climatic actions.							
	National Interest Test Statement							
	This project will aid the design of resilient buildings on expansive soils. These soils cause millions of dollars of damage every year and cover a large portion of Australia. We will address how expansive soils and infrastructure interact to better understand how water movement, due to climatic events, affects soil strength and volume change; the two key elements of resilient infrastructure design. The outcomes will be new models for use by industry in the design of bridge abutments, retaining walls, road pavements or building foundations; knowledge currently not available to industry for the design of structures on expansive soils that can withstand future climatic events. This knowledge and the models will be shared with industry via seminars, publications and user-friendly tools to facilitate translation. This will empower the infrastructure and construction industry to produce resilient and more economical designs, generating clear economic and social benefits to Australian communities. Potential savings for projects like the Torrens to Torrens Project in Adelaide are in the order of $20 million.							
DP230100126	**A novel whole-process analysis method for fractured rock slopes**	89,000.00	183,500.00	177,000.00	82,500.00	0.00	0.00	532,000.00
Wang, Prof Shanyong	Aims: The project aims to develop a discontinuous deformation and displacement analysis method to study the jointed rock slope instability. Significance: The proposed method verified by experimental tests will be inherit the advantages of finite element method and discontinuous deformation analysis and is able to provide an entire and unified description of rock deformation and failure. Expected Outcomes: The results of this integrated study will provide a new method for engineers who wish to characterise and predict the stability of rock/tunnel slopes in Australia and worldwide. Benefits: Australian society will benefit from new tools to facilitate more reliable assessment of risks associated with instability in rock slopes.							
	National Interest Test Statement							
	Locally and globally rock falls and landslides represent major challenges, both in terms of financial cost and potential loss of life. It is evident from the often-unexpected nature of these issues, that current technologies fail to accurately predict rock slope failure events, thus hindering implementation of preventative measures. This project will develop a novel whole-process analysis method combining the advantages of both continuous and discontinuous methods, to accurately predict potential rock slope instability resulting from micro-scale damage to macro-scaled failures in rock slopes. This technique will provide geotechnical and mining engineering firms in Australia with a competitive edge in ensuring the safety of rock slopes locally and nationally. The use of this technology to accurately identify new sites where construction can take place, will open up new development avenues, enhanced environmental protection, and increased construction and manufacturing opportunities. Australian mining and transport infrastructure will benefit from more reliable design of underground openings.							

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DP230100495	**Biosynthetic Hooks for an Enigmatic Marine Toxin**	100,000.00	207,500.00	215,000.00	107,500.00	0.00	0.00	630,000.00
Neilan, Prof Brett A	This project aims to characterise the genetic basis for the production of tetrodotoxin; a potent neurotoxin of ecological and biomedical significance. We hypothesise that tetrodotoxin is produced by microorganisms and transferred via the food web to fish, molluscs and other marine animals. Our integrated genomic and synthetic biology approach, targeting key biosynthesis genes, will reveal pathways for the production of tetrodotoxin and other potentially valuable compounds. In addition to providing unprecedented insight into the ecology and biosynthesis of this enigmatic toxin, the data generated will enable improved management of seafood safety and provide a foundation for the future development of novel neuroactive compounds.							
	National Interest Test Statement							
	Tetrodotoxin is a potent neurotoxin infamously associated with pufferfish and blue-ringed octopuses. It is responsible for death and illness in humans, but also has significant potential as a long-lasting pain killer. However, the genetic basis for tetrodotoxin production remains a mystery. We will use the latest genomic technologies to discover and characterise tetrodotoxin biosynthesis genes in the marine food web. This will enable the development of rapid PCR tests for monitoring food safety and water quality, resulting in reduced cases of poisoning and reduced losses to the seafood industry. Building on our successful collaborative translation pathway (for toxic algae tests), these tests will be manufactured and marketed by an Australian biotechnology company, and used by their global clientele of fisheries and water quality managers. Understanding tetrodotoxin biosynthesis will also provide a foundation for the future development (beyond this project) of chemical probes valuable for understanding pain.							
DP230100542	**Diamane: A New Frontier in Materials Science**	77,405.00	129,810.00	104,810.00	52,405.00	0.00	0.00	364,430.00
Chen, Dr Xianjue	Single-layer diamond (‘diamane’) is a new frontier of material research although its preparation is still in infancy with many structures predicted possible but have not been made experimentally. Built on a new chemical route for 'graphite to diamane' transformation, this project will address a research gap towards synthesising new diamane(-like) nanostructures and developing an in-depth understanding of the chemically induced phase transformation and structure-property correlations, which will have far-reaching impact on scientific fields beyond carbon research. Preliminary data points to both feasibility and impact for discovering new materials and technologies, which will bring foreseeable scholarly, economic, and social benefits.							
	National Interest Test Statement							
	Advances in quantum computing, quantum communication (critical for data security), and semiconductors rely on materials currently in their infancy or yet to be developed. This project directly addresses the design, synthesis and material supply by developing highly specific chemical pathways to create novel quantum property materials, such as atomically thin diamonds. Incorporation of these materials into next generation electronics will produce devices that can perform calculations in seconds, that today’s supercomputers would need decades or millennia. They will enhance data encryption, optimisation of supply chains and weather forecasting. All critical global and Australian issues. This project offers significant manufacturing, technological and economic benefits, new workforce possibilities and technology opportunities to the Australian community. It aligns directly with the National Science and Research Priorities in Advanced Manufacturing for high-performance materials, and will result in Australia becoming a global intellectual driving force in the future use of advanced materials and technologies.							
DP230100637	**A New Nano Tip Fabrication Technique for Atomic Force Microscopy**	95,000.00	195,000.00	185,000.00	85,000.00	0.00	0.00	560,000.00
Yong, A/Prof Yuen K	This project aims to develop a new fabrication technique for high-aspect-ratio (long and sharp) tips for atomic force microscopy. The technique is expected to overcome the current fabrication limitation, that is fabricating one tip at a time which is unsuitable for batch fabrication. The proposed technique can be scaled up to mass produce nano tips. The technique is expected to create new commercial products and intellectual property. This innovation will lead to the emergence of breakthrough technologies in nanofabrication and nanomaterials synthesis. The benefits to Australia include new job opportunities and the development of local expertise in the field.							

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	Atomic force microscopes (AFM) work by moving a “nano fingertip” along a sample surface, touching each atom one-by-one, and jiggling as it moves over the surface like the arm of a record player. This movement is then translated into a surface image of the sample. For semiconductor devices that have steep sidewalls and narrow trenches, a long and sharp tip is required to reach the bottom of these trenches to generate the image more faithfully. Current tip fabrication techniques are time consuming and unsuitable for production in bulk. This project aims to develop a new technique that can be scaled up to mass produce long and sharp tips. The project has a unique collaboration with the Australian National Fabrication Facility (ANFF) who supports the commercialisation activities of ANFF-enabled projects. The global semiconductor market is a high-value industry with a projected growth from $625 billion in 2021 to $1.1 trillion in 2028 at an annual growth rate of 8.6%. The end point of this discovery project is expected to be the demonstration of a new and cost-effective fabrication system to a semiconductor manufacturer and other atomic force microscope users. This proposal will increase Australia's participation in this high-value market and develop local expertise in an emerging technology sector.							
DP230101240	**Ensemble modelling of space-weather drivers**	85,000.00	165,000.00	165,000.00	85,000.00	0.00	0.00	500,000.00
Pontin, A/Prof David I	This project aims to develop methods for forecasting the evolution of magnetic fields on the Sun's surface, and to use the results to drive an ensemble of numerical simulations of the evolution of the magnetic field in the overlying atmosphere. The project expects to create a new framework for forecasting the evolution of solar active regions, applying, for the first time, methods established in Numerical Weather Prediction. The expected outcomes are physics-based prediction of solar atmospheric magnetic field evolution, including explosive eruptions. The results should have significant benefit in improving prediction of extreme space weather events, which pose an increasing threat to our technologically-dependent society.							
	National Interest Test Statement							
	This project will develop methods to computationally model the time evolution of the magnetic field at the surface of the Sun and in the Sun's atmosphere, exploiting methods currently used in numerical weather prediction. The expected outcomes are an ability to predict when the magnetic field will erupt into interplanetary space, and the prediction of key parameters of the eruption. We currently lack the ability to forecast solar eruptions, which is an important gap in capabilities because these events drive space weather storms at the Earth – threatening critical communications and power infrastructure and presenting hazards for manned space flight. The research is fundamental, but with later developments (beyond this project) could provide a basis for improved operational methods for space weather forecasting by the Bureau of Meteorology's Space Weather Services. Australia’s rapidly expanding space industry will directly benefit from this improved forecasting, and the researchers that are trained during the project.							
DP230101868	**A Holocene history of rainfall extremes for the South Pacific**	99,900.00	203,152.00	119,552.00	16,300.00	0.00	0.00	438,904.00
Verdon-Kidd, Dr Danielle C	The project aims to generate the longest ever record of rainfall extremes in the Southern Hemisphere (11,700 years) that will be used to update probabilistic recurrence intervals and inform future risks in a warming world. We will apply a palaeoclimate approach to the science of extreme events by using proxy data from stalagmites to investigate natural rainfall variability during the Holocene. Combined with state of the art Global Climate Model simulations for three major climate events of the Holocene, we will identify mechanisms of long term shifts in heavy rainfall events. The project will provide significant benefits for Australia and the Pacific islands in terms of prediction and preparedness for deluges like we experienced in 2022.							
	National Interest Test Statement							
	The devastating Lismore floods in February 2022 were a stark reminder of the economic and social costs of extreme rainfall events. In order to adapt, we need to know how common and severe these events are, and how they will evolve in the future with Climate Change. This project will extend the short instrumental rainfall records in Australia and the South Pacific by thousands of years using the climate history recorded in the layers of cave stalagmites. The data will be used to calibrate Global Climate Models to assess how extreme rainfall may change in size and frequency, providing the information decision-makers need to prioritise planning for regions most at risk. These new insights will assist our communities to develop future-proofed resilient cities and towns to reduce economic loss and improve the quality of life in a changing climate. To facilitate uptake, we will make the analysis-ready data publicly available and work closely with stakeholders in government and industry to translate this knowledge into impactful outcomes, including updated floodplain risk management plans and policies.							

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DP230102294	**Anisotropic behaviour of natural soft soils**	38,820.00	63,255.00	108,778.50	160,872.00	76,528.50	0.00	448,254.00
Pineda, Dr Jubert A	This project aims to improve current engineering analysis methods, which often fail to predict the performance of infrastructure built on natural soft soils. This project expects to develop a theoretical and mathematical framework to describe the response of soft soils to complex loading patterns imposed by transport and energy infrastructure. This will be informed by advanced laboratory experiments that transcend the capabilities of routine testing methods. The expected outcome of the project is a series of tools for the engineering analysis of earthworks and foundations built on soft soils that will underpin the construction of civil infrastructure on ground often too poor to be considered for other use.							
	National Interest Test Statement							
	Transport corridors and energy infrastructure are often built on floodplains and soft ground since this land is of low value. However, the initial expense is often overshadowed by higher-than-budgeted construction and maintenance costs and longer-than-predicted timelines. Reliable engineering methods for predicting how soft ground deforms during and after construction are required. This project will unravel the science underpinning the deformation of such soils and develop computer-based methods for predicting the performance of earthworks and the structures built on them. The outcomes will be converted into practice for engineers in charge of the design of road, rail and energy infrastructure and are expected to facilitate better design and construction methods. Reduced construction uncertainties and lower costs of future civil infrastructure projects built on soft ground will be achieved as a result of this project.							
DP230102963	**Australian clays as raw materials of slow-release phosphate fertiliser**	48,175.00	93,420.00	85,865.00	40,620.00	0.00	0.00	268,080.00
Naidu, Prof Ravendra (Ravi)	Phosphorus (P) fertiliser input in Australia is a significant problem for its inefficient plant uptake, leaching to natural water bodies and stocking of insoluble P in soil. The project aims to develop activated clays using Australian raw clay minerals to formulate effective slow-release phosphate (P) fertilisers (SRF) and delivery material for P-solubilising bacteria. Composite of these will supply P controllably even amid environmental fluctuations but when a plant needs as it grows. Development of multifunctional, nontoxic and plant growth-driven P fertiliser would benefit improve soil fertility in a sustainable way where efficiency of P input is maximised with a minimised environmental burden.							
	National Interest Test Statement							
	While Australia is the largest phosphate fertiliser user in the world, current products are inefficient. Only up to 20% of any fertiliser is absorbed by plant roots; most ends up in our waterways, causing algal blooms in rivers and bleaching of coral reefs. Additionally, the world is facing dwindling phosphate reserves. Our project will develop a slow-release fertiliser that prevents the loss of phosphate into soil and makes use of soil bacteria that naturally regenerate phosphorus for crops. This new fertiliser is produced using clay mineral, an abundant Australian resource. Economic and commercial benefits include reduced farming costs, as less phosphate is needed to achieve similar crop yields, and stronger export markets for a new fertiliser that will be of international interest. Environmental benefits include less pollution in lakes, rivers and coastal environments. Technology transfer will be straightforward given our collective national experience in agriculture. Adoption of the product will be fostered by the farming sector, as well as mineral and resources industries.							
DP230102986	**Towards 2050 - managing recovery of Australia's coral reefs**	109,740.50	235,708.50	220,563.00	94,595.00	0.00	0.00	660,607.00
Leggat, A/Prof William P	The coral reefs of Australia contribute over $6 bn each year to the economy. However, the reefs of Australia, in addition to those worldwide, are threatened by coral bleaching driven by anthropogenic climate change. If we are to preserve the economic, social and ecosystem value of these environments, it is essential that we are able to better manage the recovery of reefs from bleaching events. This project will utilise a variety of multi-disciplinary approaches, ranging from future climate models, historical satellite data to in-field experimentation to fill fundamental knowledge gaps in our understanding of coral bleaching recovery and delivery a variety of management and stakeholder relevant outputs.							

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	National Interest Test Statement							
	The Great Barrier Reef and reefs worldwide are threatened by coral bleaching driven by human derived climate change. Bleaching events are increasing in severity and frequency and, if we are to preserve the economic ($6.1 billion per annum), social and ecosystem value of these environments for Australia, we must understand the factors that impact bleaching events and, more importantly, reef recovery. This project will provide information on how historical temperatures and bleaching severity impact reef recovery. With increasing ocean temperatures predicted for at least the next 30 years, this information is essential to support the future management of reef systems. Results from this project will be incorporated into bleaching predictions, such as those at the Bureau of Meteorology and the U.S government Coral Reef Watch, and will provide coral reef managers in Australia and internationally with improved predictions of bleaching recovery in real time to inform management decision-making to mitigate long term impacts.							
	The University of Newcastle	799,040.50	1,608,845.50	1,533,068.50	817,292.00	94,028.50	0.00	4,852,275.00
The University of Sydney								
DP230100019	**A novel platform-technology for long-term subcutaneous neurophysiology**	50,370.00	118,780.00	135,705.00	67,295.00	0.00	0.00	372,150.00
Kavehei, Dr Omid	This project aims to develop a novel miniature device for subcutaneous and tetherless brain sensing. It addresses the lack of a device solution for brain-sensing that combines ultra-long-term reliable sensing capability and small dimensions for minimally-invasive procedures. We achieve this through our novel electrode architecture that significantly enhances the quality and reliability of recorded brain signals. We introduce a platform technology designed for subscalp anatomy with future use in various brain-machine interfacing applications relying on reliable, long-term and easy-to-implant systems. This project's device manufacturing, training, and intellectual property are expected to strengthen Australia's position in bioelectronics.							
	National Interest Test Statement							
	Our project aims to develop a new generation of small, wireless, under-the-skin implant technology for long-term brain sensing to assist a range of difficult-to-diagnose and progressive neurological conditions, such as epilepsy, multiple sclerosis, and fluctuating traumatic brain injury biomarkers. With the current technology, brain recording devices are limited to two options: (i) wearables for short-term monitoring or (ii) implants requiring extensive surgery. A novel electrode configuration will be used in this project to improve the quality and reliability of brain signals recorded, enabling realisation of a compact, reliable sensing system that can be implanted via a small incision. This sensing system will allow objective out-of-hospital evaluation of brain function. The commercial development of this unique technology platform through Australian medical device manufacturers will benefit the national economy and improve the quality of care for Australians suffering from a range of neurological and neurophysiological disorders.							
DP230100183	**Metallic materials with combined chemical and structural heterogeneities**	55,185.00	135,575.00	165,075.00	84,685.00	0.00	0.00	440,520.00
Liao, Prof Xiaozhou	This project aims to explore how combined spatial gradients in composition and microstructure affect the mechanical properties of metallic materials. Manipulation of composition and microstructure has been widely used to strengthen materials but this often deteriorates the ductility. The trade-off could be overcome through the introduction of gradient structures because the variations in both composition and microstructure would trigger simultaneous activation of multiple deformation mechanisms. This project is expected to provide guidance in the design of gradient metallic structures with optimum mechanical properties, which will significantly benefit Australian metallurgical and related industries.							
	National Interest Test Statement							
	Strength and ductility are two of the most important mechanical properties of materials for lightweight, energy efficient structural applications such as transportation vehicles and aerospace structures. However, the strength and ductility often trade off with each other. This project explores the possibility of breaking this trade-off to achieve the best strength–ductility combinations through double gradients in chemical composition and microstructure and seeks to understand the mechanisms underlying these effects. The outcomes of this project will guide the future design of ultra-strong and tough metallic materials that will enhance the competitiveness of Australia’s metal industry. Commercial development of this new knowledge could result in the manufacture of cars that weigh less and are more energy efficient, making road travel more cost effective for Australians and less damaging to our environment and significantly increasing the distance lightweight electric vehicles can travel on a single charge.							

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DP230100186	**Site-specific protein functionalisation at diselenides via photocatalysis**	63,500.00	165,000.00	205,000.00	103,500.00	0.00	0.00	537,000.00
Payne, Prof Richard J	This project aims to develop a new photocatalytic reaction for the on demand functionalisation of proteins. The synthetic methodology will solve a major technological gap in the field by enabling efficient access to proteins with defined modifications at specific locations. Functionalised proteins generated in the project will underpin a detailed understanding of how specific modifications influence the structure and function of several important proteins. The project will generate significant new knowledge in the fields of chemistry and biology and will foster interdisciplinary collaboration, nationally and internationally. The breakthrough technology also has the potential to benefit Australia's biotechnology sector.							
	National Interest Test Statement							
	This project will reveal how the properties of protein molecules can be improved by the introduction of precise chemical changes. An entirely new method – which harnesses light to introduce tailor-made modifications aimed at improving biological activity and/or long-term stability of protein molecules – will be developed to achieve this aim. During the project this new technology will be used to tune the activity and stability of a family of immune proteins called cytokines, making them more suitable for future application as antivirals. It will also be used to make new molecules as antivirals against SARS-CoV-2 (the cause of COVID-19) by chemically fusing two proteins together. This research will benefit Australia by providing an efficient and cost-effective method with the potential to transform the way high value bioactive proteins are made by local biotechnology and pharmaceutical industries. The project will also train the next generation of interdisciplinary scientists, thereby ensuring that critical new capacity and know-how is embedded within the Australian workforce.							
DP230100188	**Finding friendship in early English literature**	54,293.50	100,203.00	70,250.50	24,341.00	0.00	0.00	249,088.00
Anlezark, Prof Daniel C	This project aims to provide extensive new knowledge about the long story of friendship by reconceptualizing the ways in which this bond was lived and imagined in early medieval literature. The project expects to make an innovative contribution to our understanding of this fundamental human relationship through a case study of early English texts. Expected outcomes of this project include an unprecedented comprehensive study of friendship in an early medieval society through its writing, and with this develop a model for the engaged humanities. The project offers significant benefit for a range of academic disciplines, and also includes important benefit beyond the academy through engagement with a critical issue in contemporary society.							
	National Interest Test Statement							
	While friendship is a fundamental human relationship, we do not fully understand how this concept has evolved over time to form the foundation of all societies today. Taking an approach that combines historical and literary analysis, we will use early English medieval texts to uncover how the concept of 'friendship' developed in an important period of religious, cultural and geopolitical transformation. We will trace the patterns of friendship described in texts of the period to understand how factors such as social structures, gender, race and the law shaped them. In revealing how early medieval friendships could form and break down, resolve conflict or incite violence, we will improve Australians' understanding of how friendship, as a concept, can be used to create groups that engage in positive or harmful activities and how ideas about past societies impact relationships in the present. Findings will be shared with community leaders and policymakers and may be used in developing social interventions to curb extremist cultures in Australia and encourage positive alliances that unite diverse communities.							

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DP230100372	**The Social Life of Death**	80,500.00	170,500.00	227,000.00	137,000.00	0.00	0.00	615,000.00
Broom, Prof Alexander F	This project aims to investigate experiences of death, dying and bereavement amidst rapid social, economic and political transformation. In the wake of COVID19, and as Australia's anticipated 'death boom' approaches, how to foster good deaths has never been more uncertain, nor more urgent. Drawing on innovative methods and socio-cultural theory, and working in partnership with families and communities, this project aims to generate new knowledge to better inform and improve policy and spark cultural renewal around the end of life. Expected outcomes include setting the international benchmark for novel scholarly understandings of death, dying and bereavement, and centring community voices in addressing contemporary challenges to dying well.							
	National Interest Test Statement							
	The COVID19 pandemic has highlighted death, dying and bereavement as social processes that are profoundly shaped by a social, cultural, economic and geopolitical forces. Yet, little attention has been paid to how experiences of the end of life are changing as a result of the broader social transformations of the early 21st Century. Mobilising diverse person-, family- and community centred perspectives, this project will create a novel evidence base of evolving experiences of death, dying and bereavement in Australia at time of rapid and escalating social change. This will inform policy guidance across the ageing, health and social care sectors, and respond directly to the recommendations of recent national and international Commissions. Through innovative public-facing exhibits elevating the public profile of death, dying and bereavement, this project will yield considerable social and cultural benefits by: advancing more open conversations about the end of life; informing evidence-based reform of end-of-life policy and practice, and; enhancing the quality and value of death in Australia today.							
DP230100485	**Unpacking the immune system with applied mathematics**	67,000.00	137,500.00	144,500.00	74,000.00	0.00	0.00	423,000.00
Kim, Prof Peter S	This project aims to model immune interactions across cells and structures spanning scales of nanometres to millimetres. It expects to develop innovative mathematical insights, improve our understanding of immunology, and consolidate collaborations with top American and European laboratories and groups. Expected outcomes include cutting-edge techniques for multiscale biological modelling and improved prediction and analysis of immune dynamics. The project should provide benefits to industries where highly organised behaviours are important, for example those interested in robot swarming, optimal transportation, and epidemic management. It should also benefit Australian students and researchers with novel overseas training opportunities.							
	National Interest Test Statement							
	A functioning immune system is crucial to our well-being, but we still poorly understand how it works. This is partly because it consists of many cells and is incredibly complex: experimental immunology provides observations, but comprehending the big picture is challenging. Using applied mathematics, this project connects diverse data to reveal how cell interactions produce an effective immune response. This mathematical modelling will provide tools to help understand the immune system, particularly cell cooperation, and other complex phenomena with similarly organised behaviour, such as community interactions, traffic flow and the internet. Expected outcomes include cutting-edge techniques for biological modelling and improved prediction and analysis of immune dynamics. The mathematical tools and insights developed during this research can potentially be applied by governments and industries in Australia to improve immune therapies, manage epidemics and optimise transportation. This project will also train early-career researchers in skills that are increasingly needed in Australian industry.							

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DP230100555	**Gas-enriched slippery surfaces**	75,840.50	148,272.00	140,313.00	67,881.50	0.00	0.00	432,307.00
Neto, Prof Chiara	This project will exploit novel experimental and simulations approaches to investigate gas enrichment at liquid-liquid interfaces, and its effect on interfacial slip. The outcomes of the project will be a deeper understanding of oil-water interfaces capturing the presence of interfacial gas layers, slippery surfaces with superior drag reducing and fouling reducing properties, and control over nanobubble formation under flow. The new surfaces will have potential application in improving the energy efficiency of microfluidic and multiphase flow. Benefits are expected in terms of reduced emissions, fuel cost and pollution related to transport of goods by sea, and extraction of oil from rocks.							
	National Interest Test Statement							
	Building on a recent breakthrough study at the University of Sydney, this project will deliver an innovative platform for creating gas-enriched slippery surfaces with superior drag-reducing properties. At the same time the research will provide more correct descriptions of how increasing the concentration of dissolved atmospheric gas affects the stability and flow of emulsions of oil droplets in water. The new knowledge on slippery surface coatings will benefit Australia economically, environmentally and commercially, as it will lead to a reduction in fuel consumption, emissions, pollution, and the spread of invasive species associated with the transport of goods by ship and extraction of oil from rocks. Practical outcomes might include collaborating with industry partners to demonstrate the effect that surface nanobubbles have on the efficiency of oil recovery from rocks. Through collaboration with coatings microfabrication industry, new non-toxic structured coatings could be produced on a large scale to reduce drag and fouling on ship hulls and on immersed infrastructure.							
DP230100558	**Rare earth-free high-performance magnets**	103,895.50	199,561.00	120,850.50	25,185.00	0.00	0.00	449,492.00
Ling, Prof Chris D	This project aims to discover new magnetic materials that are competitive for advanced technology applications, free of the rare earth metals that currently dominate the high-performance end of the market. Global demand for non-renewable rare earth metals is rapidly approaching a critical point and alternatives are needed. The project will use data-mining algorithms augmented by quantum calculations to find the most promising candidates among tens of thousands of reported but untested materials, so that synthesis and characterisation resources can be directed to the right places. After iterative cycling to optimise the chemical composition and structure, the best materials will be prepared for fabrication into technologically useful forms.							
	National Interest Test Statement							
	High-performance magnets are critical components for energy, transport, computing, telecommunications, healthcare and other advanced technologies. This project is about making new high-performance magnets from common elements such as iron, which can replace those made of expensive and unsustainable "rare earth" elements. The outcomes will be reduced environmental impact from mining rare earth elements in Australia, reduced reliance on supply from overseas, improved safety, and cost savings across the US$21B annual market for magnetic materials. In particular, they will enhance the economic, environmental and commercial benefits of green technologies such as electric vehicles and wind turbines, which currently rely on rare earth magnets. The pathway to adoption will thus be to align the interests of established mining and materials companies with those of the emerging renewable energy companies, towards the common goal of making Australia a world leader in sustainable industrial growth.							
DP230100654	**Braid groups via representation theory and machine learning**	76,000.00	153,500.00	115,000.00	37,500.00	0.00	0.00	382,000.00
Yacobi, A/Prof Oded	This project aims to address questions about the representation theory of braid groups with important consequences in low-dimensional topology. This project expects to make significant progress on central open problems surrounding knot invariants, and create new tools that will have wide applicability in representation theory. It will pioneer the use of highly innovative methods from category theory and machine learning recently developed by the investigators. Potential benefits of this project include: the resolution of important long-standing conjectures about braid groups, the development of emerging technology with significant implications for representation theory, and the training of Australian scientists in a vital area of research.							

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	National Interest Test Statement							
	The braid group is a bridge between algebra and geometry, and it has important applications in many areas, including fluid dynamics, quantum computing, and particle physics. It is also the subject of unsolved decades-old problems, which have profound implications for the uses of the braid group in science and engineering. Our project aims to make decisive progress on these problems using tools developed by our team. This includes pioneering applications of machine learning to mathematics which are critical to a range of industries in Australia, specifically computer science and defence. These discoveries can resolve fundamental challenges remaining in the application of the braid group in the sciences. Our techniques can also lead to new mathematical problem-solving programs, which will have many potential applications including the design of more secure cryptosystems. Through our existing collaborations in industry, the code we develop will be applied by engineers working on cutting-edge problems in the far-reaching uses of machine learning in science and technology.							
DP230100749 Shen, Prof Luming	**Energy dissipation characterisation in dynamic brittle fracture** Energy dissipation in dynamic fracture of brittle materials is pivotal in mining, civil engineering and defence. The project aims to develop a novel experimentally-validated multiscale theory, with associated models, for characterising and predicting the complete dynamic fracture process of brittle materials. This theory is expected to generate close-to-reality simulations critical for understanding fundamental aspects of energy dissipation in dynamic fracture. The outcomes will enable an optimised control of the fragment size in block cave mining and mineral processing, forecast and prevent fatal rock bursts in underground mines, and minimise catastrophic failures in critical infrastructures challenged by extreme loading, e.g. explosions.	68,453.00	138,858.50	145,457.00	75,051.50	0.00	0.00	427,820.00
	National Interest Test Statement							
	Earthquakes, drilling, blasting and impact in brittle materials such as rocks, concrete and ceramics can lead to fracturing and breaks. This can cause catastrophic damage, such as in underground mines where rock bursts can lead to fatal accidents, operation malfunction and infrastructure damage. The underlying phenomenon can also be harvested for practical applications. E.g., controlled rock breaking processes are desired in block cave mining and mineral comminution for higher productivity and efficiency. To tackle such problems, this project will develop a complete framework that will enable us to better understand, characterise, predict and control the complex process of how energy dissipates and leads to sudden brittle breaks. The outcomes will help to minimise severe consequences associated with rock bursts and to optimise energy use in fragmentation technologies in comminution and block cave mining. This should lead to significant economic and environmental benefits since the mining sector is a pillar of the Australian economy, employing over 140,000 people and contributing to over 9% of GDP.							
DP230100962 Neilson, A/Prof Jeffrey M	**High-value horticulture and global production networks in coastal Australia** High-value horticulture is booming in Australia's north-eastern coastal strip, where a multifunctional landscape also provides various recreational, cultural and environmental services. This project aims analyses how incorporation within agricultural global production networks interacts with diverse drivers of landscape change to shape regional development outcomes. This will contribute to global production network theory by developing the territorial nexus of these networks. Expected outcomes include improved policy formulations capable of orchestrating a sustainable and equitable future for rural regions and livelihoods within Australia, with broader contributions to understanding rural development pathways elsewhere in the world.	81,440.50	183,594.00	199,195.50	97,042.00	0.00	0.00	561,272.00
	National Interest Test Statement							
	This project investigates how the expanding global demand for food is re-shaping development trajectories in regional Australia. It examines how the horticultural sector, whose export value tripled between 2010 and 2019, puts new pressures on co-existing demands for housing, recreation and conservation in our north-eastern coastal strip. The implications of the intensified use of farmland on governing rural resources and their social effects on regional communities are not yet understood. We will bring a new perspective to this challenge by identifying how global and local influences intersect to shape regional governance outcomes. This will ensure longer term benefits for livelihoods and environmental wellbeing in regional Australia by identifying policy options, such as zoning amendments, payments for ecosystem services and seasonal worker programs, to successfully manage competing resource demands. We will work with industry leaders and government agencies in regional Australia, through workshops and report-sharing, towards ensuring that export-oriented horticulture develops sustainably and equitably.							

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DP230101014	**Robust Data-Driven Control for Safety-Critical Systems**	70,000.00	142,000.00	145,000.00	73,000.00	0.00	0.00	430,000.00
Manchester, Prof Ian R	This project aims to develop new approaches to controlling robotic and cyber-physical systems in safety-critical applications. This project expects to generate new knowledge in how to harness the power of machine learning for robot control, while guaranteeing safety and stability at all times. The outcomes of this project will be new algorithms and a deeper understanding of the interplay of data, learning, and models, as well as experimental validation on a surgical robot and a bipedal walking robot. This project will provide significant benefits by dramatically increasing the range of applications in which the power of machine learning can be safely applied to advance the capabilities and uptake of robotics.							
	National Interest Test Statement							
	This project will develop new learning algorithms for the control of physical systems such as robots and autonomous vehicles. In particular, it will develop algorithms that can learn from experience while guaranteeing safe operation. The outcomes of this project will be new knowledge and new design methodologies, as well as software tools and experimental validation on real-world robotic systems. The gap being addressed is that current machine learning methods are not suitable for safety-critical applications such as surgical robotics since they can behave unpredictably. This will benefit Australia by creating the key technologies and training the young researchers and engineers to make Australia a global powerhouse in a burgeoning high-tech industry. This has potential to lead to new spin-off companies, highly-skilled jobs, and translational research opportunities with industry partners.							
DP230101045	**Remodelling encapsulin nanocages to help enhance plant carbon fixation**	116,256.00	229,807.00	229,602.00	116,051.00	0.00	0.00	691,716.00
Lau, Dr Yu Heng	Nature has evolved mechanisms in microbial systems to improve photosynthetic efficiency by saturating the enzyme Rubisco with carbon dioxide. These carbon concentrating mechanisms are genetically complex, precluding successful introduction into crops. Our simpler approach is to use encapsulins, a new source of robust bacterial pore-containing nanocages made from a single gene. This project will optimise the development of synthetic encapsulin-Rubisco carbon-fixing nanoreactors and transform them into leaf chloroplasts to test their impact on plant photosynthesis and growth. Our genetically simpler solution will aid ongoing global efforts to deliver overdue step change improvements in agricultural productivity.							
	National Interest Test Statement							
	There is an ever-increasing demand to improve the productivity of Australia's crops. Ongoing population growth combined with the climate-driven loss of suitable farming land mean that we need new agricultural biotechnologies to generate crops which can produce more food with less resources. This project will develop a new protein-based technology to overcome a major unsolved bottleneck in agricultural productivity – the inefficiency of plants in taking up and using carbon from the atmosphere for growth. By boosting crops' ability to use carbon, this research should lead to higher yields and reduced use of water and fertiliser. This research should benefit Australia by developing home-grown technologies to keep our growing population fed, while staying economically viable in an internationally competitive agricultural market. These benefits will ultimately be realised through working with industry partners involved in the Australian Research Council Centres for Future Crops Development and Excellence in Synthetic Biology to adopt the biotechnology in new canola and potato strains.							
DP230101054	**Wealth Inequality in Australia: Sources and Solutions**	36,000.00	111,000.00	175,000.00	195,500.00	95,500.00	0.00	613,000.00
Adkins, Prof Lisa	The project aims to investigate the causes and consequences of asset price inflation and increasing inequalities in asset-based wealth in Australia. It expects to generate significant new knowledge about the evolution of asset-based inequality and about how the increasing concentration of asset-ownership is shaping the life opportunities of young people. Expected outcomes include the identification of policy options available to mitigate the negative impact of asset inflation and growing wealth inequality. This should provide significant benefits for governments and policy makers at a time when asset price inflation and the cost of housing represent critical policy challenges.							

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	National Interest Test Statement							
	Over the last four decades, asset-based wealth inequalities have been growing in Australia – driven above all by the growth of property values. This project analyses the causes and consequences of these inequalities, examines how they are shaping life opportunities for young Australians, and explores potential policy responses. Expected outcomes include a nuanced understanding of the drivers of asset-based wealth inequalities, detailed knowledge of how those inequalities are shaping the life opportunities of young people, and the identification of a set of pathways that can lead to policy change. House price inflation has become a critical policy challenge in Australia and there are multiple stakeholders who will benefit from this research. These include policy makers working in the areas of housing, urban planning and taxation as well as financial policy makers who increasingly need to work at the intersection of economic and social policy. A cross section of these stakeholders will participate in the project by collaborating in the design of pathways for policy change.							
DP230101113 Postnova, Dr Svetlana	**Biophysics of the brain's waste disposal system: Understanding why we sleep** This project aims to develop a new biophysical model of the brain, founded on the recently discovered glymphatic system responsible for waste disposal during sleep. It sets out to formulate, analyse, and validate rigorous new multiscale quantitative modelling – to advance the study of sleep and brain clearance dynamics, at timescales from hours to decades. Among expected outcomes are powerful models ready for application at both population and individual level, and testable predictions concerning the sleep patterns that lead to aggregation of waste in the brain and eventual cognitive decline. Project outcomes should also benefit society and the economy though translation into interventions for sleep disturbance – in future applied research.	70,590.50	143,321.00	121,909.50	49,179.00	0.00	0.00	385,000.00
	National Interest Test Statement							
	Sleep is essential for clearing the brain from toxic proteins that accumulate during wakefulness. Inadequate sleep leads to fatigue and accidents in the short term, and to acceleration of cognitive decline over lifespan. These effects are related to dysfunction of brain clearance during sleep but the mechanisms are not well understood. This project will use biophysical modelling to understand the links between brain clearance, sleep, and cognitive function, and their change over adult lifespan. Nearly 30% of Australians report inadequate sleep, which contributes to sub-optimal productivity, illness, and early retirement. The estimated cost of sleep disturbances in Australia is $26bn p.a. In the longer term the model in this project may contribute to reducing these costs by enabling interventions for extending healthy lifespan and delaying cognitive decline. Translation of the model (beyond this project) is envisaged via digital tools for prediction of future cognitive states, and applied research in sleep, ageing, and cognitive science.							
DP230101206 Hyslop, Dr Gwendolyn	**Pseudo grains and adaptiveness in the Eastern Himalayas** Providing enough food for a growing planet and changing is one of the key challenges humanity must face in coming decades. Our research aims to contribute solutions to this problem by researching the domestication history and spread of two crops that are important to the eastern Himalayas: buckwheat and job's tears. We will use ethnolinguistic methodologies to document the current uses of these crops, and then incorporate archaeological, and genetic methodologies to determine whether or not the eastern Himalayas have been centres of domestication for these crops. The outcomes will include ethnolinguistic documentation, timing of domestication, and training in the relevant indigenous communities.	76,898.00	134,486.00	113,040.00	55,452.00	0.00	0.00	379,876.00
	National Interest Test Statement							
	This project will research the domestication and spread of buckwheat (both tartary and esculentum) and job's tears (Coix lacyrma-jobi), two crops important for the livelihood of communities in the Himalayas, using ethnolinguistic, archaeobotanical, and genetic methodologies. Southwestern China has been established as a centre of domestication for sweet buckwheat (Fagopyrum Esculentum), yet the time and place of bitter buckwheat (Fagopyrum tataricum) domestication remains unknown. Even less is known about job's tears. Both crops are important pseudograins for people in the eastern Himalayas and, based on distribution and use of the crops in the area, we expect their domestication to have occurred in this region. Providing enough food for a growing global population that needs to adapt to climate change is one of Australia's most pressing concerns. The outcomes of our research will contribute directly to this endeavour by showcasing the history and spread of buckwheat and job's tears, two crops that are potentially ideally adapted to grow in Australia's climate and sustain its population in the coming years.							

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DP230101228 An, Dr Xianghai	**Making Strong Alloys Ductile and Hydrogen-Tolerant via Tuning Nanogradients** This project aims to develop a novel design concept of gradient segregation engineering (GSE) to produce high-performance alloys. The innovative GSE will synergistically introduce a chemical gradient via grain boundary segregation and a physical gradient by microstructure control to simultaneously achieve an excellent strength-ductility combination and exceptional resistance to hydrogen embrittlement. This project expects to create new fundamental knowledge and provide critical perspectives for future mechanistic alloy design. The results will enhance Australia’s capacity to develop next-generation advanced alloys to underpin current and emerging industrial applications and strengthen the country’s leading position in materials engineering.	85,000.00	172,500.00	180,000.00	92,500.00	0.00	0.00	530,000.00
	National Interest Test Statement This project will develop a novel design strategy to produce high-performance alloys that are strong, ductile, and hydrogen tolerant. These material characteristics cannot currently be acquired simultaneously but are pivotal to meeting the more pressing property demands for engineering applications, especially for the evolving hydrogen-based industries. This research will generate radically new knowledge and create a step-change in guiding modern alloy design for technological advancements. This project will contribute eminently to the Australian world-leading industries of aerospace, advanced manufacturing, and mining sectors, bringing substantial economic benefits to Australia. It will also greatly enhance the potential of the perspective hydrogen economy through lower emissions in the transportation sector and lower-cost methods for producing and storing energy to address current environmental and energy challenges. Besides, this project will promote Australia’s competitive capacities in materials engineering and contribute strongly to both the present needs and future directions of Australian research.							
DP230101357 Cabrera, A/Prof Densil A	**Using acoustic retroreflection in architecture to improve rooms for speech** This project aims to discover how a novel form of acoustic treatment can improve acoustics for speech in rooms such as classrooms and open-plan offices. The project will generate new knowledge on the theory, design, and effects of acoustically retroreflective surfaces in room acoustics. Expected outcomes include solutions for effective acoustic retroreflectors, knowledge on how retroreflection influences people’s voice regulation and sound quality perception, and guidelines and simulation tools for integrating retroreflective treatments to improve speaking comfort. This should provide significant benefits including opportunities to resolve seemingly intractable design dilemmas in the acoustics of education and workplace environments.	50,000.00	137,500.00	167,500.00	80,000.00	0.00	0.00	435,000.00
	National Interest Test Statement This project is about architectural acoustic surface treatments that reflect sound back to where it came from (retroreflective surfaces). Such treatment makes rooms more comfortable to speak in, with potential broader improvements to acoustic quality. Retroreflective surfaces are almost never used in architectural acoustics because they are poorly understood, with very little prior research investigating acoustic retroreflection on an architectural scale and no commercial products available. The project addresses this research gap, aiming to develop surface design methods, room treatment methods, and validated design benefits for the use of retroreflective treatments in rooms with seemingly contradictory requirements - classrooms and open-plan work environments. Research outcomes can be used in improved room acoustic conditions for teachers and students in classrooms; along with quieter open-plan offices with reduced speech distraction. Australia's significant architectural surface industry could deploy research outcomes commercially; Australia's schools and workplaces stand to benefit.							

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DP230101694	**Degradation of atomically dispersed M-N-C carbon catalysts in acidic media**	95,000.00	190,000.00	187,500.00	92,500.00	0.00	0.00	565,000.00
Chen, Prof Yuan	This project aims to provide a clear understanding of the degradation mechanisms of transition metal (M) and nitrogen (N) co-doped carbon (M-N-C) catalysts in acidic media by utilising new model catalysts, standardised degradation tests, comprehensive catalyst characterisation, and machine learning tools to interrogate mechanistic hypotheses and link degradation mechanisms to specific catalyst characteristics. This project expects to generate new knowledge on rationally designing robust hydrogen fuel cell catalysts. This will provide significant benefits, such as new knowledge on catalyst degradation, new catalysts for energy conversion applications, and collaborations with the industry to accelerate Australia's shift to renewable energy.							
	National Interest Test Statement							
	"Green" hydrogen generated by renewable energy resources can be used as a clean fuel for fuel cells to power electric vehicles and serve as stationary or portable power supplies. The key barrier to practical application of this technology is cost. Over 40% of the total cost of current fuel cells comes from expensive precious metal catalysts used to speed up chemical reactions. While carbon catalysts present a much cheaper alternative, their durability is poor. This project will address this problem by providing a thorough understanding of carbon catalyst performance loss to pave the way for developing stable and efficient catalysts. The new knowledge generated will minimise the translation time to create and implement new catalysts technology in fuel cells. The outcomes of this research will assist in creating new commercial opportunities in the energy sector to meet emerging demands and bring significant environmental benefits by accelerating Australia's shift to renewable energy. Collaboration with Japanese partners will also expand Australia's material, catalyst, and electrochemistry research capacity.							
DP230102070	**Ultra-sensitive 3D molecular assays using total body PET and deep learning**	84,000.00	171,500.00	200,000.00	112,500.00	0.00	0.00	568,000.00
Meikle, Prof Steven R	Recent advances in biomedical engineering have led to the development of Total Body Positron Emission Tomography (TB-PET), the most sensitive imaging device to date. Despite these impressive engineering advances, computational methods lag far behind and model-based approaches cannot deal with the complexity or volume of data these systems produce. We will develop new computational methods based on deep learning and statistical methods that fully exploit the richness and complexity of the data generated by TB-PET, enabling 3D quantitative assays of molecular processes throughout the entire human body with unparalleled sensitivity. The technology we create will open up new capability for the study of complex physiological systems.							
	National Interest Test Statement							
	The Australian Government has made significant investments through the National Research Infrastructure program in the latest, cutting-edge medical imaging devices capable of imaging the entire human body in one view. These imaging systems generate huge volumes of data and, whilst the hardware that makes this technology possible is impressive, the software lags far behind. Our research will create new computational algorithms and associated software to bridge this gap, giving total body imaging devices advanced capability to observe and quantify very subtle changes taking place in the body, thus ensuring their incredible potential is fully realised. This new technology will provide the Australian advanced manufacturing sector with a competitive edge by creating a powerful tool for accelerating drug discovery. In the long term, it will lead to economic and health benefits for Australians by identifying new treatment targets for the complex physiological systems that go awry in chronic health conditions, such as cancer, cardiovascular disease, neurodegenerative disorders, and diabetes.							

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DP230102155	**Top-quarks as a portal to new physics at the Large Hadron Collider**	79,500.00	159,000.00	159,000.00	79,500.00	0.00	0.00	477,000.00
Varvell, Prof Kevin E	This project aims to use data from a Large Hadron Collider experiment, ATLAS, to investigate basic questions in physics. The project expects to use innovative analysis techniques to test the current model of fundamental particles and interactions. While the model, now completed by the Higgs boson discovery, agrees well with observations it cannot be Nature's ultimate description. Expected outcomes include a sensitive investigation of whether the highest energy particle collisions ever recorded hold evidence for a deeper theory. Significant benefits will be an advancement of fundamental knowledge, cutting-edge training of young scientists, strengthening of Australian participation in international science, and public engagement with science.							
	National Interest Test Statement							
	In this project we will search for new building blocks of matter and forces of nature using data from the world's highest-energy particle collider near Geneva and new artificial intelligence (AI) techniques similar to those used by companies like Google and Facebook. This research aims to fill gaps in our knowledge about what the Universe is made of and help develop a deeper, more satisfying picture of how it came to be as it is. Early-career researchers will receive training at one of the premier scientific laboratories and work with top international scientists, preparing them for a diverse range of careers. By sharing our findings in scientific journals and at conferences, our research will lay the groundwork for future studies. Sharing interesting AI developments with the data science community may lead to broader adoption of the techniques we use. The discoveries we make about how the Universe works will be shared with Australians through public outreach activities and could inform future education programs that explore fundamental science.							
DP230102200	**Unshackling solitons through ultimate dispersion control**	63,679.50	129,513.50	102,334.00	36,500.00	0.00	0.00	332,027.00
de Sterke, Prof Carel M	The project aims to generate and investigate several novel families of self-stabilising optical pulses by using a unique fibre laser we recently devised. By developing the associated theoretical models, the team will transform conceptual and experimental knowledge of nonlinear physics, providing deep insights into fibre lasers and the pulses they can emit. The expected outcomes are a complete understanding of entirely novel families of optical pulses, and of the degree to which the energy required to generate these pulses can be reduced. Reducing this energy means that these pulses can perform the same function at lower power, which will enable the emergence of new applications that will play powerful roles in the 21st-century economy.							
	National Interest Test Statement							
	This project aims to develop a novel method that provides substantial new capabilities for generating short, high-power optical laser pulses. The controlled production of such pulses is required for many applications, ranging from telecommunications to material processing. This project will provide industry with an inexpensive tool to generate these pulses and create opportunities to develop new applications which previously were impractical due to the high costs of the laser, for example higher data rates in telecommunications enabling faster data transmission between devices. This research will seek to instigate new partnerships with stakeholders in information technologies relevant to the communications, medical and defence sectors. The translation of this research will allow Australia to better harness its significant investment in fibre optic infrastructure, such as the National Broadband Network. The research centres around a commercially available "WaveShaper" device that is fabricated in Sydney and may also identify new uses of this technology from which the company and Australian manufacturing industry can benefit. The co-founder of a recent start-up company leads the project team. He will leverage his translation skills and strong industry connections to facilitate commercial development of the technology by the optics and laser industry.							

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DP230102331	**The impact of work-from-home environments on comfort and productivity**	67,340.50	141,038.50	148,579.50	74,881.50	0.00	0.00	431,840.00
Kim, Dr Jungsoo	This project aims to quantify the effect of indoor environmental quality (IEQ) in work-from-home (WFH) settings on worker comfort, productivity and household energy use, by employing a longitudinal field monitoring approach. This project expects to generate new knowledge that will inform current indoor environment standards and regulations to make them more relevant to our “new WFH normal”. Quantifying the impact of decentralised workforces on shifting energy usage between sectors can also help in the formulation of relevant energy efficiency policies and building codes. The project will provide significant benefits such as enhancing the quality of work-life of workers and enabling better management of residential energy use.							
	National Interest Test Statement							
	Nearly half of Australia’s workforce has worked from home (WFH) since the COVID-19 pandemic. However, relevant policies and regulations such as Work Health and Safety (WHS) codes have not yet caught up with this development. This research will be Australia’s first step toward adapting policies and guidelines around workplace environments, and associated energy demands and costs, to strengthen their relevance to home workspace design and operation. We will investigate the effect of the indoor environment on comfort, productivity and household energy use in WFH settings. The knowledge we gain will offer pathways for Australian workers to improve their comfort and productivity while simultaneously reducing energy used for space conditioning. Our findings will help Safe Work Australia develop WHS guidelines for the design and operation of comfortable and productive environmental WFH conditions. Through partnership with the Commonwealth Scientific and Industrial Research Organisation our findings will also assist government to refine relevant energy efficiency policies and national housing energy rating schemes.							
DP230102356	**Hybrid Practices in Indigenous Community-Owned Organizations**	92,522.00	205,697.50	210,629.50	97,454.00	0.00	0.00	606,303.00
Cutcher, Prof Leanne R	This project aims to equip Indigenous community-owned organisations with the practices needed to meet the goals of community development and organizational sustainability. The project aims to identify how to effectively combine Indigenous knowledges and culture and western management concepts, generating new knowledge about the distinctiveness of Indigenous organizations and extending theories of hybrid organizations. The project expects to provide an evidence-based framework that captures strategies for generating hybrid organizational practices. This should be of significant benefit to Indigenous community-owned organizations assisting them to deliver the services needed to close the gap on a range of economic, health and social measures.							
	National Interest Test Statement							
	Community-based and locally controlled Aboriginal and Torres Strait Islander organizations can play a crucial role in reducing inequality between Australians, as acknowledged in the 2020 National Agreement on Closing the Gap. Yet, too often Indigenous community-owned organizations fail to survive. To close the gap, we need to ensure the success of Indigenous community-owned organizations. This project will assist Indigenous community-owned organizations balance the twin goals of financial viability and community development. The research will developing a new framework that assists Indigenous community-owned organizations integrate western business concepts models with Indigenous knowledges and culture, helping to ensure the success of Indigenous community-owned organizations. Successful Indigenous organizations will ensure that Aboriginal and Torres Strait Islander communities are determining their futures and will generate jobs for Aboriginal and Torres Strait Islander peoples, while also benefiting the Australian economy more broadly.							

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DP230102411	**From me to you and beyond: understanding socially-induced nocebo effects**	82,290.00	164,732.50	172,753.50	90,311.00	0.00	0.00	510,087.00
Colagiuri, Prof Ben	Nocebo effects – when negative expectancies trigger adverse outcomes – cause enormous personal and societal harm. We have made great progress understanding how instruction and conditioning contribute to nocebo effects. Yet, the role of social learning – what we learn by observing others – has received surprisingly little attention despite its relevance to many prominent societal-level nocebo effects. The current project uses novel experimental methods to understand how social learning contributes to nocebo effects and which strategies inhibit these effects. The results will significantly advance scientific understanding of socially-induced nocebo effects and pave the way for translational research to reduce the substantial harm they cause.							
	National Interest Test Statement							
	‘Nocebo effects’ occur when negative information triggers expectations that cause harmful outcomes. For example, the very act of warning people about side effects can cause them to expect and therefore experience worse side effects. Nocebo effects create an enormous social and economic burden - they cause over 40% of all medication side effects, lead to poorer decisions (such as avoiding cheaper but equally effective generic medicines) and spur resistance to lifesaving vaccinations and new technologies (such as wind turbines). This project will generate new knowledge about social learning – what we learn from observing others – as a fundamental psychological mechanism underlying nocebo effects. Expected outcomes include a new evidenced-based model of nocebo effects and the identification of novel communication and behavioural strategies to combat them. The knowledge gained from this project will pave the way for translational research to mitigate the enormous burden nocebo effects cause, leading to a more efficient healthcare system in Australia.							
DP230102515	**Global Governance, Eco-Justice, and International Grievance Mechanisms**	15,000.00	63,696.00	86,953.00	38,257.00	0.00	0.00	203,906.00
Park, Prof Susan	Despite their global use, there is no evidence that grievance mechanisms provide remedies for people and ecosystems harmed by international development projects. This project aims to investigate whether grievance mechanisms provide eco-justice, where communities seek to be recognised and participate, can lead full lives safe from undue environmental risk, in ecosystems that can regenerate and repair. This is significant given increasing environmental conflict and deaths at project sites around the world. Examining over 430 original claims to the Multilateral Development Banks’ mechanisms over 25 years, and four case studies, the project aims to determine whether the mechanisms deliver eco-justice, and can improve global rules for remedy.							
	National Interest Test Statement							
	This project examines what people in developing countries want when they use international grievance mechanisms to seek justice. For example, when people are forcibly removed from their homes to make room for a power plant funded by international developers. The project will benefit Australia’s international development efforts because it will give the government information as to whether these mechanisms work for the people they were created to help. It will assess if they need to be improved, and if they should continue to be supported. The research can directly help Australia’s international development efforts by providing policy recommendations for improving global rules for international development projects, helping to ensure our investments achieve their aim of fostering prosperity, reducing poverty, and enhancing stability in our region and beyond. It will also provide recommendations for how grievance mechanisms could be improved to help people seeking justice when things go wrong. Policy recommendations will be made directly to the Australian government and the Australian Council for Overseas Aid.							

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DP230102705	**Organic Bioelectronics: Solving Key Barriers to Precision Neuromodulation**	75,870.50	155,194.00	156,122.00	76,798.50	0.00	0.00	463,985.00
Griffith, Dr Matthew J	This project aims to combine the principles of molecular electronics and neurobiology to create organic conductors with enhanced biocompatibility that enable optical neuromodulation. This project expects to generate new knowledge regarding the properties of materials that promote connectivity with neurons and the ability of new microscopy tools to visualise this bio-interface. The expected outcome of this project includes new high performing materials, measurement tools and fabrication approaches to overcome the key challenges to precision neuromodulation. A significant benefit of the new materials is their printability, providing the opportunity to establish a sovereign capability to manufacture low-cost bioelectronic systems in Australia.							
	National Interest Test Statement							
	Communicating with the human body using electronic technology is revolutionizing science. However, traditional electronic materials like metal and silicon are rejected by the body, causing implanted electrodes to fail. This project will develop electrically active inks formed from soft carbon-based polymers to solve this problem. By engineering the physical, chemical, and electrical properties of the materials at the nanoscale, these new materials will mimic the natural environment inside the body and avoid its defence systems against foreign materials. The project will deliver major benefits for our bioelectronics industry by creating a competitive advantage over international companies, whilst the new ability to print electronic devices will generate high-tech manufacturing sovereign capability and is anticipated to create new highly skilled jobs. This discovery and its future commercial development with Australian stakeholders in health and manufacturing will give Australians access to new low-cost technologies for prosthetic organs and treatment of neurological disorders.							
DP230102837	**On the Combustion of Green Hydrogen in Future Energy Systems**	85,000.00	175,000.00	180,000.00	90,000.00	0.00	0.00	530,000.00
Masri, Prof Assaad R	This project aims to address key fundamental issues that will facilitate the combustion of hydrogen-based fuels for power and mobility. This is achieved by applying advanced laser diagnostics and novel computational methods to turbulent flames of hydrogen fuel blends hence generating new physical knowledge and predictive models. These will provide engineers with essential tools to design and operate fuel-flexible energy systems that speed up the critical transition towards employing green hydrogen. Expected outcomes include novel experimental methods and databases, reliable software, and graduates capable of facilitating this transition and accelerating the global decarbonization process while positioning Australia as a hydrogen superpower.							
	National Interest Test Statement							
	Combustion of hydrogen as a carbon-free fuel is highly attractive, initially co-fired with existing fuels, then transitioning to green hydrogen to power future energy systems. However, due to its highly diffusive and reactive nature, hydrogen flames pose serious, unresolved challenges reflected in mixing inhomogeneities, possible flashback, and thermo-diffusive instabilities. This project addresses these issues through quantitative and novel measurements combined with predictive models that provide the fundamental framework which facilitates the global transition towards green fuels. Hydrogen and its derivatives form key pillars as energy carriers that can power relevant industries and mobility sectors, such as heavy-duty land and sea transportation, where batteries or direct use of renewables is not possible. With its massive and diverse energy resources, Australia is well positioned to lead the world in the global decarbonization process, and this research is aligned with Australia’s aggressive move to become a hydrogen superpower and a major exporter of green fuels.							

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DP230102907	**Plasma driven electrochemical synthesis of urea**	85,509.00	171,856.50	125,542.50	39,195.00	0.00	0.00	422,103.00
Cullen, Prof Patrick C	Urea is the most used nitrogen fertilizer in the world, with more urea manufactured by mass than any other organic chemical. However, the world is experiencing a major shortage of the compound, impacting our food costs and security along with dependent products such as AdBlue (diesel -exhaust fluid). Commercial urea production relies on a complex reaction between ammonia and carbon dioxide at high temperatures, which consumes more than 2% of the world's energy. This project aims to produce more sustainable urea driven by electricity and using air and captured CO2, through the use of a plasma-driven electrochemical technology, providing farmers with a low-cost fertilizer under a decentralized and secure supply.							
	National Interest Test Statement Australia is experiencing a major shortage of urea, impacting our food costs and security. The chemical is also critical for products such as diesel- exhaust fluid (AdBlue), which threatens our transport supply chains. Current urea production relies on a complex reaction between ammonia and carbon dioxide, requiring large, centralised infrastructure which has resulted in a few factories, based in countries where natural gas is cheap, controlling the global supply. This project will explore directly coupling air and carbon dioxide in water to produce urea, drawing on our recent breakthrough in synthesising ammonia. Our approach offers electrically driven, decentralised production along with a more sustainable manufacturing pathway. Project outcomes will be shared with leading Australian manufacturers of urea, AdBlue and ammonia, as well as associations representing end users in the agricultural and transport sectors. These collaborations will identify opportunities Australian industries to adopt this new, sustainable manufacturing technology, securing our supply of a critical product.							
DP230102918	**Bushfire analytics: optimisation of fuel reduction.**	71,850.00	142,200.00	139,750.00	69,400.00	0.00	0.00	423,200.00
Matsypura, A/Prof Dmytro	Bushfires are an integral part of the Australian ecosystem. However, their severity has been worsening rapidly over the past decade. This project aims to develop a principled and scalable methodology for optimising fuel treatment planning to reduce the potential for severe bushfires. This project expects to generate new knowledge in bushfire fuel management using a groundbreaking combination of mathematical modelling techniques and state-of-the-art optimisation methods. The expected outcomes should provide significant benefits to our nation's ability to respond and adapt to the impacts of environmental change on biological systems and urban and rural communities.							
	National Interest Test Statement Increasing urbanisation, human presence in fire-prone areas, and climate change make ecosystems and human communities more vulnerable to the devastating effects of bushfires. The challenge of responding to increased bushfire activity has emerged as a critical problem of national importance. The proposed project addresses an urgent need to a develop sophisticated Operations Research methodology for the fuel reduction planning problem. This project will provide new planning methods for firefighting authorities to aid in reducing the number, severity, and impact of bushfires. The results will also help avoid or minimise the adverse effects of fire management operations on the conservation of native species, communities and the protection of landscape features. The long-term benefits include enabling a healthier balance between fire management activities and the ecosystem, saving billions of dollars annually in recovery costs and reducing bushfire-related mortality.							
DP230102982	**Machine learning, group theory and combinatorics**	64,500.00	134,000.00	134,000.00	64,500.00	0.00	0.00	397,000.00
Williamson, Prof Geordie	This project aims to investigate group theory and combinatorics using machine learning techniques. This project expects to generate new knowledge concerning symmetric groups and symmetric functions, using an innovative approach from reinforcement learning. Expected outcomes of this project include a clarification of the types of difficult problems in pure mathematics that can be gainfully attacked via machine learning, and an understanding of the role of group theory in machine learning. This should provide significant benefits, such as progress on long standing open problems, the development of an emerging technology with significant implications for mathematics, and the training of Australian scientists in a vital area of research.							

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	National Interest Test Statement							
	Until recently, there was a widely held belief that machine learning is only helpful with tasks that most humans find easy, like speech recognition or recognising faces in an image. In the last years, we have seen machine learning providing breakthroughs on difficult problems like power-grid management. Our project will discover new ways in which machine learning can be used to help with difficult problems in mathematics. One of our aims will help understand how computers identify objects in an image, potentially increasing robustness of these methods. Another of our aims explores decision making, which has the potential to speed-up algorithms in engineering, computer science and chemistry. With a workforce skilled in these techniques, the potential applicability to future challenges facing Australians is enormous. The team's international scientific networks, which include artificial intelligence companies such as DeepMind, can provide a translation pathway for the research. It will also help attract students to Australian universities, thus contributing to the Australian economy and intellectual capacity.							
DP230103043 Park, Prof Susan	**Global Governing Gaps and Accountability Traps for Solar Energy and Storage** The climate crisis has spurred the global race for renewables, dramatically increasing solar energy and lithium-ion storage battery use. This project investigates the global governance of these technologies environmental and social impacts. This is significant because regulation lags technology: there are governance 'gaps' for protecting communities, ecosystems, and developing states, and accountability 'traps' that prioritise governance processes over outcomes. The project examines how solar and storage production, use, and disposal is governed and whether governance initiatives can account for harm. The expected outcomes are to determine whether global governance can regulate renewables, with benefit for improving global protection rules.	17,457.00	54,131.00	72,833.00	36,159.00	0.00	0.00	180,580.00
	National Interest Test Statement							
	The need for renewable energy to address the climate crisis is clear. The fastest growing renewable is solar energy, which needs battery storage for when the sun does not shine. This project examines whether there are global rules for human safety and environmental protection in producing these technologies. Solar energy and lithium-ion batteries are created through global supply chains. For example, solar energy relies on the extraction of critical minerals such as cobalt from the Democratic Republic of Congo, while batteries require lithium from Chile and Australia among others. The production and disposal of solar energy and lithium-ion batteries also has safety concerns and environmental impacts. The project analyses who creates the rules, whether they provide adequate protection, and if they do, whether they are being followed. The research will benefit Australia by providing policy recommendations to the government for how Australia can contribute to making renewable energy safer for people and the planet as we move to a sustainable future.							
DP230103050 Ranzi, Prof Gianluca	**Adaptive daytime radiative cooling and heating for buildings** This project aims to develop an adaptive daytime radiative cooling and heating technology suitable for the for the reduction of the energy consumption in buildings for the mitigation of the urban overheating in the built environment. The project expects to generate new knowledge in this area to exploit adaptive strategies in the development of future cooling and heating solutions for buildings. Expected project outcomes consist of the establishment of the new adaptive daytime radiative technology for use on building envelopes to support cooling requirements in hot weather and heating needs under cold conditions. This should lead to significant benefits for the Australian building and construction industry.	90,218.00	185,036.00	193,597.00	98,779.00	0.00	0.00	567,630.00
	National Interest Test Statement							
	This project aims to develop an adaptive and cost-effective daytime radiative cooling and heating technology capable of reducing energy consumption in buildings and mitigating urban overheating in the built environment. The expected outcomes consist in the development of coatings and surface devices that can be installed on building exterior skins typically used in Australia. The proposed adaptive technology, which will be capable of cooling under hot weather and heating under cold conditions, will avoid the overcooling produced by current high performing cooling technologies during cold days, and the associated need for additional heating in buildings. Australian cities are experiencing increasing magnitudes of urban overheating and the proposed technology is expected to have a positive impact on the capacity of our construction industry to produce healthier, energy-efficient buildings and urban solutions. The project will also develop suitable design guidelines for the deployment of the proposed technology in buildings and urban environments.							

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DP230103180	**Bidirectional Evolutionary Structural Optimization for Transient Problems**	82,708.50	163,328.50	163,640.00	83,020.00	0.00	0.00	492,697.00
Steven, Prof Grant P	Aims: This proposal aims to expand the bidirectional evolutionary structural optimisation (BESO) method for transient mechanical, multiphysical and robotic problems. Significance: The study will develop new BESO transient algorithms by integrating time-dependent analysis and stepwise design sensitivity in multicriteria and multidisciplinary optimisation. Expected outcomes: The project will largely broaden the algorithmic scope of BESO and enables it to solve more extensive real-life problems with time-varying nature. Benefits include a new BESO design framework and computer program, as well as a series of novel designs, potentially being implemented for aerospace, automotive, biomedical, mechanical, civil and mechatronic applications.							
	National Interest Test Statement							
	Almost all engineering structures - from bridges, to robots, to aircraft – are designed using static loads increased by safety factors to withstand maximum stress. However, in the real world these structures are put under different levels of stress in different loading cases and at different times – for example when an aircraft executes a turning movement, or a bridge is under construction. This project will develop new computer algorithms for structural design that are better able to cater for these changes in real environments. The new design approaches we develop will enable manufacturers to build structures and machines that are lighter and work more efficiently in real situations, and will also minimise the materials and fuel needed to make and operate them. Adoption of this research will bring significant socioeconomic benefits for the nation, such as novel design of 3D printed parts, biomedical implants, and lightweight electrical vehicles. The team's connections with and experience in the Australian software industry will facilitate commercial use of the new algorithms.							
	The University of Sydney	2,433,667.50	5,127,881.50	5,233,632.00	2,634,918.00	95,500.00	0.00	15,525,599.00
University of Technology Sydney								
DP230100127	**Defining how inter-bacterial symbioses regulate aquatic ecosystem health**	90,137.00	177,624.50	187,786.00	100,298.50	0.00	0.00	555,846.00
Seymour, Prof Justin R	This project will determine how ecological relationships among aquatic bacteria govern the health of Australia's marine and freshwater environments. Cyanobacteria support aquatic ecosystem productivity, but can have detrimental effects when they form harmful blooms, although the factors governing the balance of these contrasting impacts are largely undefined. By coupling sophisticated approaches including genomics, phenomics, and microfluidics to examine how symbioses with other bacteria influence the growth and function of important species of cyanobacteria, this research will elucidate the importance of an over-looked factor in controlling the productivity, health and value of Australia's aquatic estate.							
	National Interest Test Statement							
	Australia's marine industries and ecosystem services will yield $100 billion a year by 2025, while freshwater environments underpin our nation's food and water security, sustaining a $67 billion agriculture industry, and are a central element in the cultural identity of Australia's First Nations people. However, recent environmental changes have led to detrimental shifts in the productivity of aquatic ecosystems and acute environmental catastrophes, including toxic cyanobacterial blooms, mass fish kills, and threats to human health. The mechanisms behind these events are regularly unclear. The proposed research will elucidate the significance and nature of an emerging, but largely over-looked, ecological determinant of aquatic ecosystem health; inter-bacterial symbioses. By contributing a much more precise understanding of the intricate ecological relationships regulating aquatic ecosystem function, this research promises to deliver enhanced capacity to predict harmful cyanobacterial blooms, better manage fishery production and food security, ensure safe drinking water supplies, and safeguard human health.							

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DP230100210	**Resolving the threat of ocean deoxygenation to coral resilience**	106,853.50	199,981.00	199,045.50	105,918.00	0.00	0.00	611,798.00
Suggett, Prof David J	This project aims to uncover the role low oxygen plays in shaping healthy corals over space and time. Climate change and land use development are rapidly deoxygenating shallow water coral reefs, yet we have no knowledge of how less oxygen availability affects critical life history factors that govern coral resilience: growth, reproduction, and stress tolerance. This project unites a multidisciplinary team of experts to, for the first time, couple advanced oxygen sensing, metabolic physiology, coral reproductive and stress biology to transform our understanding of oxygen thresholds that are diagnostic of reduced coral competitive fitness across life stages (adults, juveniles, larvae), needed to improve coral reef ecosystem management.							
	National Interest Test Statement							
	Coral reef ecosystems are rapidly losing oxygen from the combined impacts of climate change and local pollution, depriving corals of sufficient oxygen to sustain healthy reefs. Australian reefs underpin an economy worth over $6B per year, largely from tourism, which is at risk if coral reef health declines further. Reef management frameworks must therefore urgently address oxygen loss on coral reefs. This project will identify how corals – at both early and mature life phases – function under lower oxygen availability, and how this alters capacity for corals to grow, reproduce and resist other stressful conditions. This critical new knowledge of oxygen thresholds will allow Government agencies to adopt more robust climate change and pollution mitigation strategies needed to ensure future reef survival and so protect this critical asset for Australia's economy and unique biodiversity. Identifying thresholds of oxygen stress will significantly enhance industry growth of oxygen-based sensor technologies for improved reef ecosystem health management, including application into more effective reef restoration.							
DP230100238	**A novel ion-selective membrane for efficient lithium recovery**	72,100.00	145,100.00	141,100.00	68,100.00	0.00	0.00	426,400.00
Shon, Prof Ho Kyong	This project aims to fabricate a novel membrane that display selective lithium recovery from brine in a renewable energy driven electrochemical membrane technology. The fabrication of lithium selective membranes embedded with nanomaterials and metal organic framework will create new knowledge on the dynamics of ion-size sieving and accelerating lithium transportation. This project will provide significant environmental and economic benefit by establishing a rapid and chemical free method to recover lithium affordably and orders of magnitude more efficiently than hard rock extraction. This project will bring significant commercial benefits to Australian mining industry, desalination and water treatment sectors.							
	National Interest Test Statement							
	Lithium is a highly valuable naturally-occurring material that is increasingly in demand in both chemical and technical applications. This project will develop a renewable energy based membrane technology that targets lithium extraction and separation from currently untapped natural water sources. The new membrane technology is expected to deliver significantly higher lithium production yields without relying on the use of harsh chemicals and other high intensity and costly processing. The outcomes of the project will help Australia diversify its lithium resources from rock deposits alone to brine and seawater, allowing it to increase its share of the estimated $213 bn lithium market. New commercial opportunities to explore lithium extraction beyond the mining stage and further down the supply chain will deliver substantial commercial benefits to Australia's mining industry, desalination, and water treatment sectors, and help establish Australia as a global leader in new technologies for sustainable mining of other precious metals in Australia as well as globally.							

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DP230100246	**Deep Learning Attacks and Active Defences: A Cybersecurity Perspective**	77,935.00	158,370.00	163,370.00	82,935.00	0.00	0.00	482,610.00
Zhu, A/Prof Tianqing	The belief that deep learning technology is imperative for economic development, military control, and strategic competitiveness has accelerated its development across the globe. However, experience has revealed the disappointing fact that deep learning models are vulnerable to a range of security attacks. Hence, a series of methodologies and defence strategies will be devised that make deep learning systems robust to these attacks. The methodologies require analysing attack lifecycles to identify them in their early stages. With this knowledge, active defence methods and forensic strategies can be developed to ensure efficient defences and prevent further attacks. Moreover, the outputs will be generalisable to most deep learning services.							
	National Interest Test Statement							
	Australian businesses, government agencies and the general public are increasingly concerned about the security and privacy of data processed by artificial intelligence (AI) systems, which may be vulnerable to external attacks and manipulation. This project aims to develop sophisticated cybersecurity techniques to provide active protection measures against attacks on AI systems, including making the detection of threats quicker, more reliable and more affordable. The end-user ready security and privacy tools developed in this project can be adopted by a wide variety of organisations using AI software, especially in critical sectors such as banking/securities, trade/customs, telecommunications, government decision-making and power grid control, plus transport and autonomous vehicles. As recent attacks and data breaches in Australia have demonstrated, the adoption of effective AI protection technologies is becoming a critical element for all organisations to counteract cybercrime and to protect their reputation, revenue and clients in a world of persistent cybersecurity threats by criminals and state actors.							
DP230100566	**Eviction: How private renters lose their homes and the consequences**	67,500.00	135,500.00	91,000.00	23,000.00	0.00	0.00	317,000.00
Morris, Prof Alan	Australia is experiencing a housing crisis that has been worsened by the pandemic. An estimated 75,000 private renters are evicted annually leading to ongoing housing precarity, poor health and trauma. This first large-scale study of the evicting process in Australia aims to examine how the process of evicting low-income private renters occurs, the actors, instruments and technologies involved and the long-term impacts of being under the constant threat of eviction or losing one’s home. The intended outcomes of the study are to deliver a comprehensive analysis of the evicting process and its impacts, identify how evictions might be avoided and provide evidence for policy changes that could benefit all parties in the private rental sector.							
	National Interest Test Statement							
	The project’s focus is the evicting process in the private rental sector and its impacts. We are also interested in the roles of the various actors in the process and how they facilitate or assist tenants facing eviction. The last major study of eviction in Australia was in 2006 so this project will fill a major gap in our knowledge. The information gleaned will give policymakers the basis for the development of constructive policy. More than a quarter of Australian households are private renters and of these approximately 40% are low-income renters – about one million households. Many of these low-income households are using a sizeable fraction of their income for rent and it is likely that for a substantial proportion the possibility of eviction is a constant anxiety. The study will be of benefit socially in that it will give us insight into the circumstances of private tenants and how they respond to the possibility of eviction. For the households evicted the economic costs are substantial. The findings of the study can be used to develop a policy framework that gives tenants more protection.							

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DP230100678	**Modernise geotechnical investigation and analysis with machine learning**	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
Sheng, Prof Daichao	The project aims to address the ineffectiveness associated with risk analysis of geotechnical systems by reducing variabilities and by rigorously quantifying such variabilities. It is expected to generate new knowledge in machine-learning-aided risk analysis and in virtual modelling of multiphase-multiphysics-multiscale problems involving random variables. Expected outcomes are datasets and computer tools that are equipped with new functionalities including parameter optimisation, uncertainty quantification, machine-learning based surrogate models and risk analysis. These tools will help to bridge the increasing gap between academic research and engineering practice, transform geo-risk analysis and optimise complex construction processes.							
	National Interest Test Statement							
	Transport maintenance is a major cost factor in the resource-driven Australian economy; rail maintenance expenses alone amount to over A$1 billion annually. A significant amount of these costs currently occur due to the need for expensive and time-consuming manual site investigations. This project aims to use artificial intelligence (AI) to develop AI-driven models and tools that will underpin intelligent risk management and the prediction of built infrastructure maintenance requirements. Civil engineers will be able to use these new tools to estimate geotechnical parameters, conduct design analysis and detect maintenance requirements. Adoption by construction and infrastructure maintenance companies will create new, digital capabilities to transform future engineering practice, resulting in fewer site visits and more efficiently planned maintenance schedules. The result for the Australian economy, and especially for the critical agricultural and mining sectors, will be vastly improved sustainability and cost savings through enhanced quality, economy and longevity of geotechnical infrastructure.							
DP230100714	**Policy for self-determination: the case study of ATSIC**	97,000.00	194,000.00	244,000.00	344,000.00	359,000.00	162,000.00	1,400,000.00
Behrendt, Prof Larissa Y	This project aims to provide a focused study of the Aboriginal and Torres Strait Islander Commission (1990-2005) to inform Indigenous policy-making and governance in Australia. Utilising interdisciplinary approaches and a national perspective it will analyse how, and in what context, the Commission functioned and document the stories of those involved. Expected outcomes of the project include detailed data on the successes and challenges of the organisation and a set of Indigenous oral histories/biographies that will inform public and political debate. This history will benefit and change the way Indigenous governance is understood, discussed, remembered and formulated in contemporary Australian society.							
	National Interest Test Statement							
	The question of Indigenous political representation and recognition, and policy concerning Indigenous governance, are pressing national priorities in Australia that resonate in global challenges of Indigenous restitution. Australian Indigenous leaders are calling for a new contract with the state, including a voice, representation and truth-telling, and the Federal government has signalled the need for sustainable change, deeper partnerships and an evidence-based approach. A detailed study of ATSIC, the most enduring Indigenous governing body in the last fifty years of a volatile policy landscape, will provide critical data, evidence and background needed for these goals. In a context of ongoing crises in Indigenous affairs, including the failure to meet targets to ‘close the gap’, this project will provide a valuable snapshot of Indigenous and governmental aspirations and practices under self-determination, of what worked and what didn’t and why. An innovative Indigenous research methodology will inform Indigenous policy studies into the future.							

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DP230100806 Zhu, A/Prof Xinqun	**Real-time bridge performance evaluation based on crowdsourcing and learning** This project aims to develop a novel strategy utilizing the real-time measurements from moving vehicles and bridges for evaluating the safety and operational performance of bridges based on transfer learning and vehicle-bridge interaction model. This is the first essential study on integrating the bridge-moving load models with transfer learning to extract common knowledge from simulation experiments to support the assessment of damaged status in practice. The project will provide an engineer-friendly low cost monitoring system for its deployment, management and maintenance of existing transport infrastructure. The innovative techniques developed enable the safe operation and reliable evaluation and maintenance of transport infrastructure.	67,500.00	122,500.00	112,500.00	57,500.00	0.00	0.00	360,000.00
	National Interest Test Statement High-quality maintenance ensures safety and efficiency of our public transport infrastructure. Bridges are very expensive to build and maintain, in fact, maintenance over the lifetime of a bridge can be more expensive than the build. Using the latest technology, this project will develop a low-cost monitoring system for accurate, real-time condition evaluation of bridges while in operation. This innovative approach is superior to the current practice where a bridge needs to be closed and load-tested with a heavy testing truck that is not only expensive and disrupts traffic, but also does not give accurate bridge condition assessments. The outcomes of this project will be innovative engineering techniques for Australian Road Authorities to assess bridge condition under normal traffic. This enables infrastructure asset owners to implement an efficient and cost-effective maintenance system, and provides our community with non-interruptive travel and safer use of public transport infrastructure.							
DP230101179 Wand, Prof Matt P	**Technology-Driven and Scalable Regression Methodology, Computing and Theory** Regression is a mainstay of data analysis, statistics, machine learning and data science but is in continual need of enhancement in the face of technological change. Scalability and flexibility for the handling of non-linear signals are fundamental to the practical utility of new regression methodology. Several streams of research aimed at confronting data from specific technologies as well as generic types of data are proposed. The project is to be networked with researchers in the United States of America and aims to have Australia-based researchers providing leadership in terms of methodological, theoretical, computational and software development.	67,000.00	137,500.00	109,739.50	39,239.50	0.00	0.00	353,479.00
	National Interest Test Statement Recent technological breakthroughs, including in areas such as gene expression and brain function, require new statistical techniques that can overcome current limitations with the processing of large datasets across a range of application areas. The contributions this project will make to statistical theory, methods and computing will deliver these urgently needed supercharged techniques. Techniques will be publicly distributed, including via software targeted to data analysts and short courses to engage data-focussed stakeholders in research institutions, government and industry. Adoption of the techniques will deliver health and social benefits, including in personalised medicine and crime policy. The project will underpin more accurate, evidence-informed decision-making concerning medical diagnoses and brain function and, subsequently, lead to improved quality of life for people with chronic illnesses and disabilities. Drawing on the tools developed, Australian criminologists will be able to make smarter use of data to inform policy-makers on devising more effective anti-crime programmes.							

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DP230101322 Wilding, Prof Derek	**Optimising Industry-led Regulation for the Digital Platforms Era** This project aims to investigate how harms caused by digital platforms can be effectively prevented through co-regulation where industry develops rules enforced by a regulator. Widely used in the broader communications sector, 'co-regulation' remains chronically under-theorised and its effectiveness has never been adequately reviewed. Meanwhile, harms such as disinformation and violent content expand in both scale and impact. This research will provide an evidential base for optimising co-regulation in the contemporary Australian communications environment, benefiting regulators seeking to meet public policy goals; consumers experiencing online harms; and platforms themselves, who might otherwise be subject to blunt regulatory tools.	58,046.00	133,188.00	135,179.50	60,037.50	0.00	0.00	386,451.00
	National Interest Test Statement Digital platforms like Facebook and Google offer services consumers value, but practices such as the spread of violent content and false information cause significant individual and community harms. Maintaining consumer value while minimising harms is a regulatory challenge. Co-regulation, where industry helps design rules that are then enforced by a government regulator, offers a potential solution. This project explores how to optimise co-regulation in the contemporary Australian communications environment. Through engagement with industry, regulators and consumers in Australia and overseas, the evidence, principles and recommendations produced will feed into timely interventions into anticipated legislative and policy reviews. There will be social benefits as project outcomes contribute to the development of a robust and 'harmonised' regulatory framework for digital platforms and traditional communication providers, helping to minimise consumer harms. Economic benefits will result from the avoidance of unnecessary regulatory costs that might otherwise arise from the use of less effective regulatory tools.							
DP230101540 Zhang, A/Prof Guangquan	**Advanced Machine Learning with Bilevel Optimization** There is an urgent need to develop a new machine learning (ML) paradigm that can overcome data-privacy and model-size constraints in real-world applications. This project aims to develop an advanced paradigm of ML with bilevel optimisation, called bilevel ML. A theoretically-guaranteed fast approximate solver and a new fuzzy bilevel learning framework will be developed to achieve the aim in complex situations; a methodology to transfer knowledge and an approach to fast-adapt bilevel optimization solutions when required computing resources change. The anticipated outcomes should significantly improve the reliability of ML with benefits for safety learning and computing resource optimisation in ML-based data analytics.	80,000.00	160,000.00	160,000.00	80,000.00	0.00	0.00	480,000.00
	National Interest Test Statement Machine learning (ML) methodologies play an increasingly central role in data analytics, business decision support systems and other digitalized applications in Australian industry and government, but they are currently extremely vulnerable to two main constraints: privacy leaks and computational resource constraints. The intended outcome of this project is to develop fundamental, translation-ready know-how to significantly ameliorate these constraints and to improve the safety and reliability of ML and related intelligence information systems. This will benefit numerous sectors in the Australian e-commence, e-business, e-learning, and e-government landscapes. Businesses and government agencies will be able to increase customer trust and improve the sustainability of data analytics in dynamic and complex environments by preventing the leakage of data and reducing the computing recourse required to operate everyday ML systems. These potential applications will directly increase public trust in Australia's transformation into a leading and efficient digital economy and society.							

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DP230101579	**Quest for Sustainable Electrochemical Energy Storage System**	85,000.00	170,000.00	172,500.00	87,500.00	0.00	0.00	515,000.00
Wang, Prof Guoxiu	This project aims to develop high performance aqueous zinc-ion batteries for grid-scale renewable energy storage. Rechargeable zinc-ion battery is a promising electrochemical energy storage technology owing to its high safety, low-cost and environmental friendliness. By developing high capacity cathode materials, dendrite-free zinc metal anodes and advanced electrolytes, this project expects to achieve practical aqueous zinc-ion batteries with high energy density, long cycle life and cost-effectiveness. The deployment of zinc-ion batteries will enable integration of renewable energies and stabilisation of electricity networks. The project will directly support Australia's commitment to achieve net zero emissions by 2050.							
	National Interest Test Statement							
	To achieve the UN climate target of limiting global warming to 1.5°C, we must accelerate the deployment of renewable energy. Energy storage is essential for widespread adoption of renewable energies. This project will address the critical issues in the energy storage sector such as how to cost-effectively and safely store renewable energy. Therefore, the proposed research will significantly benefit Australia by securing energy independence through integrating more renewable energy into electricity networks, thereby reducing reliance on fossil fuels. In particular, this proposed research will solve an intrinsic safety problem for rechargeable batteries by replacing flammable organic electrolytes with aqueous electrolytes. Meanwhile, the project will build long-lasting zinc-ion batteries based on an earth abundant element to realise low-cost and sustainability. The outcomes of the project will create innovations in advanced battery technologies with strong prospects for commercialisation, attaining a net-zero emission energy future, and generating job opportunities in the energy and manufacturing industries.							
DP230101740	**Homogenous Antibody-Metal Conjugates For Immuno-Mass Spectrometry Imaging**	70,238.00	143,125.00	151,078.50	78,191.50	0.00	0.00	442,633.00
Bishop, Dr David P	This project aims to use bespoke metal labels and high-resolution mass spectrometry imaging to address current shortcomings in approaches that visualise and measure proteins in cells and tissue. It expects to substantially increase the utility of immuno-mass spectrometry imaging technology to analyses that are refractory to current techniques and workflows. Expected outcomes include metal probes that facilitate the spatial quantification of multiple biomolecules on a single histological section, providing significant benefits to bioscience laboratories that require complex workflows to visualise and obtain quantitative data on the expression of biomolecules.							
	National Interest Test Statement							
	Understanding the function of proteins in biological systems requires knowledge of their location and amount. Typical approaches in biology and pathology laboratories use dyes or fluorescent tags to determine the presence of specific proteins, but current methods cannot provide reliable measurements of how much protein is present in the analysis. This project develops new quantification approaches using metals that can be detected using highly accurate modern instrumentation to simultaneously determine where and how much of a specific protein is within biological specimens. The project outcomes will reduce the economic costs to biology and pathology laboratories who adopt this technology through simplified workflows, and by increasing the number of proteins that can be measured at once. This will allow the development of new commercial pathology tests, resulting in globally competitive products that reduce the cost for patients and improve health outcomes for Australians.							
DP230101760	**Evolution and mechanisms of interactions in biofilm communities**	85,000.00	175,000.00	174,500.00	84,500.00	0.00	0.00	519,000.00
McDougald, A/Prof Diane	This project aims to study the long-term experimental evolution of a mixed species bacterial biofilm community. This project expects to gain understanding of the genetic and physiological basis of community evolution. Expected outcomes of this project will be an understanding of how synthetic communities evolve. This will significantly benefit the use of synthetic communities relevant to fields such as antibiotic design, biotechnology, bioremediation, and synthetic biology where evolution can be inhibited or exploited, respectively.							

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	National Interest Test Statement Microbes (including bacteria, fungi, protozoa, microalgae, and viruses) occur in natural and artificial settings, usually as mixed species communities. They have a broad range of potential applications, from food safety and security, biotechnology, value-added products, human nutrition and functional foods, plant and animal protection. This project aims to better predict how microbial communities assemble and maintain functional communities that cooperate rather than compete. Being able to better predict positive microbial community interactions will facilitate use of such communities in diverse applications from bioremediation to wastewater treatment. Industry adoption of the outcomes, facilitated by the research team's wide collaborative network, will catalyse commercial activities and competition in this space, leading to substantial commercial and economic benefits for Australia.							
DP230101769 Indraratna, Prof Buddhima N	**Response of Vertical Drains in Soft Subgrade under Cyclic Rail Loading** Soft formations (subgrade) can become unstable when subjected to heavy and repeated (cyclic) train loading. This project aims to investigate the cause and mechanisms of undrained instability of soft subgrade soil beneath rail embankments, and to assess the effectiveness of prefabricated vertical drains (PVDs) in stabilising such soils. The role of PVDs to enhance track performance will be quantified via rigorous mathematical techniques complementing a computer-based numerical model, which can be validated by laboratory and field data. It will deliver tangible outcomes for accurately predicting the long-term settlements in soft foundations over prolonged train loading while extending the life span of modern railroad infrastructure.	95,000.00	195,000.00	189,500.00	89,500.00	0.00	0.00	569,000.00
	National Interest Test Statement Soft formations (subgrade) below rail tracks can become unstable when subjected to heavy and repeated (cyclic) train loading. This project aims to investigate the cause and mechanisms of undrained instability of soft subgrade soil beneath rail embankments, and to assess the effectiveness of prefabricated vertical drains (PVDs) in stabilising such soils. The benefits of subsurface drainage to stabilise soft soil will be examined to offer tangible advances in this ground improvement method. The innovations will evolve through rigorous numerical modelling combined with unique large-scale testing to capture the variation of soil and drain properties under cyclic loading as imperative for heavy-haul tracks. The research outcomes include rigorous numerical tools to enable reliable predictions for railroad performance, and new PVD design and installation guidelines to enable transport organisations to construct safer and more resilient rail embankments with significantly reduced life-cycle costs. Practitioners will further benefit from salient outcomes disseminated through publications and industry workshops.							
DP230101955 Qin, Dr Peiyuan	**Multi-beam Transmitarrays for Unmanned Aerial Vehicle Communications** This project aims to develop fundamental technologies for multi-beam conformal transmitarrays with independent beam steering capabilities for unmanned aerial vehicle (UAV) communications. Compared to current UAV antennas, the proposed antennas can be flush mounted to the body of UAVs, improving aerodynamic performance while also achieving significantly higher data rates for wireless connectivity. This project is expected to generate scientific breakthroughs in many aspects of antenna research and enable UAVs to leverage big data technologies by transmitting/receiving large amounts of data, thus serving as a powerful tool for emergency management and for transforming many industry sectors, such as agriculture, food and water.	64,500.00	131,500.00	136,500.00	69,500.00	0.00	0.00	402,000.00
	National Interest Test Statement The smart conformal antenna arrays developed in this project have great potential to enable Unmanned Aerial Vehicles (UAVs) to leverage big data technologies. The UAV big data enabled by conformal arrays provide a new observation technology to monitor land, water and marine systems, delivering invaluable economic and environmental benefits. This means data can be collected in a faster, more comprehensive, and cost-effective way for precision agriculture, prediction of drought/bushfires, and to monitor changes in climate. In case of natural hazards, the conformal antenna aided UAVs can offer high-speed wireless connectivity to areas where the infrastructure on the ground has been destroyed. Therefore, they will make substantial contributions to emergency management and disaster relief by serving as aerial communication platforms. This technology will greatly benefit the Australian population, particularly those residing in rural areas and areas affected by annual bushfires and natural disasters. Improved planning and response to natural disasters could have huge economic and social benefits.							

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DP230102781	**Assessment of Dynamic Pile Driving Using Machine Learning**	72,007.00	140,730.50	134,169.50	65,446.00	0.00	0.00	412,353.00
Khabbaz, Prof Hadi	This project aims at developing new technology to determine ground properties and foundation capacity in real-time during pile installation by adopting rigorous numerical simulation, laboratory experiments and artificial intelligence-based computational model. Although impact driving is used commonly to install piles on site, there is no technology currently available to interpret collected data accurately and in real-time to provide live feedback and optimise construction processes. This research will provide new machine learning model to assess the ground and foundation characteristics during construction, and will increase certainty in infrastructure investment in Australia particularly for costly transport assets and infrastructure.							
	National Interest Test Statement							
	Building transport infrastructure such as roads and railways requires foundation works such as pile-driving when constructing on weak ground. However, there have been reports of cracked piles in infrastructure projects due to inability of current methods to predict foundation strength accurately, resulting in excessive construction and maintenance costs. Therefore, it is important to develop more reliable techniques to determine pile capacity to ensure cost effective and timely construction. This project will adopt new technologies, and physical and computer simulations to process data collected during pile installation via sensors, and establish a new design procedure and software to determine foundation strength and fine-tune the design. The outcomes will offer a new tool and foundation design guidelines to infrastructure designers, builders, and owners to assess foundation conditions more effectively, leading to a reduction in construction and maintenance costs. Moreover, the public will experience better quality and safer transport infrastructure with less damage, and fewer closures and interruptions.							
DP230102856	**Internet Timing for the Ages: Establishing the New Timekeeping System**	79,146.50	155,843.00	149,393.00	72,696.50	0.00	0.00	457,079.00
Veitch, Prof Darryl N	All computers incorporate a software clock, essential to myriad software applications. An economic way to synchronize such clocks is over a network, however the approach the Internet currently depends upon is unreliable and vulnerable. This project aims to establish a new architecture for networked timekeeping, built on future-proofed fundamentals, that will for the first time address each of accuracy, reliability, and trust. The expected outcome is a national prototype, serving the public with accurate and trusted time, that will form the basis of the next generation timekeeping system for the Internet and the Internet of Things. Expected benefits include enhanced productivity across the digital economy, and resilience to GPS failures.							
	National Interest Test Statement							
	Computers need to know the time. This is achieved by software communicating with time servers over the Internet, but the current system has limitations including low accuracy, a lack of trustworthiness and transparency, and an over-reliance on satellite systems like GPS, which are increasingly vulnerable to attack. This project will reengineer the Internet timing system, to deliver time to Australia's computers and devices that can be trusted. The outcomes of the project include a detailed system design, associated software, and a nation-spanning prototype, open to the public, whose performance will be authoritatively benchmarked. It will be established with the cooperation of trusted peak Australian standards bodies invested in the public good, including the National Measurement Institute, which provides a pathway toward a permanent sovereign timekeeping capability, immune to GPS failures. The availability of highly accurate, reliable and trusted network time will decrease costs and enhance productivity across the digital economy, reduce download delays, and minimise timing-based cybersecurity threats.							
	University of Technology Sydney	1,409,963.00	2,824,962.00	2,801,361.50	1,583,362.50	359,000.00	162,000.00	9,140,649.00

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University of Wollongong								
DP230100198	**Enabling High-performance Layered Oxide Sodium-Ion Battery Cathodes**	64,205.00	128,410.00	135,060.00	70,855.00	0.00	0.00	398,530.00
Pang, A/Prof Wei Kong	The great abundance of sodium on the earth's crust and similar work principles have made sodium-ion batteries the most promising replacement for commercial lithium-ion batteries, which are struggling with the increasing cost. This project studies the layered oxides for use as cathodes in sodium-ion batteries. The cross-disciplinary strategy and approaches will be employed to address the weaknesses of such oxides and release the hidden potential to achieve commercialisation. The expected outcome includes advancement in fundamental knowledge of cathode materials design and the development of clean energy, revamping the energy structure of Australia.							
	National Interest Test Statement							
	Acting on safety concerns and driving improved performance, Tesla is now transitioning from nickel-based to iron-based lithium cathodes in their batteries. Longer term layered sodium cathodes can deliver still superior safety, capacity, energy, and power performance relative to their lithium counterparts and could replace these. This project will enable that by developing novel sodium cathodes for batteries to power electronic devices and electric vehicles. We will work with our existing partners in mining, chemical and energy-related industries to demonstrate feasibility of these sodium battery cathodes. The success of this project will stimulate the growth of energy-storage industries and create more local job opportunities, thereby enhancing Australia's economy and social safety. The ability to produce more efficient, cost-effective, and reliable high-energy-performance battery systems will not only help position Australia as a green energy powerhouse, but also provide tangible downward pressure on carbon fuel consumption and demand on ageing energy infrastructures.							
DP230100323	**Reading the past to predict future biodiversity: a deep-time perspective**	50,500.00	141,500.00	170,500.00	79,500.00	0.00	0.00	442,000.00
Shi, Prof Guang R	The extent of human-moderated impact on ecosystems is rapidly increasing. To date, most current research in this field is based on short-term observations or experiments. By examining the characteristics of species and ecosystem response to climate change from a major geological Ice Age ~320-265 million years ago in eastern Australia, this study will investigate how marine species and ecological communities evolved in response to repeated glacial/interglacial cycles and associated warming/cooling climate changes. Expected findings will help to better understand the long-term links between global warming/cooling climate regimes, sea levels, changing sea-water temperature and chemistry, and species and ecosystem responses to these drivers.							
	National Interest Test Statement							
	A long-term view from the geological record is required to gauge how global warming will alter the future distribution of species in the global ecosystem, for example its impact on tropical reefs like our Great Barrier Reef. Despite increasing research into the pervasive nature of climate-driven changes in species redistribution, our ability to detect these changes is still very limited and many ecological theories remain largely untested. By investigating the characteristics of past species and ecosystem responses to climate change, this project seeks to understand how they responded to climate oscillations over time. Importantly, we will test if the poleward migration of tropical marine species under protracted global warming has resulted in any catastrophic ecosystem changes and the creation of novel communities at higher latitudes. Bringing together the world's best scientists, this project will generate new knowledge to better prepare Australia for the possible impacts of a continually warming Earth and inform how governments and societies should respond to future conservation decisions.							

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DP230100499	**Singularity and regularity for Monge-Ampere type equations**	65,900.00	133,100.00	135,750.00	68,550.00	0.00	0.00	403,300.00
Liu, A/Prof Jiakun	The Monge-Ampere equation, as a premier nonlinear partial differential equation, arises in several areas including geometry, physics, and optimal transportation. Many important problems and applications are related to the regularity of solutions, which are obstructed by singularities. This project aims to classify the geometry of the singular sets, and to establish a comprehensive regularity theory for general Monge-Ampere type equations by using innovative approaches and developing cutting-edge technologies in partial differential equations. Expected outcomes include the resolution of outstanding open problems. This project will significantly enhance Australia’s leadership and expertise in a major area of mathematics and applications.							
	National Interest Test Statement							
	During propagation of a seismic wave, differences in the conducting rock can cause accumulations of energy sparking earthquakes, volcanic eruptions, landslides, and tsunamis. Mathematically, these accumulations of energy are called singularities. This project will utilise innovative mathematical analysis to establish a detailed structure of singular sets, leading to more accurate descriptions of geometric shape and size of wavefronts. Engineers and seismologists will be able to translate the new techniques to reduce error estimates on the origin points of earthquakes or a subsurface by a factor of 6 (from 2km to 300m). The same mathematical problem also arises in medical imaging, where the “energy” is colour intensities in a CT or MRI image. The singularities, where “energy” accumulates, correspond to locations of tumour formation. Medical radiation scientists will be able to translate our results to develop fast algorithms for early detection of tumours. The project benefits Australians by building a safer and healthier future for all, and will enhance our international standing in science and technology.							
DP230100577	**The evolution of human innovation in an arid biodiversity hotspot**	54,313.50	128,824.50	146,507.00	146,229.00	74,233.00	0.00	550,107.00
Mackay, A/Prof Alexander C	This project will examine the archaeology and environmental history of South Africa’s Succulent Karoo, the world’s only arid biodiversity hotspot. Arid regions of Africa have historically been marginalised in accounts of human evolution yet recent evidence suggests that they were loci of innovation over the last 120 000 years. To explore the importance of such areas to the evolution of our adaptive capabilities, this project will produce comprehensive new datasets relating to the climatic, environmental, and social contexts of innovation among early humans occupying the site of Varsche Rivier 003. The results will test prevailing models of human behavioural evolution, shedding new light on how we came to be human.							
	National Interest Test Statement							
	This project will examine the archaeology and environmental history of South Africa's Succulent Karoo, the world's only arid biodiversity hotspot. By understanding the contexts under which new behaviours appeared in humans as they evolved, the project will carry wide-ranging implications for our understanding of the evolution of humanity generally and the management of water resources, and for the archaeological records of all continents, including Australia. The project will provide exceptional training opportunities for Australian students, enhance conservation outcomes for a global biodiversity hotspot, develop research capability in South Africa, and engage indigenous Africa communities in understanding of their ancient past. In sum, the project will help us better understand the success of our species while providing a training platform from which Australia's next generation of globally connected archaeologists will emerge. This project will generate new data from this region to explore how early societies used these and other strategies to adapt to climate change over the last 100,000 years. Understanding human flexibility and the limits of societal resilience will be critical as the world faces a future in which droughts will likely become more frequent, longer and harsher, particularly in Australia. The project will also benefit the management of Australia’s natural heritage by analysing the long-term impacts of climate variability on biodiversity in fragile arid ecosystems. Finally, at a time when cultural heritage sites globally are threatened by sea level rise, storm damage and erosion, the project will develop methods that can be applied to monitor and mitigate the deterioration of Australia’s historically significant heritage places.							

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DP230100679	**Smart materials for atmospheric water management and water harvesting**	67,000.00	136,500.00	142,000.00	72,500.00	0.00	0.00	418,000.00
Spinks, Prof Geoffrey M	Fresh water is a scarce resource in many parts of the globe but uncomfortably over-supplied in other regions. Dehumidifying machines, such as air conditioners, are extensively used in humid climates to enhance human comfort, but with great energy costs. Likewise, the production of potable water in remote dry regions is energy intensive. We propose novel hyper-absorbent desiccating polymers combined into sorption-powered engines inspired by nastic movements in plants to develop extremely efficient dehumidifiers and water harvesting machines. These polymer actuators can help address the auto-acceleration of climate change caused by the increasing use of air conditioners and provide cheap, clean water for remote communities.							
	National Interest Test Statement							
	This project will develop new water-loving materials that can literally extract fresh water from air and do so by using comparatively little energy. Water is a scarce resource in many parts of the globe but uncomfortably over-supplied in other regions. Dehumidifying machines, such as air conditioners, are extensively used in humid climates to enhance indoor comfort, but with great energy costs. Likewise, the production of drinking water in remote dry regions is energy intensive. We will develop new water-loving polymers combined into self-powered engines to demonstrate extremely efficient dehumidifiers and machines that extract clean water from thin air. These materials and systems can help address climate change caused by the increasing use of air conditioners and provide cheap, clean water for remote communities. By working with our Universities' commercial translation systems, we anticipate that the project will provide opportunities for new Australian manufacturing businesses and new green jobs.							
DP230100823	**Liquid metal composite tactile sensor**	74,447.00	153,851.00	164,761.00	85,357.00	0.00	0.00	478,416.00
Li, Prof Weihua	Tactile sensing electronic skin is a key enabling technology for smart robotic grippers and neuroprosthetics. However, traditional electronic skin is still underdeveloped in sensing of slip and force direction. Therefore, this project aims to imitate human skin structure to develop a highly sensitive liquid metal-enabled electronic skin that can achieve high-performance multiple tactile sensation capabilities, including normal-tangential force decoupling and slip detection. The expected outcome will enable future manipulator and prosthetics to detect complex forces for precision manipulation, which will provide benefits to advanced manufacturing and bring significant economic and social benefits.							
	National Interest Test Statement							
	Tactile sensing electronic skin is a key enabling technology for smart robotic grippers and neuroprosthetics. However, traditional electronic skin is still underdeveloped in sensing of slip and force direction (stopping it from slipping off the skin). Therefore, this project aims to imitate human skin structure to develop a highly sensitive liquid metal-enabled electronic skin that can achieve high-performance multiple tactile sensation capabilities, including force decoupling and slip detection. This electronic skin, which can detect force direction and object roughness, shows broad market prospects in industrial tactile sensors and wearable devices. The skin can be used on prosthetic products and enable the disabled population to receive accurate feedback to operate prosthesis conveniently, greatly benefiting their life quality. To enable the adoption, we will engage with robotic and healthcare companies following the project outcomes, and seek to collaborate to obtain commercial investment for developing practical products. Consequently, this project will benefit the Australian industry and health sectors, and enhance Australia’s global reputation and competitiveness in advanced manufacturing and healthcare technology.							

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DP230100875	**Archiving Social Movements & Building Historical Literacy for a Digital Age**	33,088.00	119,794.50	138,546.00	51,839.50	0.00	0.00	343,268.00
Crozier-De Rosa, A/Prof Sharon	This project aims to investigate how the history of social movements has been collected, catalogued and curated by archives and museums. It is significant because it will make these histories available to form an equitable and inclusive civic culture. An expected outcome is an interdisciplinary approach producing new knowledge about citizens' roles in shaping private and public collections, and about the use of these collections to shape memory and generate wider historical literacy. Benefits include providing insight into inclusive physical and digital collecting practices, which enables the project to address UNESCO's goal of achieving greater access to decision-making about culture, heritage and the formation of social identities.							
	National Interest Test Statement							
	This project will investigate the collection and presentation of the history of social movements in galleries, libraries, archives and museums (GLAM). The project addresses a significant knowledge gap about the challenges that social movements (e.g., gender reform campaigns) had to overcome to preserve their histories. It will also produce new knowledge about how subsequent generations have used these historical archives. Project workshops will deliver practical outcomes of cultural benefit including: translating research findings to GLAM professionals to improve inclusive collecting practices; educating historians, journalists and policymakers about diverse communities' historical contributions to inform public debate; and advising on opportunities and challenges facing those using new digital technologies to preserve knowledge about contemporary social movements for future generations. Project outcomes will guide the creation of more inclusive archives to enable a collective memory to emerge that informs Australians about women's and diverse communities' contributions to our social and political landscape.							
DP230101133	**Structural safety guidelines for accidental hydrogen explosion hazards**	57,500.00	137,007.00	136,908.00	57,401.00	0.00	0.00	388,816.00
Remennikov, Prof Alex	This project aims to develop structural safety guidelines to mitigate hydrogen explosion hazards which can be identified as a major safety concern due to the higher demand worldwide for sustainable energy sources with no carbon emission. The world's growing demand for hydrogen and Australia's National Hydrogen Strategy to develop the industry will make Australia a core player in hydrogen production creating a massive economic opportunity. However, the high flammability and low ignition energy of hydrogen makes it vulnerable to accidental explosions. Hence, this project will address the lack of safety protocols in Australian Standards related to the handling of hydrogen by producing essential design recommendations.							
	National Interest Test Statement							
	Hydrogen has a major role to play in the transition to a clean, secure energy future, and Australia has the potential to become a key global player in clean hydrogen technology. While Australia is already in a position to produce hydrogen at a commercial scale, it is a highly flammable gas and can cause fires and explosions if not handled properly. This project plays a critical, but often overlooked, role in transforming Australia's hydrogen plan, by accurately and scientifically characterising hazard impacts on infrastructure due to accidental hydrogen explosions. This research will develop new fundamental knowledge of hydrogen explosion characteristics to enable safe usage of hydrogen technology in vehicles, storage and transportation systems for accelerated acceptance of green hydrogen as a future energy carrier. The outcomes will be shared with Standards Australia Committee for Hydrogen Technologies for implementation as national standard thus bolstering consumer confidence in the adoption of hydrogen technologies and supporting the national plan of achieving net zero carbon emissions by 2050.							
DP230101369	**3D Bipolar Electroactive Architectures for Wireless BioStimulation**	78,000.00	161,000.00	166,000.00	83,000.00	0.00	0.00	488,000.00
Wallace, Prof Gordon G	Traditional Electrostimulation requires hard-wired metal electrodes and electronic wires connected to a power supply. These tethered systems face numerous challenges in establishing long-lasting effective electronic interfaces with targeted cells and tissues. This project aims to combine technologies in conductive polymers, bipolar electrochemistry, 3D fabrication and cell engineering to develop a 3D bioelectronic system that enables wireless cell stimulation. The major benefit is to generate advanced knowledge of wireless powered electromaterials and novel wireless biotechnology in medical engineering, which could help well-position the Australian in smart bionic devices for human well-being with a bright future.							

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	National Interest Test Statement							
	Traditional Electrostimulation requires hard-wired metal electrodes and electronic wires connected to a power supply. These tethered systems face numerous challenges in establishing long-lasting effective electronic interfaces with targeted cells and tissues. This project aims to combine technologies in conductive polymers, bipolar electrochemistry, 3D fabrication and cell engineering to develop a 3D bioelectronic system that enables wireless cell stimulation. Traditional electrostimulation of cells has been shown to promote tissue regeneration and treat conditions such as epilepsy and Parkinson's disease. However, realisation of the potential of electrotherapies is hampered due to the technical challenges associated with delivery using traditional approaches. Moving forward innovations that enable more effective means of wireless electrical stimulation are needed. Our approach addresses this challenge. The fundamental knowledge accrued here will be deployed in collaboration with Australian industry partners to ultimately deliver a new generation of biomaterials (e.g. wireless biochips) and platforms to treat medical conditions and improve patient well-being. This will enable Australian industry to be at the forefront of developing and manufacturing bionic devices, and to effectively compete in the rapidly growing, USD $4.7 billion global bionic devices market.							
DP230101458	**Weather, climate & geological risks: derivative pricing & risk management**	64,500.00	130,000.00	132,000.00	66,500.00	0.00	0.00	393,000.00
Rodrigo, Dr Marianito	This project aims to create new mathematical models and approaches for the fair valuation and hedging of financial derivatives, tackling funding for climate change adaptation and catastrophic disaster risk management. Businesses use derivatives to strategically mitigate financial losses from adverse climate conditions and geological hazards. Expected outcomes are improved models for weather variables and hazard risk assessment; richer methodology from the fusion of mathematical techniques, data analysis and earth sciences perspectives; and quantitative solutions to pressing societal concerns. Significant benefits also include highly qualified personnel training and international collaboration on common multidisciplinary research priorities.							
	National Interest Test Statement							
	Climate change has huge impacts on insurers, financial stability and the economy, with average annual losses of USD $50 billion. The Bureau of Meteorology recently declared a third La Niña officially under-way for Australia, and warned of more frequent occurrences of widespread flooding and temperature extremes. Thus it is imperative to manage the costs resulting from the harmful effects of climate change and catastrophic geological risks. This project will create new mathematical models and approaches for the fair valuation and hedging of financial contracts dealing with climate and geological risks. Combining mathematical techniques, data analysis and earth sciences perspectives, new models for weather variables and hazard risk assessment, and practical platforms for implementing solutions will be developed. With the construction and validation of new mathematical tools, Australian businesses will be well-positioned to better mitigate financial losses resulting from adverse climate conditions and geological hazards. The results will be shared with Insurance Council of Australia, Geoscience Australia and CSIRO.							
DP230101928	**How parents manage climate anxiety: coping and hoping for the whole family**	50,500.00	123,500.00	152,000.00	79,000.00	0.00	0.00	405,000.00
Patulny, A/Prof Roger P	This project studies how Australian parents manage climate anxiety for themselves and their families. Using mixed-methods/mixed-media approaches, it examines whether an increase in climate disasters is accelerating the spread of collective anxiety amongst families, how parents manage this anxiety for their children and partners, and if there are associated mental health burdens and gendered inequities in this management. It also looks at climate anxiety management across generations and climate histories, drawing out pessimistic/optimistic narratives about the future to enable action, resilience, and hope. It will produce an evidence base and photo-voice/documentary resources to help parents and support organisations combat climate anxiety.							
	National Interest Test Statement							
	After several years of heightened climate-related natural disasters (such as the 2020 bushfires and 2022 East Coast floods), climate anxiety is a looming mental health concern for Australian families. This project will examine how parents manage climate anxiety for themselves and their families. It will reveal specific emotional techniques for helping children with climate anxiety and investigate gendered differences in providing emotional support for children. The research will: inform national debates on the social impacts of climate change; benefit family support organisations; offer Australian parents techniques for managing the emotional burden of climate change, and give parents a voice about their future fears and hopes. The research will be shared via national/international workshops with community and government stakeholders to develop strategies for applying our findings (including the Climate Council, Mental Health Australia, Beyond Blue, Relationships Australia) etc. In addition to academic publications, findings will be presented through a unique set of photo-voice/documentary resources.							

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DP230101981	**Phenotyping doublecortin+ cells to unravel human adult neurogenesis**	107,914.50	238,509.00	209,551.00	78,956.50	0.00	0.00	634,931.00
Matosin, Dr Natalie	This project investigates one of the brain's most remarkable phenomena: adult neurogenesis, the birth of new brain cells in a specialised brain area (the hippocampus) occurring well into adulthood. This process contributes to many species' capacity to learn, remember and regenerate. However whether this process occurs in humans is heavily debated. Using new neuroscience tools, this project will produce new insights into human adult neurogenesis by deeply examining hippocampal cells that express the newborn cell marker, doublecortin. This will enable clarification of the existence and extent of adult neurogenesis in humans, and provide the foundation to leverage this process for improving learning, memory and brain regeneration in people.							
	National Interest Test Statement							
	With this project we answer arguably the most important question in modern neuroscience: Can the human brain produce new neurons in adulthood? It is believed these adult-born neurons migrate through the brain and integrate into areas where they are needed, for example, for learning, forming complex memories, and healing the brain after injury. This process therefore has immense health implications, as harnessing the process of birthing and integrating new neurons into the human adult brain has incredible potential for improving brain function. Some applied examples include improving cognitive ability in the workplace or during aging, healing after illness or injury and it has been hypothesised that this process could be applied as a treatment for neurological and neuropsychiatric disease. The research is expected to be patentable and might be shared with clinicians and pharmaceutical companies to enable its adoption in medical treatments. This would have significant social and economic impact for individuals, society, and the Australian community.							
DP230102221	**Giant magnetic-thermoelectricity in topological materials**	76,500.00	153,000.00	133,500.00	57,000.00	0.00	0.00	420,000.00
Wang, Prof Xiaolin	This project aims to explore magnetic field-induced exotic thermoelectricity in emerging topological materials and develop novel magnetic-field-mediated heat-to-electricity generators and coolers. The significance and outcomes of this project will be the discovery of new magnetic topological materials with thermoelectric conversion efficiency superior to traditional thermoelectric materials and unlocking the physics of the exotic magnetic-field-correlated thermoelectric phenomena. The outcomes of this project will offer new avenues for novel applications of quantum topological materials and establish a solid foundation for the next generation of thermoelectric devices for various applications.							
	National Interest Test Statement							
	Thermoelectric (TE) materials and devices convert heat into electricity (or vice versa) enabling both power generation and refrigeration. Their critical advantage is in no moving parts and zero emission of toxic gases. TEs are mechanically robust and can be readily integrated with most electronic devices, especially computers, server farms, and mobile phones. Their wider use, however, has been limited by their low energy conversion efficiency. This project takes a novel approach to tackle this problem, by using newly discovered metallic materials, exhibiting superior TE performance, when subjected to a magnetic field. This will enable the development of high-efficiency TE materials for power generation and cooling. These materials and technology will underpin environmentally sustainable transport applications and enhanced fuel efficiency, for example, in car exhaust systems. For large scale industrial applications, TEs developed here will have great potential to be used in steel making, gas pipelines, and quantum electronics, providing clear pathways for meeting net zero energy targets by 2050.							
DP230103091	**Space RAdiation Monitoring System (SRAMS) for safe space missions**	100,592.00	190,476.50	149,899.50	60,015.00	0.00	0.00	500,983.00
Rozenfeld, Prof Anatoly B	The goal of the project is to develop a comprehensive space radiation monitoring system (SRAMS) that can evaluate: i) the radiation related hazards for astronauts, ii) the radiation damage in electronics during space missions and iii) the ground radiation facility environment used in radiation hardness assurance tests. SRAMS will also address important issue in space by minimizing manned or satellite space mission aborts due to space radiation adverse effects on astronaut's health and electronics failure, and translates into an enormous economic value proposition. SRAMS will be paramount for leveraging the quantifiable standards of the space-radiation qualification facilities that are important for boosting the Australian Space industry.							

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	National Interest Test Statement							
	The hostile radiation environment of space poses significant biological consequences for astronauts on deep space missions as well as a threat to any satellite mission due to radiation damage of electronics. This project is dedicated to the development of a comprehensive space radiation monitoring system for manned and satellite space missions that continuously evaluate the biologically relevant threat for astronauts and damage to electronic components due to space weather conditions, so as to mitigate them in a timely manner and avoid catastrophic mission failures. The proposed monitoring system is unique as it is able to measure the dose equivalent for astronauts. It also measures the total ionizing and displacement doses in electronics and characterises the radiation field for Single Event Effects prediction without prior knowledge of the mixed radiation field. Adoption of the system by space industry for in–flight monitoring and on-ground testing for radiation space qualification of electronics will essentially improve the reliability of satellites leading to a direct and enormous economic benefit.							
	University of Wollongong	944,960.00	2,075,472.50	2,112,982.50	1,056,703.00	74,233.00	0.00	6,264,351.00
Western Sydney University								
DP230100175	**Boosting C4 photosynthesis to climate proof crop yields**	80,126.00	161,929.50	160,907.00	79,103.50	0.00	0.00	482,066.00
Sharwood, Dr Robert E	Building next generation C4 crops, such as maize, sugarcane and sorghum, to cope with drought and heat stress is requisite to ensure the supply of food and fodder. Here we will increase the content and / or catalytic efficiency of the primary carboxylase of C4 photosynthesis (PEPC) that supplies CO2 to the carbon concentrating mechanism and ensures high photosynthetic rates. We will develop new SynBio tools to create and test novel PEPC isoforms with desirable properties. Ultimately, the project aims to identify isoforms that improve plant fitness under stress conditions. Optimising PEPC activity will provide next generation solutions to improve water balance and carbon assimilation to keep C4 crops productive under future climates.							
	National Interest Test Statement							
	The agricultural cropping sector is crucial to Australia's economy and needs fortification to ensure continued and productive cropping against a backdrop of increasing future climate variability and the serious decline in water and arable land. By increasing the efficiency and resilience to hotter and drier climates farmers will be able to make crucial decisions which crop to plant depending on the predicted climate for that season. Fortifying a significant part of the Agriculture sector ensures future jobs and sufficient supply of food and fodder. Giving farmers opportunities to mitigate variability in seasonal climates provides increased protection of future yield. Providing sufficient quantities of food will be important to insure the nation's food security. Furthermore, we have observed the social and economic impact on farmers in the recent drought with graziers not having enough supply of fodder for sheep and cattle. The proposed research provides the next step to mitigate these serious threats to agricultural productivity by providing new solutions to improve crop production.							
DP230101448	**Can eco-evolutionary theories explain outcomes of microbiome coalescence**	95,717.00	202,141.50	197,029.00	90,604.50	0.00	0.00	585,492.00
Singh, Prof Brajesh K	Environmental microbial communities are among the most abundant and diverse natural communities, responsible for many ecologically and economically important ecosystem functions, including primary productivity and climate regulation. This project aims to identify the biotic and abiotic factors that regulate community and functional outcomes of microbiome coalescence (the mixing of two different communities) caused by natural and anthropogenic activities. The outcomes will provide a unifying ecological framework to predict variation in microbiomes across different scales, ecosystem types and disturbances, and will generate critical knowledge for the development of effective microbiome products, a rapidly growing industry							

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	National Interest Test Statement Microbial communities of soil, plant and water are vital for healthy ecosystems, agriculture and climate regulation. Natural microbial communities frequently mix (coalesce) that can lead to drastic but unknown changes in biodiversity, crop health and other ecosystem functions. This project examines how microbial communities interact by transplanting different communities from one environment to another, using new modelling and experimental techniques. Outcomes include a detailed mechanistic understanding of how these microbial communities mix, ultimately leading to a deeper understanding of larger ecological systems. This should lead to improved natural resource management and conservation policies via continuous engagements with project stakeholders in land-management, industry and government. Environmental and economic benefits include ecosystem restoration, sustainable agriculture and improved plant biosecurity—all national priority areas. Engineering microbial communities, including probiotics for soils and people, has huge commercial potential and is one of the fastest growing industries globally and nationally.							
DP230101704 Collin, A/Prof Philippa J	**New Possibilities: Young People and Democratic Renewal** Vibrant democracies require generational renewal as norms, values and cultures evolve. This project is a systematic study of Australian students in the climate change movement. Examining who the students are, why they participate, how they organise, how they represent themselves and are represented by others in social and mainstream media, the project ethically advances ways of co-researching students' civic and political participation in offline and online settings. Expected outcomes include improved capacity for investigating student political action, new knowledge of the motivations, norms and practices that characterise student climate politics and concepts and tools for democratic renewal through engagement with young people.	74,508.50	150,787.50	158,784.50	82,505.50	0.00	0.00	466,586.00
	National Interest Test Statement The mass mobilisation of school students for action on climate change suggests many young Australians want a more participatory, inclusive form of democracy. This project examines how student leadership, organising and participation is shaping Australia's political and democratic culture at a time of global, social and political change. Working with young people to document and analyse how they are participating in politics in new ways, this project will create a unique digital media library and novel resource for democratic renewal. Social and cultural benefits include understanding young people's political values, actions and future commitments to democracy. These insights will inform political parties, civil society groups and educators on engagement with a younger political generation about democratic processes. The project will share research findings via the media library, public reports and a major international workshop with policy-makers, educators, civil society organisations and students.							
DP230102564 Liyanapathirana, Prof Samanthika	**Transforming Current Design Practice for Controlled Modulus Columns** Current design methods used for Controlled Modulus Column-supported embankments are outdated and uneconomical. This project aims to use innovative numerical and image processing techniques to develop new design methods that use 100% recyclable, environmentally friendly and highly durable EPS geofoam. Outcomes will advance the fundamental knowledge of bearing capacity increase of columns due to formation of smear zone and damages to nearby columns during installation. Numerical tools and design guidelines will be developed for engineers. The benefits include the design and construction of lighter, cheaper, safer and more stable embankments with significant cost and environmental gains from future infrastructure developments in Australia.	35,670.00	74,670.00	94,000.00	75,000.00	40,000.00	20,000.00	339,340.00
	National Interest Test Statement Many Australian roads and railways are built on deep deposits of soft soils, so the ground must be prepared using columns and weight-bearing elevated platforms (embankments), to enhance load bearing and stability before construction. This project aims to transform the outdated and uneconomical current practice combining better-engineered columns and all-weather-durable, lightweight polystyrene 'geofoam' for platform layers in the construction of embankments. Outcomes include simplified engineering construction analysis methods, software and new column installation processes. These are to be shared with practicing engineers and industry via workshops and new design guidelines. Environmental benefits include the use of 100% recyclable materials in embankment construction. Economic benefits include significant cost savings in transport infrastructure and maintenance, eliminating column damage during construction. Creating resilient transport infrastructure is a national priority, maintaining access between remote, regional and metropolitan areas, for social and economic equity, and supply chain connectivity.							

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DP230103079	**Online anti-racism for Australia**	78,004.50	142,814.50	115,186.50	50,376.50	0.00	0.00	386,382.00
Dunn, Prof Kevin M	Harmful manifestations of online racism are increasing. The neo-liberal assumption is that social media users and user groups can be responsiblised to disrupt online racism. This project analyses a subset of online anti-racism campaigns. The review provides the material to test effectiveness, using surveys. The survey findings will identify the ingredients for effective, safe and efficient online anti-racism intervention. An online anti-racism program will be developed, implemented and evaluated. The development of guidelines for online anti-racism will overtly address the challenges and risks of action in this environment where regulation is so heavily contested.							
	National Interest Test Statement							
	Australians are exposed to racism in online activity every day. Online anti-racism has emerged in response, but this has been under-researched. The lessons for success from four previous online anti-racism initiatives in Australia will be used to develop and deliver an anti-racism campaign. This includes identifying the most effective and safest forms of delivery for anti-racist activists, government agencies and everyday Australians. The campaign includes a set of Guidelines to be used by our community partners, which include Councils, schools, and anti-racist Non-Government Organisations. They will also be distributed to our partners within the State Government Departments of: Education; Community and Justice; and Multicultural Affairs. Data on the challenges and risks of doing online anti-racism will be shared with online platforms, prompting them to improve regulations to better protect anti-racist activists. Outcomes of the project will help to make online racism more difficult, lessen the socially damaging effects of racism and improve community relations and social cohesion.							
DP230103184	**Graded Symmetry in Algebra and Analysis**	68,500.00	138,000.00	140,000.00	70,500.00	0.00	0.00	417,000.00
Hazrat, Prof Roozbeh	This project will study graded symmetries in mathematics by modelling them as groupoids and inverse semigroups. Groupoids have been at the centre of mathematical interest for a long time, but have gained special prominence in recent years as a focal point for algebra, analysis and dynamics. The majority of groupoids can be naturally graded. The project introduces graded combinatorial invariants for groupoids (such as graded homology) and relates them to their Steinberg and C*-algebra counterparts (such as graded K-theory). The outcome is to give sought-after unified invariants bridging algebra and analysis, and to exhaust the class of groupoids for which these much richer invariants will furnish a complete classification.							
	National Interest Test Statement							
	This pure mathematics project seeks to employ the crucial role of partitioning and grading in understanding the symmetry in mathematical objects. Outcomes include finding sought-after unified invariants, bridging two main areas of Mathematics—Algebras and Analysis—and enhancing our fundamental understanding of mathematical symmetry. Outcomes will enhance our fundamental understanding of symmetry in mathematical objects, which through abstract algebra, has further applications in theoretical physics (development of string theory that can be used to improve our understanding of the universe), biology (through evolution of genomes which can help understand inherited disorders and their treatment) and cryptography (better data & finance security). The project will directly help to maintain Australia's position at the foundational science, and the leading edge of developments in the fast-moving areas of mathematics. The project will also train future mathematicians to strengthen science, technology, and mathematical discipline in Australia, the areas which are highly needed for the future of the country.							
	Western Sydney University	432,526.00	870,343.00	865,907.00	448,090.00	40,000.00	20,000.00	2,676,866.00
	New South Wales	10,299,965.00	21,235,329.50	20,914,228.00	10,680,559.00	883,695.50	182,000.00	64,195,777.00

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Northern Territory								
Charles Darwin University								
DP230102933	**Improving the Governance of Species Lists**	49,596.00	102,337.00	107,176.00	54,435.00	0.00	0.00	313,544.00
Garnett, Prof Stephen T	The aim of this project is to develop a system of governance for the creation of taxonomic lists. This project expects to apply knowledge of how other science organizations govern themselves to the governance of taxonomic lists, estimate the costs of current inefficiencies and identify impediments to improvement. Expected outcomes of this project include a process for validating global lists of species. This should provide significant benefits, such as single lists of species that can be adopted at any scale and are readily comparable across countries and applications. A single list will ensure threatened species and those of quarantine or health concern don't fall through the cracks and cause problems.							
	National Interest Test Statement Taxonomic lists are important for determining if a species is under threat of extinction to prosecute illegal wildlife traders. Currently taxonomists generate competing lists and non-taxonomists cannot tell which is the best one to use. Confusion about competing lists can lead to poor decisions such as allowing a pest into Australia because the correct name is not listed. This project aims to develop a governance process for creating a single list of the world's species that is informed by the practical uses of taxonomic lists. The result will be a single, accepted, regularly updated global list of species. An international advisory committee, consisting of lead players in governments and major taxonomic institutions, is in place to ensure the results are applied. Economic benefits include more efficient use of resources by government, industry and community groups by removing confusion about the taxonomy of species on lists. Environmental and health benefits include ensuring threatened species and those of quarantine or health concern are not missed simply because they do not have the right name on a list.							
	Charles Darwin University	49,596.00	102,337.00	107,176.00	54,435.00	0.00	0.00	313,544.00
	Northern Territory	49,596.00	102,337.00	107,176.00	54,435.00	0.00	0.00	313,544.00

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Queensland								
Bond University								
DP230101472 Rajaguru, A/Prof Gulasekaran	**Price Discovery in Equity and Volatility Futures for Trading and Hedging** This project aims to develop a multivariate asynchronous technique to analyse the price discovery of movements in equity stock indices, volatility index futures and exchange traded products. This project expects to generate new knowledge in the area of financial econometrics using an innovative mixed frequency sampling approach to establish robust causal inferences. Expected outcomes of the project include enhanced econometric theory and its implementation in applied finance. This should provide significant benefits in the price discovery of the equity index in Australia, including insights that will help Australian funds in hedging and trading volatility.	44,492.00	87,467.50	80,935.50	37,960.00	0.00	0.00	250,855.00
	National Interest Test Statement Alternative asset classes perform differently over time and superannuation funds use this diversification feature to help manage market uncertainty on behalf of members. However, there is no unique way to execute this responsibility – there are literally thousands of superannuation options available. This project will contribute to the national economy by proposing a novel approach to appropriately manage risk. This strategy involves learning from the observed link between special financial measures and the make-up of asset classes within a superannuation fund. This will allow fund managers to make more informed and superior decisions about the optimal composition of their portfolio. This approach should improve superannuation outcomes, particularly for retirees where unexpected dramatic market downturns can substantially impact retirement income. Put simply, these members will benefit by better avoidance of riskier asset classes. Crucially, the project's state-of-the-art evidence-based findings will be openly shared across the superannuation industry and with regulators.							
	Bond University	44,492.00	87,467.50	80,935.50	37,960.00	0.00	0.00	250,855.00
Central Queensland University								
DP230102780 Roach, Prof Gregory D	**Impact of cognitive task demands on the accumulation/dissipation of fatigue** Fatigue-related errors and accidents that occur at work cost the Australian economy $5.8 billion every year. Regulators and employers use mathematical models in special software to assess the fatigue risk associated with work schedules based on prior wake, time of day and recent sleep. Incredibly though, these models assume that the demands of your job have no influence on your level of fatigue, i.e., they do not differentiate between sitting quietly at work – and controlling air traffic, performing surgery or driving a truck. This project will improve the models by assessing how mental task demands affect fatigue. Models that are better able to predict fatigue will improve the health, safety and productivity of the Australian workforce.	55,299.50	120,574.50	118,414.00	53,139.00	0.00	0.00	347,427.00
	National Interest Test Statement Fatigue-related errors/accidents at work cost the Australian economy $5.8 billion pa. Biomathematical models are used to assess/control the fatigue risk associated with work schedules in safety-critical industries. Incredibly, current models assume that the job you do has no influence on your level of fatigue – they do not differentiate between sitting quietly for 12 hours, and controlling air traffic, performing surgery, or driving a truck for the same period of time. Rather, the models assume that fatigue is primarily affected by time on task. In this project, we will quantify the effects of task demands on fatigue across a day of work. The results will be used to improve fatigue models by including task demands as an input. If this improvement leads to just a 1% reduction in fatigue-related errors/accidents in Australian workplaces, that would provide savings of $58 million each year. The investigators have an ongoing collaboration with an Australian company that produces (and exports) software to manage fatigue risk in safety-critical industries, so there is a clear translation pathway for this research.							
	Central Queensland University	55,299.50	120,574.50	118,414.00	53,139.00	0.00	0.00	347,427.00

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Griffith University								
DP230100153	**Intelligent pattern recognition of water end uses enabling recommendations**	65,000.00	136,935.00	144,370.00	72,435.00	0.00	0.00	418,740.00
Zhang, Prof Hong	This project aims to develop a hybrid machine learning method for autonomously disaggregating high- and low-resolution water flow data received from smart meters into discrete end-use events, and a customised recommender system for efficient resource demand management. Project novelty and significance relates to this coupling and autonomous disaggregation of datasets from advanced sensors, enabling more efficient utility services delivery and lower customer utility bills. Project benefits include enabling utilities to better manage and plan resources in the information age, while empowering customers with real-time water end-use data and behaviour changing consumption recommendations.							
	National Interest Test Statement							
	Residential smart metering systems are now available to measure water usage at point of use. The project employs innovative approaches for harnessing and analysing data collected from smart water meters for use by consumers and providers. The analysed water end-use data (e.g., shower, toilet, outdoor, etc.) can reduce citywide water demand by up to 20%, as well as reduce the cost to supply water to customers. Residential water customers will benefit from easily understood and customised information on their household water usage. This information will empower households to make consumption choices that reduce their water bills and instil long-term resource consumption behaviour change. In addition, it will enable the water utility grid to operate more efficiently and at a lower cost. Substantial benefits will be realised in the management of strategic Australian water infrastructure assets, and environmental benefits including reduced greenhouse gases.							
DP230100460	**Safety and robustness of tall timber buildings under extreme dynamic events**	52,170.00	122,503.00	114,146.50	43,813.50	0.00	0.00	332,633.00
Guan, Prof Hong	This project aims to develop innovative and robust structural connections in tall mass timber buildings by characterising their mechanical behaviour under dynamic loads induced by extreme events like earthquakes or progressive collapse. This project expects to generate new knowledge in the safe, economic, and efficient design of mass timber buildings. Expected outcomes of this project include enhanced robustness design guidelines for the engineering community. This should lead to significant benefits, such as contributing to uptake of viable low-cost timber housing solutions in response to population growth and contributing to net zero emissions in Australia by 2050, and transition to safer and resilient infrastructure in urban development.							
	National Interest Test Statement							
	The current design of tall mass timber buildings poses uncertainties relating to their structural robustness level and their ability to resist dynamic loads induced by extreme events such as earthquakes, explosions, vehicle impacts, and climate related natural disasters like cyclones. This project aims to develop innovative and robust structural connections for mass timber buildings to transition to resilient infrastructure in urban development. This project will address critical knowledge gap in the safe and efficient design of future tall mass timber buildings. Expected outcomes include enhanced robustness design guidelines for the engineering community, new building standards and novel connections, enabling safer design and resilient buildings to support the UNs' Sustainable Development Goals, thus providing significant environmental, social, economic and commercial benefit to the Australian community. Project outcomes will also facilitate the Government towards providing low-cost housing solutions to address Australia's rapidly growing population while simultaneously achieving net zero emissions by 2050.							

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DP230100556	**Resolving surface nanobubbles as cavitation nuclei**	67,984.50	135,969.00	135,969.00	67,984.50	0.00	0.00	407,907.00
An, Dr Hongjie	This project aims to investigate the onset and control of cavitation, a challenging problem for over half a century. Cavitation is a process of bubble growth and subsequent collapse, and causes noise and damage to adjacent surfaces, e.g. the failure of ship propellers and valves. This project expects to unravel the mystery of cavitation nuclei, and to develop cavitation-free designs to mitigate the cavitation caused damage to propellers and valves, and noise. The anticipated outcomes will significantly advance existing fundamental knowledge at the forefront of fluid physics and provide Australia with a significant advantage in the marine, pump and valve industries, and significantly benefit the Australian industry and economy.							
	National Interest Test Statement							
	When mechanical parts like propellers spin in liquids, turbulence produces areas of greatly reduced pressure near the machinery's surface. Minute amounts of liquid vaporises as a result, creating tiny "cavities" which then implode due to higher pressure liquid surrounding them. This process of formation and collapse, called "cavitation", releases highly destructive shockwaves (over miniscule areas). Cavitation causes significant damage to machinery, costing billions of dollars in repairs each year in the maritime and manufacturing industries. It can also hinder the operation of prosthetic heart valves. This project aims to discover where cavitation originates and how it develops, so that novel technology can be developed to minimise or entirely prevent cavitation occurrence and damage. Through the development of cavitation-resistant technologies and commercialisation, this project will deliver significant cost savings to Australian marine and manufacturing industries. Further, enhancements to implanted medical devices will benefit thousands of Australians whose lives depend on their safe functioning.							
DP230100701	**Every Day Matters: Reducing School Non-Attendance in Autistic Students**	59,647.50	113,547.50	106,295.00	52,395.00	0.00	0.00	331,885.00
Adams, A/Prof Dawn M	Autistic children miss one day a week of school, three times more than their peers. This significantly impacts their learning, wellbeing and later, their vocational outcomes. This project aims to identify the factors that put autistic children at increased risk of missing school and map the supports and interventions used to reduce school non-attendance. Expected outcomes include an autism-specific model of the how and why school non-attendance is elevated for autistic students. It is anticipated that this model make the important step of enabling teachers and professionals to identify which autistic children are most at risk of absenteeism and select the best strategies to support a positive and beneficial return to school.							
	National Interest Test Statement							
	Autistic students miss three times more school than their peers, but we don't know why. This will be the world's first study to ask autistic children and adults, their parents and teachers what makes it so hard for autistic students to attend and what helps get them back into school. We will use this to inform a model of prevention and intervention which can be used by educators and policymakers to improve attendance, thereby allowing immediate translation into policy and practice. We will hold translation events, including a national symposium, to ensure key stakeholders are informed of outcomes. Improving school attendance for autistic students is critical. High rates of nonattendance impact learning, wellbeing and vocational outcomes, all of which have social and economic impacts for Australia. This is why Australia set school attendance as a national goal and school attendance in students with a disability as an area of key importance. With 43% of autistic students attending below the national target of 90%, there will be at least 32,000 Australian autistic students who will benefit from this work.							
DP230100704	**Re-Theorising Employee Voice in Times of Change**	22,954.50	78,930.50	93,274.50	37,298.50	0.00	0.00	232,458.00
Townsend, Prof Keith J	This project aims to generate new knowledge of the concept of employee voice as a part of organisational realignment throughout and following the CoVid-19 pandemic. The project aims to build a better theoretical modelling of efficient, effective "employee voice pathways" for the first time, including a understanding how voice changes over time. When confronted with a major external calamity, employee voice can play a critical role in any organisation's success, as well as the employee wellbeing. Expected outcomes include rigorous empirical evidence and theoretical developments to inform new policy and support organisations' capacity to survive and thrive, as well a support employee wellbeing.							

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	National Interest Test Statement Employee voice refers to workers having a say over matters that affect their working lives. Voice can improve organisations' problem-solving and dispute resolution while also contributing to employee dignity and wellbeing. However, how best to implement it in times of significant organisational change, such as the recent Covid pandemic, is less known. Through Australian and international case studies and through interviews with employees, unions and management, this project will identify the workplace conditions and processes that support employee voice. The findings will then be 'mobilised' for policy makers and industry practitioners, including via industry workshops and toolkits for managers. This will provide organisations with a practical evidence base of how employee voice can be used in decision making processes as well as ensuring employee wellbeing and organisational success, which in turn will deliver both social and economic benefits for Australia.							
DP230100780 Murphy, Prof Kristina L	**Understanding the emerging threat of conspiracy-fuelled extremism** This project aims to address the emerging threat of conspiracy-fuelled extremism in Australia. The project expects to produce new knowledge by identifying the unique factors driving this new form of extremism and the social harm it causes. Through three studies, the project will test a new theoretical model of conspiracy-fuelled extremism, will explore the threats and social harms this form of extremism creates, and will develop evidence-based insights into how it can be mitigated. The research should produce benefits for Australia by providing policymakers with a risk-assessment tool to identify individuals most 'at-risk' of violent extremism, and by providing knowledge about the services families may require to de-radicalise loved ones.	66,939.50	141,212.00	160,158.50	85,886.00	0.00	0.00	454,196.00
	National Interest Test Statement This project examines the emerging threat of conspiracy-fuelled extremism in Australia, which has been recognised as an emerging and increasing threat since the beginning of the COVID-19 pandemic. By identifying the factors driving conspiracy-fuelled extremism, the project will directly offer policymakers the insights required to identify and target those most at-risk of violent extremism. Specifically, both policymakers and intelligence agencies can use the risk assessment tool created in this project to identify 'at-risk individuals' and prevent conspiracy-fuelled extremist behaviour. The knowledge gained about the social harms caused by this type of extremism will also have direct application for services that families may require when seeking help to de-radicalise their loved ones. This research contributes towards creating a more socially cohesive, law-abiding, and safer society for all Australians.							
DP230101022 Pavlidis, Dr Adele	**Engaging Outsiders in Sport: Transforming Sport Event Legacy Planning** The project aims to investigate intersectional inequities in sport participation for girls, women and non-binary people in Queensland by working with them to envision legacies for the 2032 Olympic and Paralympic Games. Using a co-creation approach this project expects to identify how and what benefits can be achieved through legacy planning that engages with end-users who have historically been marginalised in sport. In doing so, the expected outcomes of the project include the development of evidence-based resources to improve engagement in sport and to build capacity and sustain meaningful change for communities and organisations.	59,000.00	103,500.00	109,824.00	65,324.00	0.00	0.00	337,648.00
	National Interest Test Statement Girls, women and non-binary people face a range of social, cultural, and economic barriers to sport participation. This has huge implications for health and wellbeing, community cohesion and the economy. Mega sport-events such as the Brisbane 2032 Olympic and Paralympic Games have the potential to break down these barriers, catalysing positive change and providing higher inclusion benchmarks as part of their legacy. We aim to work with people who are disengaged from sport to create a legacy plan that speaks directly to their needs and wants. We will engage girls, women and non-binary people across the life course (teenagers, parents of young children, older people) to develop a methodology for sport legacy planning that addresses questions of disadvantage. We will also engage key stakeholders in sport, government and community. The evidence-base developed through this project will directly benefit sport professionals working in diverse community settings to develop gender responsive practice and plans. The work will also demonstrate Australia's leadership, informing future planning processes globally with the goal of increasing sport participation, ensuring equitable investment and engaged communities.							

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DP230101205 Baum, Prof Scott W	**Regional resilience to economic shocks: Australia's COVID Economic slowdown** This project is designed to analyse how employment outcomes in Australian regions respond to economic shocks such as that caused by COVID-19. Set within the emerging literature dealing with employment resilience, the project uses unique data (Payroll Jobs index) to measure employment resilience and understand the factors that impact diverse regional outcomes. Understanding these patterns is significant as a region's economic performance has the potential to impact the well being of individuals and their families, as well as the sustainability of local economies and communities. The project will result in a nuanced understanding of regional employment performance that will inform policy in both government and non-government sectors.	45,661.50	118,742.00	127,898.50	54,818.00	0.00	0.00	347,120.00
	National Interest Test Statement During periods of economic shock, such as the recent pandemic, some Australian regions faced serious economic downturn, as evidenced by increased unemployment, while other regions were more resilient. Understanding how regions react to economic shocks and the speed at which they recover is important for the viability and well-being of local communities and their economies and for managing shocks and ensuring long-term prosperity. The project will investigate how the COVID-19 pandemic impacted employment in regions across Australia, how they were impacted, the length of time different regions took to recover and the factors that resulted in different outcomes. Outcomes will benefit local regional communities, businesses and governments by evidencing the way regional economic performance has evolved and identifying key features from regions displaying higher levels of resilience. Adoption will be facilitated through online tools that will allow the mapping of regional outcomes and the identification of factors key to identifying regional employment/economic resilience.							
DP230101253 Litvinyuk, Prof Igor	**Novel source of excited metastable atoms for Atom Trap Trace Analysis** This project aims to understand and to control light-induced processes in atoms by using finely shaped and tailored laser pulses, focusing on efficient production of excited metastable atoms. This is critical for efficient Atom Trap Trace Analysis, the most advanced technique for dating ground water and geological samples. Expected outcomes of this project include new and enhanced knowledge of physics of light-matter interactions, developing an efficient, clean source of excited metastable atoms, and integrating that source into the Australian National Facility for dating geological samples. This should provide significant benefits, such as significant improvement of operational efficiency and productivity of that facility.	55,839.50	160,186.50	210,581.50	106,234.50	0.00	0.00	532,842.00
	National Interest Test Statement Being able to prepare specific types of atoms in particular long-lived excited states is the key to being able to detect very small numbers of such atoms. This has many applications, including determining the age of ground water samples. With our advanced laser technology, we can do this preparation with high efficiency. This project aims to design and build this preparation device and integrate it into Australia's most advanced ground water analysis facility in Adelaide enabling a tenfold increase the efficiency over the current process used at the facility, with information provided to hydroelectric, mining industries and agriculture industries. As ground water is a national asset, and an increasingly scarce resource, it is important to know how old ground water samples are. Their age is a prime indicator of the time required for natural replenishment of the underground water reservoirs. Precise knowledge of the replenishment rate will allow more effective management of water resources and prevention of overuse and depletion and contribute to our understanding of water circulation in the planetary crust, facilitating evidence-based efficient water management in Australia and worldwide.							

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DP230101273	**Human use of early tropical forest ecosystems**	132,866.50	242,938.50	158,149.00	48,077.00	0.00	0.00	582,031.00
Louys, A/Prof Julien	This project aims to investigate the earliest records of tropical forests occupied by modern humans. This project expects to reconstruct ancient tropical ecosystems through time and in unprecedented detail by applying interdisciplinary methods including analyses of fossil mammals, carbonates, and pollen records. Expected outcomes of this project include novel ecological techniques of reconstructing the tropical forests that people first inhabited, and advancing our understanding of modern human behaviour, environmental adaptation, and past exploitation of key ecosystems. This should provide significant benefits such as better understanding of the long-term interaction between tropical forests, their faunas, and people.							
	National Interest Test Statement Tropical forests are powerhouses of many ecosystem services. Their clearance is the leading cause of animal extinctions and their exploitation exposes people to novel viruses. Yet we do not understand the nature of tropical forests first occupied by people nor people's impacts on those forests. By reconstructing tropical forest ecology through time, using novel chemical and fossil data, this project will provide accurate measures of the impact of environmental change caused by climate and human factors. This information is critical for conservation and in sustainable growth initiatives of neighbouring Asian countries. In Australia, rainforests are strong drivers of tourism and are of biodiversity and cultural significance but are at risk from environmental change and urbanisation. This project will benefit Australia by providing data used in predicting the effects of environmental change, helping safeguard the natural, cultural, and economic benefits of rainforests. The outcomes will have practical applications in planning of rainforest protection, contributing to the conservation and land management sector.							
DP230101499	**Decoding Bacterial Epigenetic Regulation**	112,174.50	236,106.50	228,157.00	104,225.00	0.00	0.00	680,663.00
Seib, Prof Kate L	This project aims to characterise bacterial epigenetic regulation by determining the mechanism of action and impact of bacterial DNA methylation. This project expects to generate new knowledge about fundamental aspects of bacterial gene regulation, using a novel combination of cutting edge DNA and RNA sequencing, proteomic and bioinformatic approaches. The expected outcomes of this project will provide new tools to facilitate the integration of epigenomic analysis into genomic studies, exponentially increasing the volume and value of data gathered. This would provide significant future benefits to all academic, biotechnology, agricultural, veterinary and pharmaceutical applications that involve bacterial genomic analysis.							
	National Interest Test Statement Bacteria are a fundamental part of all aspects of life, and have a significant impact on the environment, agriculture and health. Our understanding of bacteria has been revolutionised by genetics and DNA/RNA sequencing. However, the impact of epigenetics (changes that alter the physical structure of DNA but not its underlying sequence) on genes products (proteins) being switched on and off is only now being appreciated. This research project will provide new information to facilitate routine epigenetic analysis to allow a bacterial protein to be produced reliably with an optimal yield, which is crucial for commercial production of proteins for vaccines, therapeutic and protein products. The use of genetic and genomic information is widespread, and this research will add a new layer of valuable information that is currently invisible and will significantly contribute to Australian scientific and commercial interests. We will communicate this information through scientific publications and new, publicly available databases and software tools that will insure rapid uptake of the new technology.							
DP230101634	**Determining principles for successful episode retrieval of repeated events**	57,139.00	126,274.00	100,482.00	31,347.00	0.00	0.00	315,242.00
Powell, Prof Martine B	This project aims to develop the first-ever set of explanatory principles for how people successfully retain and retrieve individual episode memories from repeated experiences (e.g., one occurrence of a routine social encounter or job-related activity). By deepening our understanding of how memory works, this new knowledge is expected to lay the foundation for interview guidance and ongoing research aimed at enhancing the proficiency of investigations into matters that rely on detailed and accurate accounts of specific episodes. This includes workplace or traffic accident investigations, infectious disease contact tracing, as well as prosecution of repeated sexual offences.							

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	National Interest Test Statement							
	Repeated events are fundamental human activities. Recalling individual episodes of such events is challenging but often critical. Poor episode memory can profoundly impact societal and individual wellbeing. For example, sexual assault victims suffer the lowest prosecution rates of all indictable offences due to difficulty particularising these offences. Reducing the spread of infection relies on accurate reports with contaminated patients to identify contacts. Teachers, police, customs officers and corruption officials all interview people about repeated events as part of investigations into harm and wrongdoing. Achieving accurate enquiries would benefit all Australians, yet there is no guidance around how episode retrieval is optimised. This Discovery Project addresses that knowledge gap by generating a set of principles on how best to augment memory performance. The production of guidance documents will directly enable trained interviewers (even those without human memory expertise) to modify their interview techniques, while a short animation will allow the broader public to engage with the new knowledge.							
DP230101777 Brown, Prof Alexander J	**Mapping & Harnessing Public Mistrust: Constitutional Values Survey 2023-27** Declining public trust is well recognised as a problem of democratic government, including in Australia. However solutions are more elusive, confounded by the reality that mistrust and distrust play not just negative, but positive roles in our existing political and constitutional traditions. This project aims to be the first to comprehensively map the positive values of mistrust in citizen political attitudes and experience, building on previous Constitutional Values Surveys (2008-21) to test new measures of the content of trust including a first-ever longitudinal study of changing trust over time. The results will inform concrete solutions to three key policy reform dilemmas, providing better answers for sustaining public trust overall.	120,000.00	225,000.00	242,500.00	277,500.00	240,000.00	100,000.00	1,205,000.00
	National Interest Test Statement							
	Healthy democracy and the effectiveness of all public services hinge on maintaining trust by our communities. This project will benefit all Australians by providing the evidence governments and other stakeholders need to comprehensively address declining public trust in public institutions. We will provide more useful, world-leading measures of trust's different dimensions (e.g., performance, probity, process) across the community, establishing how mistrust and distrust can be better harnessed, institutionally, to support greater trustworthiness in our political system. Our national survey research will inform concrete responses to key concerns and policy challenges for citizens, notably through reforms to combat the rise of disinformation in politics, ongoing trust conflicts between federal and state governments, and questions over the honesty and integrity of officials, also reflected in current anti-corruption reforms. The project will extend valuable time-series data collected by the Australian Constitutional Values Survey since 2008, adding new longitudinal studies of changing trust. The project benefits Australians socially and economically by helping rebuild and sustain trustworthiness in the constitutional and policy systems on which all prosperity depends.							
DP230102158 Feng, A/Prof Huiyun	**Discerning China’s Foreign Policy Playbook: Goals and Strategies** This project aims to unpack China’s foreign policy decisions and policy making through exploring the agency of Chinese scholars. By conceptualising a new theoretical model of Chinese scholars’ perceptions, signals and debates, this project expects to generate new knowledge on the goals and strategies of China’s foreign policy in the economic, trade, political, and security dimensions through elite interviews, textual analysis, and focus group research. The outcomes will include analyses for use by Australian policy, academic and business communities. During times of difficult communications, attaining a realistic understanding of China’s current and future policy orientations can enable more constructive and effective China policy.	20,587.00	55,551.00	65,188.00	30,224.00	0.00	0.00	171,550.00
	National Interest Test Statement							
	This project is an exploration of a new approach to the study of China's foreign policy. Whether China is seen as a strategic partner or a strategic competitor, Australia needs to "get China right" to protect the rules-based international order in the Indo Pacific. The need for comprehensive, systemic, and original unpacking of China’s goals and strategies is more critical than ever. Built on a new theoretical model, this project will analyse Chinese foreign policy through a systematic examination of the perceptions, signals, and debates of Chinese scholars. This research produces new knowledge and a new pathway to understand and predict Chinese behaviours in the key areas of economy, trade, democracy and human rights, and military alignment. The outcome is a series of theory-driven, evidence-based, and policy-relevant research and policy reports for Australian policymakers e.g., DFAT, in guiding a more constructive and effective China policy.							

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DP230102192 Li, Prof Qin	**Biomass-derived Carbon Dots Enable Flexible, On-Demand Hydrogen Delivery** Methanol is a promising liquid hydrogen carrier for long distance H2 transportation and exportation, because it is rich in hydrogen content, cheap, recyclable between methanol-formaldehyde and easier to manufacture from renewable resources including biomass waste. The critical bottleneck in adopting methanol as the carrier is the demanding dehydrogenation process. The project aims to create a new class of photocatalyst based on biomass-derived carbon nanodots grown on transition metal (di)chalcogenide nanosheets that can effectively enable a light-controlled methanol H2 release of desired quantity. The key outcomes will be a new class of photocatalysts and flexible, on-demand hydrogen delivery technology for liquid hydrogen carriers.	67,246.00	139,620.50	149,378.50	77,004.00	0.00	0.00	433,249.00
	National Interest Test Statement Hydrogen (H2) is a vital energy solution for reducing carbon emissions. Australia is on track to be a major H2 producer, able to generate export income of up to $10bn pa by 2040. However, long-distance transport of liquefied H2 is still economically unviable due to the very low temperatures required. Stable “carrier” materials are needed. Methanol stands out as a cost-effective liquid H2 carrier that is able to hold and then release H2 without emitting carbon and which can be used with current transport infrastructure and storage methods. Further, Australia produces over 130 mega tonnes of biomass (animal and plant) waste pa. Utilising this waste to produce methanol is cost effective and reduces its negative environmental impact. The missing piece is an on-demand, room-temperature H2 release process. This project aims to develop a new technology platform to enable controlled H2 release from methanol as required at the site of use and at room temperature. This platform and its commercial development through the hydrogen industry will advance Australia as a key global player in the green hydrogen industry.							
DP230102313 Stanisic, Dr Danielle I	**A next-generation whole parasite bovine Babesia vaccine.** In Australia, Babesia parasites cause most of the severe and often fatal cases of cattle-tick fever, a globally significant tick-borne disease. It can be prevented by a live-attenuated parasite vaccine which has critical limitations of a 4-day shelf-life and risk of severe disease if administered to adult cattle. This project aims to evaluate in cattle a novel whole parasite Babesia bovis vaccine that cannot cause disease and can be preserved as an off-the-shelf product without losing efficacy. The expected outcome is a significantly improved vaccine for a major infectious disease that affects primary food production. As the disease imposes a major economic burden, it will have great benefit for the Australian livestock industry.	217,703.00	301,085.00	83,382.00	0.00	0.00	0.00	602,170.00
	National Interest Test Statement Cattle tick fever results in substantial economic losses to the Australian cattle and dairy industries. While the current live, attenuated vaccine is generally effective, it has several limitations including a 4-day shelf-life and risk of severe disease if administered to adult animals. This project will enable evaluation of an effective next-generation vaccine that addresses these issues. This is advantageous to Australian livestock producers as it can be administered with minimal risk and the extended shelf-life would enable easy deployment in regional areas. The outcome of this project will have great national benefit for the Australian livestock industry, in the form of an improved vaccine for an infectious disease that affects primary food production and imposes a great economic burden. It is anticipated that an improved vaccine will have major economic benefits by boosting productivity of the livestock industry. The data generated in this project will enable meaningful engagement with veterinary pharma companies and this will inform further development of this vaccine and its adoption into practice.							

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DP230102504	**Towards Robust Hydrogen Electrode for High-Rate Alkaline Electrolysis**	59,104.50	117,209.00	116,209.00	58,104.50	0.00	0.00	350,627.00
Liu, A/Prof Porun	This project aims to develop robust, efficient porous hybrid hydrogen electrodes for electrochemical hydrogen production in anion exchange membrane water electrolyser. anion exchange membrane water electrolyser powered by renewable energy has emerged as a key avenue towards clean hydrogen with zero carbon footprint. However, the electrochemical turnover on the hydrogen electrode has been significantly hindered by the sluggish reaction kinetics in alkaline solution. The project is expected to generate cost-effective hydrogen electrodes for hydrogen electrolyzers, advanced knowledge in the electrode material engineering, electrochemical reaction mechanistic insights, and eventually promoted development of disruptive electrolysis technology.							
	National Interest Test Statement Greener energy systems are essential to Australia achieving net-zero emission targets to mitigate global warming, while still fulfilling increasing energy demands. A new means to achieve these goals comes from using renewable (solar and wind) generated electricity to split water into green hydrogen and oxygen. This approach has enormous potential, but some technological challenges are constraining 1. production efficiency, through large energy losses at the splitting-reaction surface, i.e. the hydrogen electrode, and 2. the durability of the electrode. This project aims to design and engineer efficient, reliable and cost-effective hydrogen electrodes. The outcome of this project will be the proof of concept for novel hydrogen electrodes that achieve high-rate, stable water splitting, ready to advance to prototyping in conjunction with Australian industry. This project will make a significant contribution to the development of cost effective and clean hydrogen production and driving both environmental and economic benefits.							
	Griffith University	1,282,017.50	2,555,310.00	2,345,963.00	1,212,670.50	240,000.00	100,000.00	7,735,961.00
James Cook University								
DP230100078	**Sex is important in adaptation to environmental change**	59,992.00	129,440.50	114,190.00	44,741.50	0.00	0.00	348,364.00
Donelson, Dr Jennifer M	Aims: This project will use novel experiments with the aim of determining the potential for plasticity to be adaptive with sexual selection and how non-genetic effects transfer across generations by establishing genomic mechanisms. Significance: Plasticity (or acclimation) is often hailed as the saviour for species in the face of rapid climate change, but it is problematic if it is not adaptive in nature. Expected outcomes: Expected outcomes include an enhanced ability to predict adaptation of fish under environmental change. Benefits: This project will provide significant benefits to Australian and international communities that rely on fish for nutrition, economic and social values, through an improved evidence base to inform management.							
	National Interest Test Statement Understanding of whether plants and animals can adjust and adapt to rapid environmental change is critical to managing the natural resources that our human population relies on. Some individuals within a population can acclimate to environmental change, but whether this benefits future generations can depend on if these individuals get to reproduce. This project will test an important knowledge gap by including processes like mate choice, which might select the sexiest individuals but not the best for living in altered environments. This research will provide enhanced understanding to resource managers on the response of fish and fisheries to future environmental change allowing more resilient freshwater and marine ecosystems. Economic benefits to Australia will result from Federal and state management agencies, for example the Department of Primary Industries, using the knowledge gained to adjust conservation and harvest practices creating greater food security and environmental sustainability.							

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DP230100112	**Advancing the chemistry of rare earths - an Australian resource**	85,500.00	171,000.00	171,000.00	85,500.00	0.00	0.00	513,000.00
Junk, Prof Peter C	This project aims to advance knowledge of the synthesis, structures and reactivity of highly reactive rare earth metal-organic compounds. The project expects to build the knowledge and skills to underpin many developments of Australia's still under utilized rare earth resources to diversify from Chinese domination. The anticipated outcomes will be new synthetic and reaction chemistry including a demonstration of how size and electronic factors can be used to modify and advance rare earth chemistry. This project should provide significant benefit such as are a better knowledge base in rare earth chemistry to underpin future applications in chemical manufacturing, new materials, catalysis and recycling.							
	National Interest Test Statement The holy grail in chemical synthesis is the discovery of new ways to transform molecules under mild, sustainable conditions. Our highly reactive rare earth (critical metal) compounds will make and break carbon-carbon and carbon-oxygen bonds, delivering innovative new products. Australia has vast rare earth deposits, from which are produced rare earth oxides which supplies materials essential for cars, computers, and green power. New rare earth chemistry will strengthen Australia’s world ranking position in this area. Our project will provide the next generation of highly qualified scientists in the field. Significant advances in newer greener synthetic methods (e.g., replacing mercury with copper or other simple procedures) will be developed and chemistry involving breakdown of harmful molecules, e.g., fluorocarbons, will enhance Australia’s environmental credentials. The project will underpin future applications in chemical manufacturing, new materials, catalysis, and industrial recycling.							
	James Cook University	145,492.00	300,440.50	285,190.00	130,241.50	0.00	0.00	861,364.00
Queensland University of Technology								
DP230100025	**New mathematical approaches to learn the equations of life from noisy data**	75,390.00	210,600.00	217,610.00	82,400.00	0.00	0.00	586,000.00
Simpson, Prof Matthew J	New mathematical models and mathematical modelling methods must be continually developed to interpret emerging biotechnology experiments. Contemporary research in tissue engineering involves growing tissues on 3d-printed scaffolds to mimic constrained in vivo geometries. Previous mathematical models of tissue growth focus on computationally expensive discrete mathematical models that are poorly suited for parameter inference and experimental design. This project will deliver and deploy high-fidelity, computationally efficient moving boundary continuum mathematical models that will: (i) predict/interpret new experiments, (ii) provide quantitative insight into biological mechanisms, and (iii) enable reproducible experimental design.							
	National Interest Test Statement Tissue growth experiments produce artificial tissues in the laboratory, with the long-term aim of repairing damaged or diseased tissues (e.g. skin, bone, muscle). Current experiments are developed using trial-and-error, which is expensive and wasteful, and provides limited biological information. In contrast, mathematical models can speed up the design and interpretation of these complicated experiments. This project will produce new mathematical models of tissue growth experiments that will benefit the Australian biotechnology sector by developing new ways to rapidly design experiments without trial-and-error. Mathematical models will be translated into free-to-use computer algorithms and smartphone applications that biotechnologists will use to optimise data collection protocols that maximise biological insight, while minimising experimental cost and waste. This project will contribute to Australia’s long-term economic prosperity and social wellbeing by developing new tools to translate benefits of the biotechnology revolution into improved economic and health outcomes for all Australians.							

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DP230100041	**Teacher attraction and retention in hard-to-staff schools**	49,945.00	106,525.00	127,030.00	70,450.00	0.00	0.00	353,950.00
Mills, Prof Martin D	Australia is facing a teacher shortage crisis. Many schools have become 'hard-to-staff' – evident through either a lack of teachers or a high teacher turnover. The aim of this project is to provide the foundations for strategies that can be implemented by schools and systems to address this problem. Due to the schools' locations, these shortages can have severe consequences for already educationally vulnerable young people. This has been a significant concern of governments nationally and internationally. An important outcome from the project will be how best to attract and retain teachers in hard-to-staff schools. This will have benefits for the teaching profession, young people who attend hard-to-staff schools and the broader community.							
	National Interest Test Statement							
	This project will enhance Australia's capability to address teacher shortages by investigating the problems that schools in 'less desirable' locations have had in attracting and retaining teachers and how they have sought to address these, and by tracking teachers who begin their careers in these schools. The project will produce substantial educational, economic and social benefits for the Australian and international community by ensuring that the most marginalised young people in Australia have access to a high quality and stable teaching workforce. It will offer high quality postdoctoral mentoring and postgraduate training in a world class intellectually stimulating environment. The findings will inform future approaches to the global problem of teacher shortages, especially in hard to staff schools, nationally and internationally.							
DP230100305	**Sequence-Defined Polymers with Optical Information Readout**	76,625.50	156,625.50	150,775.50	70,775.50	0.00	0.00	454,802.00
Barner-Kowollik, Prof Christopher	The project aim is to introduce the first optically readable sequence-defined polymers based on fluorophore excimers, whose information content can be read as simply as conventional barcodes. These macromolecular barcodes, embedded in solid polymer matrices, will overcome the current limitations of reading information from synthetic macromolecules. An interdisciplinary effort will fuse chemistry, law, and criminology to develop the technology in ways that are expected to address illicit plastic waste trafficking – ending the anonymity of polymer waste by creating a regulatory and criminological paradigm for tracing plastic waste to hold actors in the value chain responsible.							
	National Interest Test Statement							
	Plastic waste is one of the biggest issues facing Australia and the world. A barrier to reducing plastic waste is the lack of effective traceability along supply chains. Knowing who produced a plastic product and how they produced it is important for recycling, incentivising new manufacturing practices and combatting illegal plastic waste. Our project creates a way to trace plastics through supply chains by unique object identification. As well as developing the technology required to trace plastics, our project investigates how to embed plastic traceability in supply chains and law. The project is an investment in Australia's ability to regulate plastics trading in light of the newly introduced ban on the export of plastic waste, the National Plastics Plan and the international treaty developed to combat plastic waste. The project's outcomes will engage plastic manufacturers and regulators in Australia and globally. Ultimately, industries and regulators will be provided with a new technology for plastics traceability and the knowledge about how to use this technology to combat plastic pollution.							
DP230100445	**Microspheres from (Sun)Light – A Sustainable Materials Platform**	54,500.00	110,500.00	106,500.00	50,500.00	0.00	0.00	322,000.00
Barner-Kowollik, Prof Christopher	This project will break new ground in light-induced step-growth precipitation polymerisation techniques for polymer particle formation that do not require any initiator, surfactants, additives or heating, thus constituting an environmentally friendly process. The project will establish the underpinning photochemical particle formation processes and establish a broad monomer base for the production of particles with a wide property profile, including particles with tailored surface properties and the ability to degrade upon a defined trigger signal. Scaling the particles' synthesis, including using Australian sunlight, will enable multi-gram production allowing real-world applications.							

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	National Interest Test Statement							
	The project will pioneer a new energy-efficient method for harnessing sunlight to produce materials used in diagnostic tests (such as COVID rapid antigen tests or home-pregnancy kits) as well as for drug delivery. These materials known as polymeric microspheres are constituted of long chains of molecules that assemble into spheres, usually via a thermal process. Our project will develop novel chemistries exploiting Australia's sunlight for the production of microspheres featuring a wide range of properties with less waste and at lower energy cost, ultimately being scaled into commercial production. This project is particularly tailored to Australia by leveraging its abundance - yet underutilized resource - of natural sunlight and will place Australia at the forefront of chemical innovation with an environmentally friendly approach. Once established, this Australian owned technology can be commercialised through partnerships with leading healthcare or diagnostic companies or through the potential foundation of start-up ventures to produce and sell bespoke microsphere products.							
DP230100721 Toh, A/Prof Yi-Chin	**A Biologically Responsive and Anatomically Authentic Human Nasal Model** As respiratory conditions caused by pollutants and viruses become more prevalent, human nasal models to study infection/protection mechanisms and nasal drug/vaccine delivery are increasingly important. This project aims to develop a world-first human nasal model to mimic both anatomical and biological aspects of the nasal cavity and predict the distribution and deposition of fine particles and the resultant biological response from the nasal mucosa. The aim is to overcome a key fabrication challenge - to 3D print an anatomically accurate nasal construct with a porous wall on which to grow and mature functional nasal tissue that lines a nasal cavity wall. The benefit would be enabling faster development of more targeted drugs and vaccines.	72,000.00	161,090.00	178,590.00	89,500.00	0.00	0.00	501,180.00
	National Interest Test Statement							
	This project aims to develop a world-first combined physical and biological model of the human nose. It can replicate and measure the movement of particles (e.g. pollutants, allergens and viruses) within the human nasal cavity and their subsequent biological interaction with cells lining the cavity. This would overcome current reliance on a battery of computational, cell and animal models to conduct preclinical testing of new antiviral therapeutic or preventive medicine as well as drugs or vaccines delivered through the nose, which is slow and often inaccurately predicts human responses. This model could help Australian therapeutics companies tap into the USD 71 billion intranasal antiviral therapeutics and USD 70 billion intranasal drug delivery markets by accelerating and diversifying their product development. To facilitate adoption QUT will utilise its extensive relationships with Australia's biofabrication industry stakeholders, to negotiate a licence to manufacture the new nasal models for therapeutics companies or for preclinical testing service providers.							
DP230101171 Woodcroft, Dr Benjamin J	**Global integration of microbial community and climate data** Microbial communities in the environment control the cycling of carbon and nutrients on Earth, but climate models do not directly incorporate microbial inputs. This interdisciplinary project will link planetary-scale climate modelling data with novel large-scale microbial community analysis, using climate information to provide insight into the fantastic diversity of microbial processes on our planet. The interdisciplinary approach will inform the next generation of climate models and better predict our future climate's feedbacks. Conversely, it will make progress on the grand challenge of understanding microbial community function by enabling microbial ecology to be treated as a data-intensive machine learning problem.	44,127.00	114,514.50	142,912.50	72,525.00	0.00	0.00	374,079.00
	National Interest Test Statement							
	Microorganisms play key but underappreciated roles in the health of our planet - some contribute to climate change while others constrain it. Yet current models of climate change mostly ignore the influence of microbial communities. This study will be the first of its kind to incorporate large scale microbial data into climate change models, thereby increasing their accuracy. Sharing our new results on microbial community profiles with traditional climate change scientists will enhance the utility of climate prediction models. In the long run, better climate models will help inform practical ways that Australian society and businesses can adapt to offset the many socio-economic and environmental challenges of climate change. The project will also help us better understand how environmental conditions shape microbial communities. A project website will illustrate the complex relationship between Earth's ecosystems and microbiology. Our findings will guide novel applications of microbiology in environmental sustainability, industrial enzyme use and human microbiome health.							

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DP230101313	**Building A Better Built Environment for Older Australian's Ageing-in-place**	57,462.00	115,876.50	115,279.50	56,865.00	0.00	0.00	345,483.00
Xia, A/Prof Bo P	Most older Australians prefer to age in place after their retirement. This project aims to understand how the built environment as a comprehensive system supports (or hinders) their ageing-in-place given that the existing Australian built environment fails to meet older Australians' requirements for independent living. This project expects to generate new knowledge in the area of ageing-friendly communities using Bayesian Network analysis and interactive design charrettes. Expected outcomes include an evidence-based Bayesian network model that determines how the built environment affects independent living in the community and design innovation and guidelines to improve the built environment design for older Australians' ageing-in-place.							
	National Interest Test Statement							
	Most older Australians prefer to age-in-place, meaning they want to live independently in their homes within their familiar community for as long as possible. However, most existing built environments in communities do not make it easy for older people with reduced mobility and strength, and may not always fully support their physical, mental and social health and wellbeing. This project investigates how the built environment as a system affects and supports older Australians' ageing-in-place. This new knowledge will benefit older Australians by enabling them to continue to engage and remain active in age-friendly communities. This project will deliver practical guidelines for urban planning departments at all government levels, architects, and facilities managers to better plan, design and manage the built environment to support older Australians' ageing-in-place. Application of these guidelines will lead to socio-economic benefits as prolonged independent living of older Australians not only improves their quality of life but also significantly reduces public expenditure on aged and clinical care.							
DP230101404	**Understanding bone structure evolution using machine learning**	87,000.00	176,500.00	111,500.00	22,000.00	0.00	0.00	397,000.00
Pivonka, Prof Peter	Bone remodeling is the ancient process of bone resorption and formation that optimises material properties and has led to evolution of terrestrial vertebrates. To date it is not understood how remodeling achieves tuning of bone material. This proposal aims to develop a machine learning based approach, linking computational modeling and imaging to address this problem. Intended outcomes are development of a multiscale model of remodeling and machine learning algorithms for image analysis. This approach will help establish a structural-functional link between remodeling and bone material optimisation which ultimately provides significant benefits for bone tissue engineering, fracture healing and improved therapies for osteoporosis.							
	National Interest Test Statement							
	There is a clear lack of understanding of how human bones are optimised towards being strong and light weight at the same time. This project will provide new insights into the structural-functional links that lead to optimisation of bone material properties. Relying on knowledge that exists only in the QUT laboratory this project will develop a new technological platform for bone research that will allow testing to determine how exercise and/or drug treatments can strengthen bones. This project has the potential to help identify better osteoporosis treatments including combinational therapies based on optimised bone material properties. Understanding how bones are mechanically optimised to resist fracture is of major relevance to Australia's national interest, because osteoporotic bone fractures have major detrimental effects on an economic and social level. Research outcomes will be shared in the form of presentations to relevant health system providers. To ensure translation and adoption of these research findings engagement with Australian bone health foundations and societies will be sought.							

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DP230101625	**2D oxide supported single-atom catalysts for sustainable fuel generation**	57,500.00	115,000.00	117,500.00	60,000.00	0.00	0.00	350,000.00
Liao, A/Prof Ting	This project aims to develop two-dimensional oxide supported single-atom catalysts for sustainable fuel generation from water and CO2 using combined theoretical and experimental investigations. The outcomes of this project will offer atomic and electronic level principles in designing high-performance catalysts and provide novel approaches on green fuel generations for emerging energy technologies. The success of this project will meet the knowledge gap between advanced materials and practical sustainable energy technologies, and contribute to the development of sustainable society of Australia and international community by supplying low-cost and green fuels.							
	National Interest Test Statement							
	Research on sustainable fuel generation is urgently needed to meet Australia's target of net zero emissions by 2050. This proposal seeks to generate clean hydrogen from water and to convert the over-emitted CO2 in the atmosphere to carbon-containing fuels. The sustainable generation of fuels, however, can only be realised with the help of catalysts, which unfortunately suffer from issues of high-cost and low-efficiency. This project will develop new theory and experimental validation for the design of novel catalysts with maximum efficiency for hydrogen production and CO2-fuel conversion. We will also develop new design principle to minimise the use of costly active metals in these processes. The breakthroughs in catalysts we will achieve in this project will be translated into building hydrogen industries as a part of the National Hydrogen Strategy. Project outcomes will position Australia as a leader in clean energy technologies, will advance cutting-edge sustainable technologies, and will contribute to the reduction of CO2 emissions for the environmental benefit of Australia and beyond.							
DP230101666	**Innovative Stable Free Radical-Substituted Conjugated Electronic Polymers**	82,500.00	170,000.00	177,500.00	90,000.00	0.00	0.00	520,000.00
Sonar, Prof Prashant	The project aims to develop an innovative class of stable free radicals side-chain substituted conjugated donor-acceptor electronic polymers with unique polaronic and radical charge transport capabilities. The targeted optoelectronic material class is unique and has not been explored in depth before. The combination of unpaired electrons and delocalized backbone -electrons delivers exciting modes of charge transfer that provide these novel materials with clear potential as electroactive materials with applications in various nanoelectronics devices. Developing a fundamental understanding of charge transport properties and potential device applications will open up a new field of research in advanced optoelectronic technology.							
	National Interest Test Statement							
	The active materials used in electronic devices are undergoing continual improvements to generate devices that are lighter, flexible, stretchable, and more energy efficient. This project will pioneer a new type of polymer with uniquely tunable electrical conductance provided by two parallel channels and a wide range of light absorption properties for incorporation into the next generation of advanced electronic devices. The composition of the innovative material can be tailored to enable significant improvements in energy efficiency and increased flexibility when it is printed for use in lightweight electronic devices such as transistors, wearable sensors, energy conversion, and storage devices. This work will provide a competitive advantage to Australian companies manufacturing materials for electronic devices and facilitate a shift towards a more sustainable and resource-efficient society. It is anticipated that these advances in materials design and manufacture will be translated into commercial products through established partnerships with industries within the advanced manufacturing sector.							
DP230101904	**2D Multiferroics: From Materials Design to Device Conceptualization**	70,000.00	155,000.00	165,000.00	80,000.00	0.00	0.00	470,000.00
Kou, A/Prof Liangzhi	This project aims to design new transistors with high efficiency and low energy costing for the storage applications based on two-dimensional multifunctional heterostructures. Extensive computational simulations and joint experiments will be employed to develop fundamental knowledge essential to understanding the phenomena of magnetoelectric coupling, which is used to guide rational device design and implementation. The designed magnetoelectric heterostructures and the multiferroic devices are expected to provide strong foundations for technological innovations resulting in devices with superior functionality and efficiency. The outcome of the project will significantly benefit high-tech electronics.							

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	National Interest Test Statement							
	The continuous miniaturization of silicon chips that have powered computers in the past decades is reaching the physical limit imposed by fundamental physics laws. This project will address this challenge by developing new electronic technologies based on ultra-thin materials, which are only one or a few atoms thick, through a synergy of theoretical prediction and experimental demonstration. This project will generate fundamental knowledge on the design of new digital memory and logic devices, which can operate faster, have higher information storage capacity and be more energy efficient than today's silicon-based chips in smart devices. The produced knowledge and prototypes will inform further research in Australia to develop next-generation electronic devices and help place Australia at the vanguard of the global strategic microchip ecosystem. The technological know-how and intellectual property generated from this project will create paternship opportunities with Australia's semiconductor sectors through licensing and commercialisation pathways for boosting this critical manufacturing capability.							
DP230102229 Sauret, Prof Emilie	**Novel framework for optimising battery-cooling microchannel heat exchangers** Thermal overheating can affect the capacity, safety and life expectancy of batteries for renewable energy storage and electric vehicles. Microscale heat exchangers are a potential high-efficiency, low-bulk solution. This project aims to develop a novel computational methodology to optimise the design of those heat exchangers in which viscoelastic fluids are used to control flow instabilities and enhance heat transfer at the microscale. A new microscopic fluid physics model will provide data for an innovative neural network framework to optimise the working fluid conditions and microscale design, which could contribute to increased adoption of renewable energy technologies that are supported by microscale heat exchangers.	88,842.00	168,842.00	155,000.00	75,000.00	0.00	0.00	487,684.00
	National Interest Test Statement							
	Overheating of batteries reduces their lifetime and energy storage capacity, and can lead to fires. This project aims to develop a new method for designing a class of battery cooling devices known as microchannel heat exchangers. Based on a deeper understanding of the flow of novel cooling fluids, a machine learning-based software will be developed to optimise the design and operating parameters of new devices with significantly greater ability to remove heat. These devices will be lighter, easier to manufacture, and use less energy than alternative devices. They could be used for renewable energy storage, in electric vehicles, or for high-power electronics. As such, this research will aid Australia to reach its carbon emissions reduction targets of 43% by 2030 and net-zero by 2050. QUT is already advancing battery manufacture through the National Battery Testing Centre established in collaboration with industry and state government participants of the Future Battery Industries CRC. These industry connections are a direct route to accelerate the adoption of the design software developed in this project.							
DP230102299 Turner, Prof Ian W	**Transforming Australian bio-based industries through multiscale modelling** Agricultural and forestry biomass can be converted into feedstocks for production of biofuels and biomaterials via synthetic biology. A key challenge is the complex biomass microstructure renders it highly resistant to conversion, and pretreatment is crucial for enhancing process efficiency. Micro-CT imaging will enable particle characterisation and identification of changes in the fibre composition during pretreatment. This information will be used to create a virtual biomass particle model for an in silico investigation to inform optimal process design. The framework will transform the way biomass is processed, contributing to the growth of the Australian bio-manufacturing industry by making it more productive, profitable and sustainable.	76,000.00	160,500.00	163,000.00	78,500.00	0.00	0.00	478,000.00
	National Interest Test Statement							
	The Australian agricultural and forestry sectors produce large amounts of forest residues, wood and agricultural fibre wastes that are a major renewable organic material resource. This resource can be exploited by emerging industries to help grow Australia's economy, by manufacturing renewable bioproducts such as biofuels, bioplastics, textiles, and biochemicals. This project will create new methods for optimising the development of bioproducts by bringing together advanced imaging, experimentation, and mathematical modelling to better understand fibre-based feedstocks, and how they are modified through manufacturing processes. The technologies developed will provide model-based approaches that can inform biomanufacturing industries on ways of improving process design, leading to efficient and sustainable operations along with reductions in overall manufacturing costs. The growth of biomanufacturing industries, through the production of high value bioproducts, will increase farm revenues and create knowledge-intensive jobs in regional and rural areas that will sustain communities in regional Australia.							

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DP230102414	**Computational modelling of nanofluids for industrial applications**	59,000.00	123,000.00	127,500.00	63,500.00	0.00	0.00	373,000.00
Liu, Prof Fawang	The use of nanoparticles in heat transfer fluids, then known as nanofluids, increases their specific heat and thermal conductivity. Recent experimental works highlight that anomalous transport phenomena are evident in nanofluids that cannot be adequately described by classical conservation laws. We will extend these conservation laws to incorporate fractional operators to capture the fluid memory effects and the impact of particle clustering. Computational modelling and experimental investigations will be undertaken to identify the heat transfer mechanisms of various nanofluids. The outcomes of the work will increase knowledge on nanofluids and offer a significant opportunity to improve the efficiency of many thermal engineering systems.							
	National Interest Test Statement							
	As energy consumption continues to rise sharply, many industries are focused on the implementation of technologies that provide improvements in energy efficiency and reduce operating costs. Heat transfer fluids are widely used in these industries as cooling systems for this purpose. This project will use a combination of computational modelling and experimentation to expand current knowledge of the fundamental mechanisms of the unique enhancement in heat transfer properties of the fluid observed when small solid particles are added to heat transfer fluid (to make what are called nanofluids). This study will form a new framework enabling the broader application of nanofluids across the Australian energy sector. This framework will be vital for optimising the design and adoption of efficient and high-performance energy systems having the potential to reduce greenhouse gas emissions across many fields of technology, including power plants, biomedical technologies, solar energy, microelectronics, and microfluidics.							
DP230102727	**Artistic Practice in Australian Videogame Development**	22,857.50	54,471.00	65,961.50	34,348.00	0.00	0.00	177,638.00
Keogh, Dr Brendan R	The game industry is the largest cultural industry in the world. Its economic growth relies in part on the artistic innovations of non-commercial developers and communities operating beyond the industry's purview. Policymakers and researchers alike struggle to account for the cultural contexts and creative origins of game development. This project conceptualises and empirically investigates 'artist-gamemaking' to generate new knowledge on the ambitions, techniques and histories of Australia's game industry. It develops resources that will enable cultural institutions to better support them. This research is important as it articulates the cultural and economic value of a vital site of creative practice in contemporary Australia.							
	National Interest Test Statement							
	Australian videogame developers have built global reputations and successful businesses from ideas that began as artistic, non-commercial projects. The game industry is well understood to be a creative industry, but we don't yet understand how the creative innovations of developers who consider themselves first-and-foremost 'artists' interacts with and drives commercial ambitions and success. This limits current policy options for growing the game industry in Australia. This project identifies new sites of creative innovation by examining the practices, work contexts, ambitions, and communities of Australian game developers. This will inform future funding and support strategies to enhance Australian game developers' ability to compete in a global marketplace now worth over $150 billion. Research outcomes will be shared with industry bodies (such as the Interactive Games and Entertainment Association) and policymakers (such as the Australia Council of the Arts) through reports, a website, and an information-sharing symposium to be held at the end of the project.							
DP230102740	**Light Powered Materials for Producing Chemical Fuels**	73,980.00	139,710.00	133,710.00	67,980.00	0.00	0.00	415,380.00
Xu, Prof Jingsan	This project aims to develop a hybrid, solar-powered catalytic material for the manufacture of liquid hydrocarbon chemicals, without consuming external heating. The key concept is to transform hydrogen and carbon monoxide into long-chain hydrocarbons over hybrid materials that can convert light energy into heat and simultaneously catalyze the chemical transformation. Investigations on the relations between material synthesis, nanostructures, and performance of the new catalysis processes will be conducted using experiments and theoretical computation. Expected outcomes include low cost and efficient materials for solar-to-fuel conversion, will provide benefits to low-carbon living, new clean energy resource and environmental protections.							

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	National Interest Test Statement							
	Australia has an abundance of sunlight. Converting this solar energy into other forms of energy that can be easily stored, transported and used is of great importance to sustainably ensuring Australia's productivity and quality of life. This project creates a new material that converts greenhouse gases in the atmosphere into high value fuels using sunlight as the only energy source. The process is an ideal strategy with zero carbon emissions as carbon dioxide gas is reused to produce fuels rather than being released back into the atmosphere. The application of this technique will contribute to Australia's response to the global fuel crisis and will also help mitigate the effects of climate change around the world, saving ecosystems and ensuring food production is not threatened. This project will provide a new pathway to take advantage of solar energy, complementing the solar panels already in use across Australia. Close collaboration with the green energy industry will be adopted to promote the advancement of the proposed technology.							
DP230102934 Hutmacher, Prof Dietmar W. W	**The Material Science of Biomimetic Soft Network Composites** Nature combines stiff and strong collagen fibres intertwined within a weak polymer matrix of proteoglycans into soft tissues with outstanding mechanical durability and biological properties. We converge a biomimetic design strategy inspired in the architecture of natural soft tissues and a novel additive manufacturing technology termed melt electrowriting (MEW) to manufacture advanced biomimetic soft network composites (BSNC). The SNCs are composed of a weak polymer matrix and a MEW reinforcing fibrous phase printed at the nanometre scale, containing patterns mimicking the natural tissue architectures. Advanced computational tools are applied for the rational design of the SNC while reducing costs and times associated to experimental work.	71,213.50	146,908.50	153,360.50	77,665.50	0.00	0.00	449,148.00
	National Interest Test Statement							
	Using new 3D printing technologies developed in the QUT laboratory this project will inform understanding of the underlying material science important to the advanced manufacturing industry to develop new products and enhance their capability to compete in international markets. This project will provide essential new insights on how to develop advanced materials such as a new class of soft network composites that meet the design and performance criteria for high-tech products in soft robotics, marine science and agriculture, tissue engineering and wearable and stretchable electronics. In the manufacturing sector research is vitally needed in critical process advances related to the manufacturability of advanced materials and the manufacture of both new and existing products. This project will lead to significant economic and commercial benefits to Australian given its potential to revolutionize healthcare, wearable devices, manufacturing, and robotics. Translation of the research outcomes will be via publications, presentation to forums of the advanced manufacturing industries as well as spin off companies.							
	Queensland University of Technology	1,118,942.50	2,385,663.00	2,408,729.50	1,142,009.00	0.00	0.00	7,055,344.00
The University of Queensland								
DP230100092 Dux, Prof Paul E	**Neurochemical predictors of cognition and the impact of brain stimulation** This project aims to determine how neurochemical equilibrium between excitation and inhibition (E/I balance), across the brain, is associated with executive function and how this balance is influenced by non-invasive brain stimulation. Brain stimulation shows immense promise for enhancing executive function in applied settings, but the neurochemical basis for this is unknown. Using advanced imaging and stimulation techniques, the project aims to provide comprehensive insights into the causal relationship between stimulation, E/I balance and executive function. Outcomes and benefits include identifying neurochemical characteristics that determine stimulation efficacy and informing the design of protocols for applied use.	66,863.50	241,827.00	266,758.50	91,795.00	0.00	0.00	667,244.00

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	National Interest Test Statement							
	Non-invasive brain stimulation involves the application of a weak electrical current to the cortex via electrodes placed on the scalp. It has shown promise as a tool to enhance cognitive performance, including in military settings. However, individual's responses to stimulation can vary. Here we assess if individual differences in stimulation outcomes are predicted by concentrations of neurochemicals in the brain – particularly the balance between excitation and inhibition (E/I balance) – and if stimulation affects cognition and E/I balance. Employing state-of-the-art stimulation and imaging, this research will contribute to our understanding of the neural mechanisms of brain stimulation and human cognition and learning. The findings will support the development of targeted stimulation protocols based on an individual's neural characteristics with applications in industry where enhanced learning and concentration will improve productivity and increase economic return. The findings can also be integrated into education to improve learning outcomes to create social benefit by investing in a smarter workforce.							
DP230100139	**Switching, sensing and multifunctionality in spin crossover materials**	56,500.00	135,500.00	148,500.00	69,500.00	0.00	0.00	410,000.00
Powell, Prof Benjamin J	This project aims to increase the temperature range where molecular spin states can be switched optically or electronically, and to develop new multifunctional materials combining switchable hosts with functional guests. By combining novel theories, synthesis and experiments, this project expects to generate step-change advances in the understanding of spin-switching materials and discover materials with novel properties worthy of commercial development. Significant anticipated outcomes and benefits include the identification and development of several new classes of materials function, each of major fundamental interest, and the generation of new advanced materials with applications in electronics, sensing and gas separations.							
	National Interest Test Statement							
	Spin-crossover (SCO) molecules can be switched between magnetic and non-magnetic states by temperature, pressure, chemical environment, or irradiation by light. Building on two recent breakthroughs in modelling SCO materials, this project will design and make new smart materials that can detect and react to their environment. This will enable new chemical sensors and more efficient gas separations. Chemical sensors have applications from monitoring air quality to detecting explosives at airports. Gas separation is vital to Australian industry. Uses include purifying natural gas; separating oxygen from air for medical use; carbon capture and storage; and producing hydrogen for use as a carbon-neutral fuel. Current separation processes are inefficient, consuming 15% of the world's total energy production. Sustainable industrial and economic growth requires new separation technologies that are energy- and resource-efficient. Advances will be rapidly deployed through existing industrial collaborations and licensing of emerging technologies, ensuring rapid uptake of new technologies.							
DP230100300	**Pyroptotic macrophages posthumously sculpt immune responses**	94,375.00	190,750.00	190,750.00	94,375.00	0.00	0.00	570,250.00
Schroder, Prof Kate	The life of an organism relies on the timely birth and death of its cells. Importantly, it is crucial for cells to die not only at the right time, but also in an appropriate manner. This proposal investigates a cell death pathway that triggers potent immune responses. This proposal seeks to reveal precisely how cell death sculpts immune responses. Expected outcomes include new insights into how immune cells die, and how they instruct immune responses from beyond the grave. Project benefits include a fundamental understanding of how cell death signalling sculpts tissue immune responses, and knowledge of how to manipulate cell death responses for future basic research and commercial applications beyond this project.							
	National Interest Test Statement							
	The life of an organism relies on the timely birth and death of its cells. It is also crucial for cells to die in an appropriate manner, so that they prevent or ignite immune responses. However, currently little is understood about precisely how cell death can spark immune responses. Our project will investigate novel features of dying mammalian cells, so that we can define new pathways that instruct immune responses. This will reveal previously unknown mechanisms allowing cells to signal from beyond the grave to shape the body's immune response. Such fundamental knowledge of how cell death instructs immunity may be harnessed in future assay design and drug development programs to generate new commercial products, such as research tools, diagnostics and immune-modulatory drugs. The project team is skilled at discovering new pathways of immune regulation and using this knowledge to develop new commercial products and working with Australia's biotechnology sector. Other benefits include investment in training the next generation of Australian scientists in cutting-edge microscopy techniques.							

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DP230100331	**Well-being and Productivity in Metricised Employee Performance Systems**	40,000.00	95,000.00	120,000.00	65,000.00	0.00	0.00	320,000.00
Edwards, A/Prof Martin R	The project will advance knowledge around the impact that the increasing use of digitised monitoring, performance measurement and metric systems are having on the workforce. It will generate a greater understanding of why, when and how these systems have a positive rather than a negative impact on employee motivation, well-being and performance. It will produce design guidelines to enhance organisations' understanding and capability to sustainably manage and implement the use of monitoring and metric systems. Increasing this capability will help reduce the financial burden of workplace stress that these systems will have, it will positively influence worker well-being and work culture and help increase workplace productivity.							
	National Interest Test Statement							
	Digital HR technologies that incorporate the processing of data linked to employee performance promise to help organisations with efficient performance management. These systems are increasingly being used to monitor employee productivity and present metric-based employee performance information. The impact of these systems on workforce wellbeing, motivation and productivity has not been assessed and they could be doing more harm than good. This project will study the impact that these systems have across different workplace contexts and identify design guidelines setting out how to sustainably implement these monitoring and metric systems. Ensuring that these performance management technologies are well implemented will reduce the likely cost to business arising from work stress with their introduction. Careful implementation will also help to positively influence worker well-being, work culture and productivity in Australian workplaces. The findings and guidelines will be shared in industry publications, Management and HR practitioner conferences, and a project website for wide dissemination.							
DP230100336	**Robots as a Social Group: Implications for Human-Robot Interaction**	55,000.00	105,000.00	105,000.00	55,000.00	0.00	0.00	320,000.00
Vanman, A/Prof Eric J	This Project aims to identify psychological factors that can limit the acceptance of robots in the home and workplace. As robots become more pervasive in everyday life, they are also likely to elicit fear, rejection, and even damage. The significance of the Project lies in its social neuroscientific approach to promoting better human-robot interaction by considering robots as a social group. Expect outcomes include theory development about human and robot intergroup acceptance, enhanced institutional and international collaborations, and much needed psychological knowledge for robot designers. Benefits include a detailed understanding of how to increase the acceptance of robots in a wide variety of fields.							
	National Interest Test Statement							
	Australia's rapidly growing robotics industry produces robots for healthcare, hospitality, education, and the home, and are now far more prevalent than just a few years ago. Yet, the development of these "social" robots has not fully considered the psychology of human-robot interaction. Thus, many potential users reject or are openly hostile to robots in their everyday lives because they view them as threatening to humans. To address this problem, our novel approach applies established methods for improved interactions among people from different groups to consider robots as a social group as well. We will use our research experience in social psychology, neuroscience, and robotics with state-of-the-art methods to provide vital brain and behavioural knowledge that yields greater understanding of the acceptance of social robots. Given the growing importance of robots, particularly in countries with rapidly aging populations and falling birth rates, this project will provide essential knowledge for roboticists, enabling them to deliver practical applications as they design the next generation of robots. We will use existing ties to engineers and robotics researchers working in this area to transfer knowledge gained from the project.							

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DP230100379	**Glucocorticoid receptor-D1 modulates stress and inflammation**	87,199.50	166,184.00	151,964.00	72,979.50	0.00	0.00	478,327.00
Clifton, Prof Vicki L	Environmental stressors in mammalian pregnancy often cause inflammation in the mother which has an adverse effect on the fetus and its survival. The current grant aims to examine the mechanism by which stress and inflammation coexist in pregnancy because stress hormones normally exert anti-inflammatory actions. Contrary to convention, a new glucocorticoid receptor (GR), GRalpha D1, is linked to increasing inflammation. Using innovative molecular biology approaches, GRalphaD1's function will be examined to provide a deeper understanding of how stress regulates inflammation in animal reproduction. The project aims to enhance interdisciplinary collaborations with expected benefits including a paradigm shift in our knowledge in this field.							
	National Interest Test Statement							
	Severe stress responses to catastrophic events such as floods and bushfires can cause significant health changes in the body and is very serious during pregnancy. Stress responses during pregnancy can lead to early birth or critically small babies resulting in lifelong complications and even death. These complications are a significant economic burden for the agricultural industry due to lost animal productivity, a challenge for zoo-based species conservation due to pregnancy losses, and a burden to health funding when caring long term for children with disabilities. A solution is required but we do not have sufficient knowledge to treat stress responses during pregnancy. The grant will significantly advance the knowledge required for the development of selective stress modulators that could target specific cell types or organs and repress adverse responses to stress. It has wider implications related to the identification of mechanisms associated with inflammation-induced glucocorticoid resistance, a problem with no known solution that can tackle national problems related to managing stress in reproduction. This project is designed to find new understandings of stress pathways that are active during pregnancy. The findings will be commercially important as the data will contribute to industry partnerships to develop stress modulator drugs or nutritional supplements for humans and animals which will reduce the economic burden associated with severe stress.							
DP230100393	**Adrenomedullin: a specific regulator of venous vessel integrity**	107,115.50	210,868.00	229,629.50	125,877.00	0.00	0.00	673,490.00
Lagendijk, Dr Anne Karine	Arteries and veins display different adhesive properties, which enable them to fulfil their physiological roles. We are yet to understand the mechanisms that establish and maintain adhesive function in different vessel types. We have discovered that signalling by the peptide Adrenomedullin (ADM) is a key mediator of adhesion, only in veins but not arteries. This project aims to utilise innovative models (zebrafish, mouse and bioengineered vessels) to identify the biochemical and mechanical mechanisms by which ADM controls venous adhesion. Outcomes will improve our understanding on how vessel integrity is controlled across vessel types and will expand the scope of Australian research by informing efforts to vascularise engineered tissues.							
	National Interest Test Statement							
	The aging of the Australian population presents a major economic challenge as well as significant implications around healthcare in old age. In recent years, the emergence of engineered organs has brought great promise towards repairing dysfunctional organs, however these organs often lack functional blood vessels that can deliver oxygen and nutrients. This limitation must be overcome before engineered organs can become a viable option. We therefore first need to understand how arteries and veins are made during normal organ development. This project builds on our discoveries which identified a gene that specifically controls development of veins. Here, we will uncover how this gene mediates blood vessel development, adding critical knowledge to this important field. The new knowledge will result in immense benefit for the commercial and economic capacity of Australia, by providing the critical information required to create specific blood vessel subtypes in engineered organs.							

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DP230100504	**Migration-Dependent Signalling in Macrophages**	105,000.00	212,500.00	215,000.00	107,500.00	0.00	0.00	640,000.00
Stow, Prof Jennifer L	The project aims to investigate a mechanism of communication used by immune cells to guide each other towards sites of damage. The project will characterise newly revealed cell signalling membrane trails left behind by migrating cells, utilising biochemistry, innovative imaging and microscopy and a transparent zebrafish model to view cell migration through living tissues. Expected outcomes include new fundamental knowledge in the area of immune cell migration with relevance to the basic biology of inflammation, repair and regeneration and new innovations for cell imaging. Significant benefits are expected to arise from this new knowledge and from advanced skills training and improved national capabilities in bio-imaging and analysis.							
	National Interest Test Statement							
	Our ageing society faces a rapidly growing economic and healthcare burden associated with inflammation, which causes tissue damage and injury in many chronic diseases. As part of the body's defence, immune cells are recruited to sites of tissue damage to initiate vital repairs for these injuries. However we do not fully understand the mechanisms directing immune cells to these critical sites. This project will use advanced live microscopy to investigate recently discovered membrane structures that are left behind as signposts by migrating immune cells, to guide other cells to sites of damage. The project outcomes will include new fundamental knowledge and identify specific molecular targets as foundations for the future development of new therapeutics to enhance tissue repair and regeneration in chronic inflammation. Consumers stand to benefit from improved healthcare and quality of life. This project will deliver national benefit by enabling on-shore development and commercialisation of new immune-directed, tissue repair therapies.							
DP230100529	**The impact of leader financial rewards on work group functioning**	35,000.00	75,000.00	80,000.00	40,000.00	0.00	0.00	230,000.00
Steffens, Dr Niklas	This project aims to investigate when and why organisational leaders' financial rewards improve or undermine social group functioning. Leaders' pay has increased markedly in recent years, fuelling debate about the impacts on organisational functioning. While some studies have found high leader rewards have positive effects on group outcomes, others found negative or no effects. Expected outcomes include data on the effects of leader rewards on social identification with the group and contribution to collective goals, that will help policy-makers design reward systems that optimise functioning. This has the potential to significantly benefit Australian business and organisations to facilitate high-functioning groups and improve productivity.							
	National Interest Test Statement							
	The financial rewards that workplace leaders, particularly CEOs and top executives, receive have risen substantially over the last few decades. Leader pay has become the focus of growing attention from stakeholders, prompting some governments to mandate the publication of leader-worker pay ratios. However, little is understood about whether and how financial rewards that leaders receive impact organisational functioning and productivity. This project will use novel techniques to illuminate when and why leader financial rewards improve or subvert team and organisational outcomes. This project will contribute to Australia's social and economic outcomes by identifying principles for the design of effective organisational reward structures. By integrating these principles into executive education and a successful leadership development program, this project will develop leaders' ability to foster healthy and high-functioning teams and organisations.							
DP230100552	**The functional architecture of a unique family of lipid droplet proteins**	90,000.00	240,000.00	236,000.00	86,000.00	0.00	0.00	652,000.00
Collins, 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.							

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	National Interest Test Statement							
	How cells control the transport and metabolism of fats and cholesterol is of fundamental importance. Malfunction of these processes is associated with loss of brain cell function and various diseases (e.g. lipodystrophy, a disease affecting fat storage). This project addresses a gap in understanding how proteins called 'sorting nexins' regulate the storage and removal of fats. State-of-the art imaging technologies will be used to 'see' how sorting nexins work in the cell. This will help us understand how sorting nexin mutations cause diseases affecting muscle control and balance, and how they slow ageing. It could also inform cellular engineering strategies for biotechnology to optimise the production of fats and oils of commercial value. The project will build national capacity and international collaborations in cutting edge biochemistry and cell biology research, including new machine learning or 'artificial intelligence' methods that are transforming studies of protein structure, function and drug design via highly accurate computational modelling.							
DP230100572 Luo, Dr Bin	**Solar rechargeable Zinc-Bromine Flow Batteries** This project aims to develop a new solar rechargeable Zinc-Bromine flow battery for better utilization of the abundant yet intermittently available sunlight. The key design is to create a solar-driven photoelectrochemical process to convert the discharged electrode materials back to their charged states and realise the direct storage of solar energy. Expected outcomes include new solar driven rechargeable technology and photoelectrode materials, as well as new knowledge generated from collaborations across materials science, photoelectrochemistry and nanotechnology disciplines. Further advances in functional materials for solar energy storage will assist in addressing the global energy shortage and mitigating environmental pollution.	66,616.50	134,667.50	138,286.00	70,235.00	0.00	0.00	409,805.00
	National Interest Test Statement							
	Australia has an ambitious target to achieve net zero emissions by 2050, and solar rechargeable batteries are important for Australia to shift to lower emissions electricity and achieve this goal. Typically, such systems involve two separate devices, a photovoltaic cell and a rechargeable battery, and devices that integrate conversion and storage in one unit are an attractive approach for solar energy systems. This project aims to develop a new solar battery system by integrating solar energy conversion and storage in the one device for better utilisation of abundant yet intermittently available sunlight. This new technology with low cost and high solar-to-electricity efficiency will have strong commercial potential in the burgeoning stationary energy storage market and help reduce electricity costs and propel the Australian government's investment in clean energy. This project will deliver benefits to Australian battery-related industries by generating high-tech manufacturing capability and creating job opportunities, through technology licensing to existing and new industry partners.							
DP230100590 Craik, Prof David J	**A peptide platform to fight pests threatening global food security** This project aims to develop a platform technology for the efficient design of new crop protection agents based on peptides to protect Australia's food security. It will be first applied against the highly destructive fall armyworm, currently spreading alarmingly in Australia. The project is significant because insect pests cause huge economic and environmental impacts. Peptides are a new generation of crop protection agents that are potentially more effective and sustainable than chemical pesticides. Expected outcomes are a new rapid response technology and associated lead molecules to protect against current and emerging pests. Major benefits are increased food security, improved crop yields and a more sustainable agriculture industry.	95,000.00	205,000.00	230,000.00	120,000.00	0.00	0.00	650,000.00
	National Interest Test Statement							
	Australia is a major agricultural producer, with >300,000 jobs directly in agriculture and 1.3 million additional jobs in the associated supply chain. This sector represents 3% of our GDP and a gross value of $60 billion. This project aims to develop new molecules to protect our crops from pests and thus safeguard our agricultural industry. In the first instance we focus on one of the most destructive pests in the world, the Fall armyworm, which reached Australia in 2020 and is rapidly spreading. The class of molecules we are developing are more specific for killing target pests and safer for the environment than traditional crop protection chemicals. Thus, in addition to benefits to the Australian economy through the protection of our agricultural industry there will be benefits to our environment. The environment is an important source of revenue for Australia, with the tourism industry worth 3% of GDP and is also important for our well-being and way of life. We have an Australian industry partner ready to translate our research findings into products.							

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DP230100621	**Photoelectrode design for solar driven methane to methanol conversion**	74,000.00	166,935.00	191,370.00	98,435.00	0.00	0.00	530,740.00
Wang, Prof Lianzhou	This project aims to achieve efficient photoelectrocatalytic partial oxidation of greenhouse gas methane for methanol production with high selectivity. The program will design new semiconductor materials through rational defect engineering and co-catalyst selection to revolutionise methane conversion. The expected outcomes include sustainable processes to convert methane into valuable liquid chemicals like methanol, and comprehensive understanding on functional material design for solar driven catalytic reactions. The significant benefits will include revolutionary methane mitigation technologies and sustainable processes for value-added chemical production, alleviating key environmental and energy challenges facing Australia and the world.							
	National Interest Test Statement							
	Australia’s natural gas and major livestock industries produce significant amounts of methane, a potent greenhouse gas that is estimated to warm the earth around 30 times more than carbon dioxide over a 100-year timescale. Australia urgently needs sustainable technology to mitigate the impact of methane emissions on the environment. This project aims to develop a new technology using renewable solar energy to convert harmful methane into valuable liquid fuels such as methanol which can be used as a fuel in vehicles to replace non-renewable petroleum. Success of this project will provide significant environmental benefits to Australia by reducing greenhouse gas emissions, contributing to the Australian Governments 2030 Emission Reduction Target, and accelerating the transition to net zero emissions in line with Australia’s Long-Term Emissions Reduction Plan. The technology developed will be shared with Australia’s chemical production industries, allowing them to tap into the global methanol market valued at $60 billion.							
DP230100675	**Cell–fluid interaction: inside and outside cells**	92,500.00	190,000.00	190,000.00	92,500.00	0.00	0.00	565,000.00
Rubinsztein-Dunlop, Prof Halina	The project aims to measure mechanics at the cellular level using a combination of optical tweezers for measurement of nano-scale environment around/inside cells and light-sheet microscopy for imaging. The project expects to generate new knowledge about movement of cells through their environment, relating to collective behaviour which is of importance in understanding infections and formation of biofilms. Expected outcomes include deepened understanding of an enigmatic process conserved from amoebae to humans, by which cells ‘drink and eat’ by ‘gulping’ fluid and supplement their nutrient intake by degrading proteins and cell debris. It will generate new knowledge of these processes to better understand how mechanics affects cellular life.							
	National Interest Test Statement							
	Urgent action is needed for understanding cancer growth and infections. However, an essential part of our immune surveillance and defence, the enigmatic process by which cells ‘drink and eat’ by ‘gulping’ fluid, is only partially understood. While this process is essential to life, it also provides nutrition for the rapid growth of cancer cells, and is a path for infectious bacteria and viruses to enter cells. Our project will measure the mechanics of this cellular-level interaction using super-resolution microscopes and optical tweezers, a device that can manipulate a single molecule. This research generates new knowledge of these processes to better understand how mechanics affects cellular life. The research will benefit Australia economically and socially, by providing new knowledge on the interaction between cells and fluids, and as a result will provide better approaches to the understanding of immune system functions. This research is essential for the development of new tools for the diagnosis and treatment of infections that affect large numbers of people.							
DP230100728	**Tuning the activating stimulus of voltage-gated sodium channels**	79,204.50	156,539.00	157,899.00	80,564.50	0.00	0.00	474,207.00
Keramidas, Dr Angelo	This proposal aims to advance fundamental knowledge about how proteins (ion channels) found on the surface of neurons (brain cells and nerves) function as molecular conduits of cell-to-cell electrical communication. We aim to study how molecular probes and structural parts of these proteins affect the local chemical environment of ion channels, and how this leads to fine tuning of the ion channel's sensitivity to the stimulus that activates them (cell membrane voltage). The conceptual knowledge gained from this project would advance our understanding of a fundamental physiological process and facilitate the development of drugs that regulate ion channel function, such as anti-epileptics, analgesics and insecticides.							

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	National Interest Test Statement							
	There is a potential multi-billion-dollar market in Australia for eco-friendly drugs to control agricultural pests, alleviate pain and treat epileptic seizures based on manipulating ion channels, the proteins that the brain uses to communicate. However, this potential is limited by our understanding of how ion channels work with enough detail that allows us to alter their function to our benefit. This project will manipulate ion channels using a new class of drugs derived from natural venoms, to investigate how they attach onto ion channels and alter the way they operate. Studying the effects of these drugs on ion channels will provide the knowledge-base required for researchers and industry to develop new venom-derived products for health and agriculture. To achieve the longer-term goal of drug development we will share our findings with agricultural and pharmaceutical companies in Australia. The benefits to Australians will be safer and more effective pesticides, the economic benefits that come with commercialisation of new drugs, and the benefits to Australian society from more effective pharmaceuticals.							
DP230100759	**Remembering to remember: Prospective memory function in everyday life**	55,300.00	135,048.00	158,023.00	114,925.50	36,650.50	0.00	499,947.00
Henry, Prof Julie D	Prospective memory is a core cognitive skill that refers to memory for future intentions. The goal of this project is to establish when, why and how real-life prospective memory function breaks down at different stages of the adult lifespan and in different everyday contexts - and what strategies most effectively prevent this from occurring. In doing so, this project expects to deliver knowledge that is theoretically transformative, and that delivers the practical understanding of what can be done to reduce real-life vulnerability to prospective memory failures. Given that lapses of prospective memory account for more than half of all daily cognitive errors, this should provide important social and economic benefits for all Australians.							
	National Interest Test Statement							
	Prospective memory (PM) refers to memory for future intentions and is involved in many important everyday tasks, such as remembering to take medication, to check food cooking, to turn off appliances, and to pay bills. Failures of PM can therefore cause serious harm in many everyday contexts. This Discovery project will identify the real-life PM activities people struggle with; it will establish when age-related PM difficulties emerge and how they progress when they do, why PM fails in some everyday contexts and not others, how PM breaks down when it does, in terms of the type of error(s) made - and critically, what can be done to reduce real life vulnerability to serious lapses of PM. By answering these questions, this project will provide the high-quality research evidence that is now critically needed to inform policy and practice that supports real-life PM function. This will include the development of ergonomic interventions tailored to the needs of specific age-groups and environmental demands, with important economic and social benefits for all Australians.							
DP230100905	**Stochastic majorization--minimization algorithms for data science**	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00
Nguyen, Dr Hien D	The changing nature of acquisition and storage data has made the process of drawing inference infeasible with traditional statistical and machine learning methods. Modern data are often acquired in real time, in an incremental nature, and are often available in too large a volume to process on conventional machinery. The project proposes to study the family of stochastic majorisation-minimisation algorithms for computation of inferential quantities in an incremental manner. The proposed stochastic algorithms encompass and extend upon a wide variety of current algorithmic frameworks for fitting statistical and machine learning models, and can be used to produce feasible and practical algorithms for complex models, both current and future.							
	National Interest Test Statement							
	Many problems faced by Australia involve the accurate monitoring of data and effective decision-making using data. For example, estimating traffic volume for city planning; business analytic predictions of prices and inventory quantities; economic estimation of interest rates, and inflation; and climate predictions and forecasting. However, often datasets for these activities are too large for conventional methods of analysis. This project aims to develop new frameworks for constructing algorithms that allow for rapid, accurate, and robust inference of large, complex datasets. Such tools will support practitioners such as logisticians, business analysts, economists, and meteorologists to make fast decisions with greater confidence. The algorithms developed will be universal and can be applied in many data analytic settings, from monitoring of bushfire spreads via spatial imaging to monitoring and forecasting electricity loads. Our algorithms will be developed so that they can be distributed widely throughout Australia via convenient and adaptable software in open-source repositories for plug-and-play usage.							

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DP230101080	**Elder Abuse: A Longitudinal Prospective Study of Perpetrators and Victims**	95,000.00	239,000.00	292,500.00	148,500.00	0.00	0.00	775,000.00
Najman, Em/Prof Jackob M	This project aims to improve the quality of the available data and fill major gaps in knowledge about elder abuse in Australia. The study is significant as it aims to generate new knowledge about the perpetrators and victims of abuse and neglect of older women. The Council of Attorneys' General of Australia has explicitly prioritised this need for further research on the population prevalence of elder abuse. The anticipated project outcomes will be to identify the prevalence, causes and consequences of elder abuse in Australia, with the intended benefit of the development of reliable and validated estimates of the population prevalence of elder abuse and identify the early life and current circumstances of women who experience elder abuse.							
	National Interest Test Statement							
	The abuse and mistreatment of the elderly is a major public health problem. Perhaps 15% of the elderly population have been reported to experience abuse in the past year. The social and health consequences of this abuse are substantial and are the focus of this current grant proposal. The major gaps in knowledge that this proposal addresses are: (i) Strengthening the way elder abuse is measured as current knowledge is based on weak studies with unreliable measurement and what is known may not be a good indication of experiences in the Australian population. (ii) There is a need to know more about factors contributing to the abuse of the elderly and identifying opportunities to reduce the level of elder abuse. (iii) There is little specifically known about the perpetrators of elder abuse and the extent to which social and economic circumstances earlier in life lead to elder abuse. The current study will address major gaps in knowledge about the causes and consequences of elder abuse, and working with government and non-government agencies, identify pathways to preventing the abuse of the elderly.							
DP230101156	**Regulation of lung immune-epithelial networks sensing environmental change**	122,563.00	254,478.00	228,789.50	96,874.50	0.00	0.00	702,705.00
Belz, Prof Gabrielle T	This study aims to uncover how lung epithelial cells engage with immune cells and determine their cellular and molecular wiring to ensure homeostatic maintenance and essential repair processes of lung tissues. Maintenance of lung epithelial-immune networks is essential to maintain normal lung tissue structure and function, and to induce immune responses to protect against microbial challenges or inhaled potentially toxic substances. Understanding this molecular program of epithelial-immune cell-mediated sensing/repair will be essential to understand how tissue-repair processes can be driven in the lung, an organ critical for respiration and thus life.							
	National Interest Test Statement							
	Lungs are the centre of our respiratory (breathing) system. The ability of the lung to repair the damage that occurs in response to environmental insults, such as pollutants, chemicals, asbestos, and smoke, is essential to ensure our body receives the oxygen it needs to survive. However, the processes that underpin lung repair are not fully understood. This project seeks to unravel how the lungs function in response to environmental damage and aims to uncover significant new knowledge to understand how our blood delivers the signals necessary for the body to repair lung damage. Understanding these pathways is a prerequisite for developing next-generation therapeutics based on nanotechnology and RNA, a basic building block of all cells and used in COVID-19 vaccines, to deliver medications to the lungs. This new industry, predicted to be worth more than 2 billion dollars by 2025, represents a considerable economic and job-creating opportunity for Australia and will provide new avenues to protect the Australian livestock industry through improved protection against lung infections and increased productivity.							

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DP230101196 Huang, Prof Zi H	**Responsible modelling respecting privacy, data quality, and green computing** With the unprecedented growing impact of data on science, the economy and society, there comes the need for responsible data science practices which are accountable for the social good. This project aims to investigate the challenging problem of how to provide responsible data management, spanning across privacy-aware data exploration, resilient modelling to cope with imperfect data, and efficient model architectures for resource-constrained environments. This will be achieved by developing theories and techniques for complex real-world multi-modal data retrieval throughout the data life-cycle. The expected outcomes will significantly contribute to building capability in emerging technologies in the context of responsible data science.	82,500.00	162,500.00	160,000.00	80,000.00	0.00	0.00	485,000.00
	National Interest Test Statement The Australian Government has launched the Digital Economy Strategy to take the nation towards becoming a top 10 digital economy and society by 2030. While data have become a foundation of the digital economy, managing data in an ethical, legal and efficient manner remains a great challenge. This project aims to develop responsible data management technologies for data controllers. It delivers a set of novel algorithms to transform big data techniques to fulfil privacy requirements, cope with unreliable data sources, and enhance energy efficiency, while still achieving high data utility. The outcomes will potentially produce economic and social benefits for Australia's data-intensive sectors, such as agriculture, banking and healthcare, unlocking the power of booming big data techniques while addressing the rising public concerns on their ethics, reliability, and resource consumption. This endeavour will propel Australia towards being a leader in the responsible data science field as well as equipping its businesses with strong capability of complying with stringent data regulations around the world.							
DP230101340 Guo, A/Prof Jianhua	**A novel microbial process breaking through the nitrogen cycling** Nitrogen transformation is central to life on Earth. This project will challenge a century-old paradigm that microorganisms must cooperate in a team to convert nitrogen from organic- to inorganic forms. We will carry out the first-ever systematic investigation of a novel process, where a single organism mediates complete ammonification and ammonia oxidation, directly connecting organic- and inorganic nitrogen. By revealing metabolic pathways, characterising ecophysiological properties, isolating key microorganisms and exploring their application potential, this project will change our fundamental understanding of global nitrogen cycling, improve the sustainability of water management, and contribute to the circular economy transition	35,710.00	120,622.50	167,375.00	82,462.50	0.00	0.00	406,170.00
	National Interest Test Statement Urea is the most common organic nitrogen compound in soil and water ecosystems. It was thought that microorganisms cooperate in a team to convert organic nitrogen into inorganic forms. However, this project aims to characterise a novel process, in which a single microbe independently converts urea into inorganic nitrate. This new process and the responsible microorganism will fundamentally change our understanding of the global nitrogen cycle. This project aims to bolster Australia's international reputation for ground-breaking work in microbiology through national and international collaborations. This project lays the scientific foundations to develop a novel, commercial biotechnology to recover nitrogen from wastewater to generate environmentally friendly liquid fertiliser for agricultural use. This work will support the Australian water and agricultural industries in achieving more sustainable management of soil and water, and positions Australia as a leader in circular economy innovation.							

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DP230101367 Veeraragavan, A/Prof Ananthanarayanan	**3D Hypersonic Shock-Turbulent-Boundary-Layer Interactions** Shock-wave turbulent-boundary-layer interactions occur on hypersonic flight vehicles and can lead to high heating and increased drag. This is a paramount design issue that needs addressing. We aim to understand and quantify fundamental phenomena occurring in such interactions using state-of-the-art instrumentation and wind-tunnel facilities. Surfaces will be heated to realistic flight temperatures to simulate accurately the flight environment and include effects not reproduced with cold models. The effects of 3D features of the interactions will lead to new understanding of how the flow develops through a combination of experiments and numerical simulations. Future designs of hypersonic flight vehicles will benefit from knowledge gained.	42,500.00	110,000.00	152,500.00	112,500.00	27,500.00	0.00	445,000.00
	National Interest Test Statement 1. The project is about understanding the flow that occurs when one or more shock waves interact with the layer near the surface of a hypersonic flight vehicle. When these interactions occur, the heating can be severe and the flow downstream may be significantly disturbed. 2. We will reproduce the flow in our hypersonic wind tunnels and measure what happens near and at the surface. We will test our flow simulations and see how well we can reproduce the phenomena. This will be the first time that 3D interactions will have been studied with heated walls and will help designers of future hypersonic flight vehicles produce more reliable and efficient vehicles. 3. Australia’s strong international reputation in the field of hypersonics will be enhanced by this project and help maintain our leadership in the area with AUKUS partners. Australian companies working on hypersonic flight vehicles will be able to use the knowledge gained to improve designs. 4. Hypersonic Defence industry will be engaged, via UQ's strong connection with DSTG, thus enabling the development of hypersonic systems for national security.							
DP230101439 Pope, Dr Benjamin	**Planet Formation at Solar System Scales with the James Webb Space Telescope** Planetary systems like our own form within vast disks of primordial gas and dust around newborn stars. This project will observe such disks spanning a range of ages with the James Webb Space Telescope to reveal the detailed in-situ physics of planet-forming disks themselves. We will deliver the sharpest-ever infrared images in astronomy, exploiting the only Australian-designed instrument on the spacecraft: the Aperture Masking Interferometer. This yields new physics for actively growing protoplanets, carved rings and gaps in disks, and gravitationally sculpted patterns of leftover cometary debris. Confronting state-of-the-art models with these data will immediately yield profound insights into planetary system formation, including our own.	64,000.00	131,000.00	131,000.00	64,000.00	0.00	0.00	390,000.00
	National Interest Test Statement This project employs the most ambitious astrophysics facility yet launched, NASA's James Webb Space Telescope, to directly observe the processes of planetary formation. This explores the origin of our planet's geology and atmosphere, illuminating profound connections between the planets and Sun. This project aims produce high resolution images of disks where planets form, using an instrument - the Aperture Masking Interferometer - which is the unique Australian hardware contribution to the mission. Employing the same underlying mathematics as MRI medical imaging, the program will develop new algorithms for rendering complex data and into high fidelity images surpassing all prior work. All algorithms will be released as open-source products applicable widely in and beyond astronomy. Astronomy is of great importance to Australian society: it is a key gateway to STEM studies, and addresses the deep cultural question of how we came to be. Our path involves an integrated project of optical hardware design, applied mathematics, and machine learning, and will train students and researchers in these technologies.							

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DP230101503	**Responding to Sexual Harm: An Australian Historical Criminology Approach**	44,250.00	106,177.00	105,105.00	123,819.00	80,641.00	0.00	459,992.00
Featherstone, Prof Lisa S	Despite sustained interventions from the 1970s onwards, sexual harm is a problem of enormous magnitude within Australia. The project focuses on contemporary histories of reform, aiming to understand how social, political, legal and cultural contexts have shaped experiences and conceptualisations of sexual harm. This project expects to generate vital knowledge on the impacts of recent historical reforms on diverse communities, advance mixed methods and co-design approaches in historical criminology, and enhance Australia's research capacity by training a new team of topic matter experts. By understanding the impacts of past reform, findings should provide significant benefits in informing future reforms and responses to sexual harm.							
	National Interest Test Statement							
	This project aims to provide a contemporary historical analysis of law reform pertaining to four distinct forms of sexual harm in Australia. We seek to create new interdisciplinary knowledge and innovative frameworks to evaluate the social, cultural, and political drivers of shifting understandings of sexual harm in Australia from the 1970s onwards. Conservative estimates put the economic cost of sexual and gendered violence at 20 billion dollars annually, with incalculable individual, social and community costs. Despite decades of legal and policy reform, sexual harm is vastly under-reported, and survivors continue to experience the legal system as a source of harm rather than a site of justice. By providing insights into the impacts of contemporary historical reform, this project should generate knowledge and enhance Australia's research capacity to directly inform future policy and practice. Findings have the potential to shape the development of effective responses to sexual harm, in turn mitigating the economic, social, and cultural costs associated with sexual harm in Australia.							
DP230101628	**Tissue Bio-physicochemical Quantification Using Magnetic Resonance Imaging**	92,583.50	172,303.50	163,720.00	84,000.00	0.00	0.00	512,607.00
Liu, Prof Feng	This project aims to develop novel magnetic resonance imaging methods to investigate tissue structure and function. Current MRI technologies use standard water-based contrast mechanisms to generate images with limited tissue information. In contrast, this project expects to provide a non-invasive, ultra-high-resolution MRI technology that measures the electrical, magnetic, and chemical signals generated from the human body. Thus, the new imaging methods can probe deeper biological functionality while examining tissue structure. The potential benefits include: expanding the scope and capabilities of current MRI, facilitating a wide range of imaging-based research and applications, and accelerating knowledge expansion in life science.							
	National Interest Test Statement							
	Magnetic Resonance Imaging (MRI) is used for seeing inside biological tissues, conventionally by translating the tissue water content into images. However, these water-based MRI techniques have remained unchanged for decades and can only provide limited information on tissue structural and functional properties, thus meeting challenges in modern applications. This research aims to develop new MR imaging methods that can offer much more detailed depictions of tissue structures and what they are made from, allowing us to examine and better understand how the body works, including how it changes as we age. In particular, the new imaging methods will provide a more in-depth insight into brain function than was previously possible. Teaming up with scientists from MRI manufacturer Siemens, the developed technology will have a clear translational pathway into the future. This research is expected to benefit a broad range of MRI-based research and applications and significantly contribute to developing timely solutions that can help address the aging problem in Australia.							

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DP230101671	**A Novel Approach to Semi-Supervised Statistical Machine Learning**	78,224.50	154,554.50	126,775.50	50,445.50	0.00	0.00	410,000.00
McLachlan, Prof Geoffrey J	Recent successes in the construction of classifiers for making diagnoses and predictions are due in part to their using much data labelled with respect to their class of origin. But typically there are little labelled data but plentiful unlabelled data. The goal of semi-supervised learning (SSL) is to leverage large amounts of unlabelled data to improve the performance using only small labelled datasets and so SSL is of paramount importance to applications where it is expensive or impractical to obtain much labelled data. The project is to develop a novel SSL approach that adopts a missingness mechanism for the missing labels to build a classifier that not only improves accuracy but it can be greater than if the missing labels were known.							
	National Interest Test Statement There has been an explosive increase in the use of data to form statistical-based rules for making decisions and predictions in almost every area of science, business, government and society, including in diagnostic testing, speech recognition, video surveillance, rule-based spam filtering, and fraud detection. These rules, which aim to predict behaviours, can only have high accuracy if they use extensive training data all labelled. However, in fields such as medicine or defence, images can often only be correctly classified by a process that is expensive or laborious. This project will develop a way to use unlabelled training data while maintaining the accuracy of the analysis. The benefit of this ingenious way of providing more powerful predictive models where unlabelled data are plentiful will be seen in the analysis of scans from advanced imaging, spectroscopic and diagnostic technologies, and of genomic data to provide insights for complex analyses, with the ultimate goal to improve predictions and outcomes. Developed software will be made open access and shared widely with data scientists/technicians.							
DP230101685	**Probing new physics with atomic parity violation**	65,085.50	135,892.50	142,436.00	71,629.00	0.00	0.00	415,043.00
Ginges, Dr Jacinda S	This project aims to provide a new level of rigour in tests of the standard model of particle physics at low energies, and to reveal or more tightly constrain new particles or forces. This will involve the development of state-of-the-art atomic theory techniques and collaboration with world-leading experimental groups. The expected outcomes and benefits include a breakthrough in the precision of atomic theory calculations, new insights into nuclear magnetic structure, improved determination of fundamental particle physics parameters, stronger ties with the international experimental community, enhancing Australian leadership and expertise, and high-level training of the next generation of scientists.							
	National Interest Test Statement This project aims to provide new insights into the fundamental building blocks of the universe. Through state-of-the-art atomic calculations that will be advanced and implemented in this project, we will test the Standard Model of particle physics at a new level of rigour. These precision searches for possible new particles complement the experiments at the Large Hadron Collider at CERN and may even exceed its discovery potential. We expect to deduce some of the most precise information ever on subatomic matter, and develop new techniques for high-precision atomic calculations that have applications in areas such as atomic clocks for precision timing, positioning, and navigation. The project will strengthen ties to scientists at the world-leading nuclear facility ISOLDE at CERN and will elevate Australia's standing in the international atomic, nuclear, and particle physics communities. Young scientists will be trained in advanced techniques, and the project will provide social and cultural benefits by addressing one of the biggest questions in science that has long fascinated humankind.							

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DP230101734	**Tapping into non-English-language science in tackling global challenges**	61,289.50	127,531.00	136,221.00	69,979.50	0.00	0.00	395,021.00
Amano, Dr Tatsuya	This project aims to transform the conventional practice of English-biased evidence use to multilingual evidence synthesis to enable us to better tackle global challenges. The project expects to lay the foundations and provide platforms for multilingual, unbiased evidence-based solutions to global issues including biodiversity loss, climate adaptation and animal-origin diseases. Expected outcomes include a database of non-English-language evidence on the three global issues of focus, machine learning tools, and machine translation platforms that make non-English-language evidence accessible. This should benefit national/international policies and practices by making a neglected source of evidence available for science-led decision-making.							
	National Interest Test Statement							
	Many global challenges including biodiversity loss, climate adaptation, and pandemic diseases are international in nature, and have significant research (36% in conservation) being published in non-English languages. Yet much of this work is unavailable to most researchers and policymakers, and is ignored. For instance, 96.6% of citations by leading global biodiversity assessments are in English. This reliance on English-language evidence leaves a critical gap in efforts to tackle global issues, and can lead to ineffective, biased, or wrong decisions. This project aims to raise the accessibility of non-English-language evidence by developing a database and tools for identifying non-English evidence for scientific solutions, and disseminating to scientists and decision-makers globally. It will make currently untapped but relevant non-English evidence accessible to Australian scientists and decision-makers; make a unique contribution to international policies with multilingual, unbiased evidence; and highlight the power of equity, diversity and inclusion in science, key to Australia's multicultural society.							
DP230101750	**What drives the Anterior Expansion of the Central Nervous System?**	83,781.50	173,547.50	182,676.00	92,910.00	0.00	0.00	532,915.00
Thor, Prof Stefan T	A striking and highly conserved feature of the central nervous system is that the brain is larger than the spinal cord. Despite the manifest implications this has for nervous system function, the underlying drivers are largely unknown. This project aims to investigate the mechanisms controlling anterior expansion of the central nervous system, and will generate new knowledge in the areas of nervous system development and evolution. This project aims to impact on our understanding of nervous system function, develop bioinformatics tools with broad utility within the biosciences field, strengthen Australia's international standing in the developmental neuroscience, and enhance the capacity for interdisciplinary international collaborations.							
	National Interest Test Statement							
	A striking feature of the central nervous system is that the brain is much larger than the spinal cord. This feature is seen in all animals, including humans. Brain size has increased during evolution and underpins the emergence of higher cognitive functions, including thinking and communicating. Understanding this process is fundamental for understanding the evolution of complex behaviours. Currently, the mechanisms controlling brain size are largely unknown. This project will identify the genetic forces driving brain growth, which underlies the formation of our large brains and the remarkable evolution of cognitive capacity. This project will further maintain and strengthen Australia's renowned international standing in the brain sciences and will develop advanced genetic analysis tools with broad utility within the life sciences field. Moreover, a growing list of major human ailments, such as Autism, involve an under- or over-grown brain. Our results will therefore provide information regarding potential targets for the therapeutics industry, hopefully ultimately treating such brain disorders.							

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DP230101753	**Short Sequence Representation Learning with Limited Supervision**	65,000.00	132,500.00	137,500.00	70,000.00	0.00	0.00	405,000.00
Li, Prof Xue	Predicting events based on short text and video data is widely found in real-world applications such as online crime detection, cyber-attack identification, and public security protection. However, to develop such an effective prediction model is very difficult due to the problems such as limited supervision, heterogeneous multiple sources, and missing and low-quality data. This project is to tackle these challenges. Expected outcome of this project will lay a theoretical foundation for effective short sequence representation learning and build next-generation intelligent systems. This should benefit our society and economy through the applications of multimodality-integrated video technologies for cybersecurity and public safety.							
	National Interest Test Statement							
	People using smartphones generate tons of short audio videos and text messages on social media and social networks every second of the day. This information can be used by businesses to understand customers, competitors, and markets. It is also important for Australia’s government to detect and manage risks to society. Yet it is a challenge to fully understand of these events and trends to respond in a timely manner as data may be incomplete or in low-quality and noisy, due to poor recording conditions. The project aims to address this challenge by providing cutting-edge algorithms and tools in the field of artificial intelligence to automatically understand the content of short videos and audio data. These tools can be used to identify fake news, rumours, cyber-attacks, online crimes, and public opinions. This project will benefit Australian businesses and governments through providing them with tools and software services with an effective method to deal with big data challenges. The outcome of this project will enhance Australia's international leadership in artificial intelligence research. The translation and adoption pathway is to make our model and the datasets available in public domain. People can use our project outcome as a baseline to further test and improve their solutions for the same challenges that we address in this project.							
DP230101841	**Novel Hybrid Nanotechnologies by Infiltration of Functional Polymers**	86,000.00	169,000.00	171,500.00	88,500.00	0.00	0.00	515,000.00
Whittaker, Prof Andrew K	Hybrid inorganic-organic materials have important applications in energy, environmental and health technologies. Sequential infiltration synthesis (SIS) of polymers is a recently introduced approach to preparing such hybrid structures. Advancement in the field is however hampered by lack of fundamental understanding of the mechanisms of interactions of SIS molecules with polymers, and the narrow range of polymers studied so far. This project aims to build a fundamental framework for the development of SIS through systematic studies of interactions of polymers and SIS molecules. Expected outcomes include new methods for constructing nanostructures using functional polymers and novel fabrication processes exploiting polymer self-assembly.							
	National Interest Test Statement							
	The modern world relies on computer chips. They are found in our personal computers, phones, automobiles and in all modern appliances. Tomorrow’s computers demand ever faster chips, and this can only be achieved by shrinking the size of the component microelectronics. This is not possible with current manufacturing technologies. This project aims to address this challenge by developing new materials and manufacturing processes that will enable the production of faster and smaller computer chips, among other innovations. These novel materials and new methods of manufacture have the potential to be licensed to major computer chip manufacturers, accelerating development of new chips, and generating valuable income. The materials and methods may also be useful in a range of other technologies such as in sensitive biosensors, batteries, and filtration membranes for water purification. As such, the project has the potential to disrupt the microelectronics market and will allow Australian nanotechnology companies to tap into the global microelectronics market valued at over $400 billion.							

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DP230101901	**Responsive Metal-organic Framework Glass Membranes for Molecular Sieving**	85,000.00	170,000.00	170,000.00	85,000.00	0.00	0.00	510,000.00
Hou, Dr Jingwei	Metal-organic frameworks are an important category of microporous materials, showing extraordinary structural and chemical diversities. The recent discovery of their melting behaviours endows these materials with high processability, enabling the transformation of crystal powders into mechanically durable microporous bulk glasses for device assembly. This project aims to understand the melting and modification mechanism, and to incorporate responsive moieties to the glass. It further aims to realise switchable membrane separation for gas mixtures. This project is expected to enhance the understanding and application of these emerging glass materials and promote Australia's capability in value-added manufacturing of metal minerals.							
	National Interest Test Statement							
	Microporous materials which have pores with sizes smaller than 2 nanometres—about the width of a strand of DNA—are driving a revolution in membrane separation processes, with benefits for the environment, energy storage, and the pharmaceutical industries. However, fabricating membranes with these materials is extremely challenging. To address this issue, this project will develop a new type of microporous material that is a highly processible liquid upon heating and a mechanically robust glass after cooling. These new materials, made from inexpensive minerals such as zinc and iron, will provide significant value-added manufacturing opportunities for the Australian mining industry, and the potential development of innovative new materials for phone screens and lighting devices. In addition, the resultant membranes can provide more effective carbon capture from exhaust gas and natural gas, helping to achieve the net zero target. With Australian industry partners, these new membranes will offer technical and economic benefits to the wider chemical engineering, environmental, and energy sectors.							
DP230101930	**Untangling the matrix of bacterial biofilms**	80,000.00	160,000.00	155,500.00	75,500.00	0.00	0.00	471,000.00
Schembri, Prof Mark A	This research aims to use forefront molecular microbiology and biophysical approaches to advance fundamental knowledge on bacterial biofilms. These bacterial clusters are held together by an extracellular matrix comprised of bacterial-derived fibrous protein and the polysaccharide cellulose, which imparts structural integrity and resistance to antimicrobials. The major goals of this project are to dissect how bacteria regulate production of the biofilm matrix, and examine how changes in the composition of the matrix alters its properties, including the penetration of antimicrobial peptides and antibiotics. The outcomes will help address the economic burden of difficult to treat industrial, environmental and biomedical biofilms.							
	National Interest Test Statement							
	We typically think of bacteria as individual organisms. However, bacteria can use sophisticated systems to communicate with each other to protect their local community. Biofilms are communities of bacteria encased in a matrix or glue that holds the structure together. Bacteria that reside within biofilms exhibit extraordinary resistance to antibiotics and biocides, making biofilms a global industrial, environmental, and biomedical problem. This study will dissect how bacteria produce components of the biofilm matrix, examine its structural properties, and determine how it impedes the diffusion of antibiotics. Understanding the properties and function of the biofilm could lead to the development of new approaches to inhibit or dismantle biofilm communities. The new knowledge produced by this project will be of significant interest across multiple industrial sectors, and therefore has the potential for social and economic benefits for Australia such as protecting our food manufacturing industry, improving the quality of our environment, and allowing us to lead healthy lives.							

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DP230101941	**High value biocoke for low emission steel production**	72,500.00	145,000.00	145,000.00	72,500.00	0.00	0.00	435,000.00
Steel, A/Prof Karen M	This project aims to discover methods to fill nanopores that form during conversion of biomass to biocoke through controlled adsorption and carbonisation of tar compounds. By filling nanopores, their disruptive effects during coke-making will be avoided. Coke will remain a vital ingredient for steel production in the future and is currently produced from coal. The expected outcome is breakthrough knowledge to enable, for the first time, technologies for incorporating biomass materials into coke-making operations. Key benefits are for Australia to provide essential technologies for the world's steel industries to lower CO2 emissions in addition to creating high value carbon products from its agricultural wastes.							
	National Interest Test Statement							
	Steel production processes contribute to 8% of global CO2 emissions. High-strength coke plays a vital role and is currently made from metallurgical coal. Supplementing coal with biomass reduces emissions, however biomass properties lead to low strength biocokes. This project presents an innovation to overcome the deleterious properties of biomass and is expected to lead to a new technology that enables high levels of biomass from agricultural wastes to be blended with coal to produce high-strength cokes. Metallurgical coal provides $40 billion annually to the Australian economy and this novel technology will help Australia maintain its position as a major supplier of essential materials for steel production, take a leading role in curbing global CO2 emissions, and create high-value products from its agricultural wastes. We have demonstrated experience in translating research into commercialised outcomes, having taken many new technologies through to successful large-scale trials. We will work with companies in the supply chain, particularly overseas steelmakers, to enable rapid adoption of this technology.							
DP230102041	**Novel role of RNA methylation in neuronal homeostasis**	77,543.00	159,666.50	160,286.50	78,163.00	0.00	0.00	475,659.00
Widagdo, Dr Jocelyn	This proposal is aimed at understanding the RNA signalling that takes place in neuronal homeostatic response. The crucial role of neuronal homeostasis for normal brain function is evidenced throughout the nervous system; however, the precise underlying mechanisms are still not well understood. The proposed research will utilise high-throughput sequencing approaches coupled with biochemical, molecular and cell biological assays to provide mechanistic insights into the molecular processes that control neuronal homeostatic responses. This will elucidate how neural plasticity and network stability are maintained, a process that is critical for our understanding of sensory processing, learning and memory throughout life.							
	National Interest Test Statement							
	Understanding how learning and memory are regulated in the brain is one of the major goals of modern neuroscience. Neuronal activity drives all aspects of sensory processing (e.g vision and hearing), as well as cognitive processes such as learning and memory; however, we still do not understand how nerve cells are protected from sensory overload throughout life. This project will investigate the previously unexplored processes that operate as a safeguard mechanism to maintain ideal brain function. The outcome of this research will lead to strategies that restore neural stability to improve learning and mental health, which are of major relevance to Australia's national interest. In the longer term, improvements in these areas could benefit education, health, and social outcomes, as well as economic productivity across generations. Translation of these discoveries into practice could occur by partnering with the pharmaceutical industry to create novel therapeutics, or with health professionals to improve the challenging diagnoses of neurological conditions that often arise from neural network instability.							

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DP230102109	**Origin and evolution of animal-bacterial symbiosis**	158,919.00	313,380.00	253,416.50	98,955.50	0.00	0.00	824,671.00
Degnan, Prof Sandie M	This project seeks to understand how interactions between animals and their microbial symbionts – the holobiont – evolved, and how they are influenced by the environment over an animal's life. Using a homegrown Australian model, a sea sponge from the Great Barrier Reef, and advanced multi-omic approaches (genomics plus cell biology), this project aims to uncover the mechanisms underlying the establishment and maintenance of the holobiont through development, and under changing ecological and environmental conditions. Because of the evolutionary position of sponges, outcomes of this project expect to reveal cardinal rules governing animal-microbe interactions that are fundamental to the health and conservation of most animals and ecosystems.							
	National Interest Test Statement							
	The health of all animals depends on their microbial symbionts, the tiny single-celled organisms that live in beneficial relationships inside the animal. Disruption of animal-microbe interactions can have devastating impact on individuals, such as ill-health when the human gut microbiome is disrupted, and on ecosystems, such as coral bleaching when coral-microbe symbiosis breaks down. Despite this, we know very little about how the interactions are formed or maintained through changes in the animal's life. Our project will use a Great Barrier Reef sponge to reveal fundamental rules governing animal-microbe interactions, and how they are affected by change. This knowledge can be used to predict and regulate stability of the symbioses, with benefits for health of animals and ecosystems. In the hands of policy-makers and ecologists, this could revolutionise management efforts to mitigate threats to Australia's world-renowned natural environments and the biodiversity they support. Successful mitigation is crucial for bolstering Australia's tourism industry, worth $60.8 billion GDP in the 2018-19 financial year.							
DP230102124	**Mitochondria as sensors of environmental threats**	88,279.50	181,999.50	191,460.00	97,740.00	0.00	0.00	559,479.00
Sweet, Prof Matthew J	This project aims to understand how energy-generating mitochondria control immune responses, both in immune cells called macrophages and in the nematode Caenorhabditis elegans (a free-living roundworm used as a model organism to study gene function and evolutionary biology). The project expects to advance knowledge of how a process called mitochondrial fission enables cells to respond to environmental threats. Expected outcomes include important conceptual advances in cell biology and genetics, new international and national collaborations, and improved methods for cell biology research. Anticipated benefits include a knowledge base that can be indirectly applied in the long term in the development of new strategies to combat infections.							
	National Interest Test Statement							
	All animals require an immune system to defend against harmful bacteria and other microbes that cause infections. Immune cells can use many different approaches to directly kill bacteria, however there are significant gaps in our understanding of how the immune system detects them. This project will address this knowledge gap by exploring one specific process that enables immune cells to detect and destroy bacteria. A better understanding of this cellular pathway would enable us to switch on the immune system to better fight infections caused by bacteria. In the future, this knowledge could lead to the development of drugs and/or vaccines that improve and/or maintain the health of livestock, companion animals and humans. By using the immune system to defeat harmful bacteria, this project can also help reduce antibiotic use and the emergence of antibiotic-resistant bacteria. This research thus has the potential to deliver economic benefit to the Australian pharmaceutical, livestock, veterinary and/or health industries, as well as social and environmental benefits to the Australian community.							

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DP230102179	**A new perspective on how we learn motor skills: two adaptation classes?**	48,652.50	103,824.00	112,631.50	57,460.00	0.00	0.00	322,568.00
Carroll, Prof Timothy J	The capacity to adapt and acquire movement skills is essential for success in almost every aspect of our lives. This project will test the idea that there are two fundamentally distinct classes of motor learning processes in the brain that are driven by different error types. Using brain recordings, robotic perturbation of movement, and novel variations of classical learning paradigms, the project aims to reveal the neurocomputational properties of these proposed adaptation classes across a range of sensorimotor learning paradigms. The knowledge gained from this project may identify new strategies for adapting movements that are widely applicable to industry, defence, sport, and health.							
	National Interest Test Statement							
	Accurate body movements are crucial in many industrial, defence, sport, and health settings, and every action we take must account for variations in the states of our bodies and the environment. However, the brain processes that allow us to move accurately despite changes in our bodies (fatigue, posture) and the environment (weight and position of objects) are not well understood. This project challenges conventional thinking about the processes that underlie motor learning—the changes in movement that reflect changes in the nervous system. It will use new approaches to reveal how the brain controls our ability for flexible and efficient movement. This may identify new strategies for acquiring motor skills that are widely applicable, including protocols for learning how to remotely operate machinery and medical devices, and to control complex vehicles. The outcomes may benefit Australia by reducing accidents, increasing productivity, and improving engagement with technology. Existing links with aircraft manufacturers, defence agencies, and medical institutes will promote adoption of the project outcomes.							
DP230102264	**High-speed impact fractures and the global origins of projectile technology**	80,391.50	149,633.00	140,563.00	71,321.50	0.00	0.00	441,909.00
Clarkson, Prof Christopher J	It is often argued that complex projectile technology emerged and spread out of Africa with Homo sapiens, but this hypothesis remains untested. Recent research shows certain tip fractures and usewear/residues on stone points may be diagnostic of high-speed projectile impacts, facilitating identification of early complex projectiles. This project aims to use controlled ballistic experiments to generate diagnostic markers of high-speed impacts, test these against ethnographic collections, and analyse archaeological points on four continents. The should provide significant benefits in understanding the origins of complex projectiles, their role in human dispersal, inter-species competition and reasons for early appearance in Australia.							
	National Interest Test Statement							
	The origins of complex projectiles (bows and arrows and spear throwers) is one of the great leaps forward in the evolution of human technology. It is assumed that our ancestors had developed such technology by the time they spread out of Africa 60-80,000 years ago. However, archaeologists have been unable to determine whether this was the case or not, because organic components like wood do not survive over time. This project will identify damage to preserved stone projectile weapon tips to trace the origins and spread of high-speed projectile weaponry around the world. This will test whether complex projectiles facilitated human expansion out of Africa and the colonisation of Australia 65,000 years ago. The project will determine whether our species had a competitive technological edge over archaic humans that facilitated our success and their demise. The research will fill a critical knowledge gap, and benefit Australia culturally in understanding the technology of our human ancestors as well as the First Australians, who also developed the oldest known axe and seed grinding technologies worldwide.							

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DP230102268	**Torres Strait Islander History: Sport, Culture and Identity**	91,904.00	136,087.50	103,612.00	59,428.50	0.00	0.00	391,032.00
Osmond, A/Prof Frederick G	This project aims to investigate sport as a means of understanding the cultures, identities and history of Torres Strait Islanders. Through a community-centred approach, and a project team including Torres Strait Islanders, the project challenges versions of Australian history that marginalise the Strait or conflate Islanders with Aboriginal people. Expected outcomes of this project include a more nuanced history of Indigenous Australia, a significant body of repatriated resources on Islander sport and increased involvement of Islander communities in the history-making process. Anticipated benefits include a multifaceted contribution to reconciliation and better understanding of our unique and complex national identity.							
	National Interest Test Statement							
	This project examines the history of the Torres Strait through its local, national, and international sporting past by involving Islanders in the history-making process. The prevalence and popularity of sport amongst Islanders provides an ideal opportunity for their involvement in their history and to understand the complex cultures and identities of the Torres Strait. It addresses a major gap in knowledge of Indigenous history, which frequently ignores the Torres Strait or conflates Islanders with Aboriginal people. Expected outcomes, which extend to local and national digital resources, will benefit those who reside in the Islands and the diasporic communities of Torres Strait Islanders who live on the Australian mainland. This project will provide a body of literature and resources for national communities, schools and scholars demonstrating the uniqueness of Torres Strait Islander history, cultures, and identities.							
DP230102269	**Click chemistry to reveal how neurons and glia shape perineuronal nets**	70,000.00	150,000.00	159,500.00	79,500.00	0.00	0.00	459,000.00
Götz, Prof Jürgen	The extracellular matrix (ECM) and its perineuronal nets (which are net-like structures with holes wrapped around neurons) are largely underexplored, despite representing a remarkable 20% of the brain's total volume and having been suggested to be involved in many brain functions. Interestingly, digestion of the ECM improves learning and memory, but deficits return once the ECM has reformed. However, how this ECM remodelling is organised at a cell-type level is not understood. Here we aim to close this knowledge gap, using cutting-edge technology including bioconjugation and ultrasound-mediated cargo delivery. Together, this project aims to contribute to a deeper understanding of this major brain compartment in neuronal function.							
	National Interest Test Statement							
	Up to 20% of the human brain is composed of a glue-like meshwork that forms fine nets wrapped around the cells in the brain. Interestingly, the role of this meshwork goes beyond mere structural support, as it is thought to be involved in many brain functions, including learning and memory. When the meshwork is partly dissolved, memory and learning improve; when it re-forms, they become impaired. Surprisingly, little is known about which gene products are made by which cell-types in this process. Here, we aim to close this knowledge gap using cutting-edge technology. This project will also develop novel and versatile tools that help to easily manipulate this meshwork to improve normal brain function, including learning and memory, which is important because this impacts many facets of the Australian quality of life including educational outcomes and healthy ageing. Translation of this knowledge and these tools into practice will occur by designing gene therapies and licencing them to the pharmaceutical industry to combat cognitive impairment in normal ageing.							
DP230102278	**Role of Tau and Synapsin in clustering distinct synaptic vesicle pools**	79,727.50	159,375.00	159,295.00	79,647.50	0.00	0.00	478,045.00
Meunier, Prof Frederic A	Neurotransmitter-containing synaptic vesicles (SVs) are highly enriched in specific locations of brain cells, called nerve terminals via an unknown mechanism. The clustering of SVs depend on the phosphorylation of an unknown set of proteins. Two key proteins have been identified for their phosphorylation pattern and their potential to form membraneless compartments: tau and synapsin. Using highly innovative single-molecule super-resolution microscopy, this grant will uncover how tau and synapsin phosphorylation controls the clustering of SVs thereby regulating neurotransmitter release. This project uses improved nanoscopic technologies and international collaborations to unveil novel avenues in our understanding of brain communication.							

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	National Interest Test Statement							
	Understanding how neurons, the fundamental cells of the brain, communicate at the level of the synapse, the junction between two neurons, is essential to unravelling the deeper processes of brain function. However, there is currently only limited knowledge of these intricate processes. This project will use innovative microscopy techniques capable of tracking individual molecules as they perform their functions in living neurons, to uncover how key proteins control neuronal communication at the synapse. This project will deliver for the first time an understanding of how synapses work at nanoscale level and will unveil the inner working of neuronal communication. Outcomes of the project will enhance our understanding of how the brain can change its activity in response to stimulus and how neurons can maintain connections for a lifetime to underpin our memories and thoughts. These findings could provide a fundamental basis for future treatment strategies for neurological diseases in which molecules malfunction and form clumps called aggregates, a hallmark of neurodegenerative such as Alzheimer's disease.							
DP230102298	**Pathways to semelparity versus early maturity in animals and plants**	49,752.00	119,447.00	143,495.00	73,800.00	0.00	0.00	386,494.00
Fisher, A/Prof Diana O	The project aims to resolve an important but unresolved question in life history evolution and ecology- which mechanisms and constraints lead to semelparity (breeding once, which is rare), and which lead to fast life history (breeding early, which is common) in animals and plants. Theory predicts that both may be adaptations to schedules of adult death. Understanding why males and females have either semelparous or fast life history strategies is crucial to predicting survival of harvested and threatened species under pressure from climate change, drought, predators, and diseases that kill adults. Expected project outcomes include improved ability to address agents of decline of threatened animals and plants including semelparous species.							
	National Interest Test Statement							
	A species survives only if it can compensate for deaths by breeding. To harvest animals and plants sustainably and manage species for conservation we must understand if species can adapt their reproductive intensity and timing to replace adults that die. Some species breed multiple times, and others only once per lifetime. This project will identify which species can adapt to poor adult survival by concentrating their energy on breeding only once and increasing the number of young (suicidal reproduction), or alternatively by starting to breed at a younger age. It will discover how species adapt their reproductive intensity and timing to compensate for increased adult deaths from climate change, predators, disease, and overharvesting. Project outcomes will be shared with Australian and global environment and biosecurity agencies, through publications and meetings. These outcomes will enable decision-makers to improve threatened species recovery results and harvest quotas by accounting for reproductive adaptation.							
DP230102359	**Zooplankton: the missing link in modelling the ocean carbon cycle**	59,901.00	131,081.00	142,119.50	70,939.50	0.00	0.00	404,041.00
Richardson, Prof Anthony J	What is arguably the biggest gap in our ability to close the ocean carbon cycle, and thus improve future forecasts of carbon sequestration and fisheries? The answer is our modelling of zooplankton, the most abundant animals on Earth. This project aims to build a next-generation ecosystem model that resolves zooplankton groups, their traits and key processes, generating novel insights into carbon sequestration and fisheries. Expected outcomes include new methods for zooplankton modelling, leading to a paradigm shift in how we model carbon cycling. This should provide significant benefits, including vastly improved estimates of carbon sequestration and fisheries production, vital for carbon budgets and food security in Australia and globally.							
	National Interest Test Statement							
	The ocean is responsible for removing 40% of the carbon dioxide (CO_2), a greenhouse gas contributing to climate change, from our atmosphere. Zooplankton are abundant ocean animals (e.g. microscopic species, krill, jellyfish) that play a critical role in CO_2 removal and as fish food. However, zooplankton are poorly understood, only limited groups have been modelled, and their key processes that move carbon through the food web (e.g. eating, swimming, defecation) have been omitted. To solve this, we aim to increase the number of zooplankton groups in marine models and include their key carbon cycling processes. Our next-generation model will improve forecasting of wild fish numbers in different areas, assisting Australia's fishing industry which generates $1.7 billion a year, to adapt to climate change. This work will also improve estimates of CO_2 removal, helping Australia meet commitments under the UN Climate Change Conference (COP21) Paris Agreement. Our innovative zooplankton model will be shared with industry and collaborators including CSIRO to ensure maximum uptake.							

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DP230102566	**Neural circuit control of effort under stress**	102,483.50	212,746.50	222,487.50	112,224.50	0.00	0.00	649,942.00
Tye, Dr Susannah J	This Project aims to investigate how the 'decision' to persist in exerting effort to obtain a reward is encoded in the the brain and affected by stress. This work will generate new knowledge on the neural mechanisms through which stress modifies neural activity to control decision making processes underpinning adaptive behaviours essential for survival. The expected outcomes of this work include enhanced capacity at the interface of behavioural and computational neuroscience, that will in turn provide significant benefits through greater insight into brain functions essential for survival, with long ranging implications for performance optimisation and brain-inspired computing.							
	National Interest Test Statement							
	Persistent effort in the face of diminishing returns is essential for success in life, and critical for survival in challenging economic times. In this way, perseverance in goal-directed behaviours underpins modern life and the Australian economy. However, little is understood about the brain processes that enable individuals to 'keep going' when rewards are not immediately received, and critically, how stress encourages 'giving up'. Our project will identify these basic biological processes and develop a computer-generated model explaining how the brain encodes and controls persistent goal-directed behaviour. This discovery will benefit Australia by providing an understanding of the underlying processes that govern perseverance during times of stress, which is particularly relevant to defence, corporate, and education sectors where high performance under pressure provides competitive advantage. New tools (software) can be developed as commercial products for behavioural training and non-invasive brain therapy for peak performance and cognitive illness. Industry pathways are in place for this technology.							
DP230102601	**Expanding the scramjet operating envelope through oxygen enrichment**	85,000.00	187,500.00	207,500.00	105,000.00	0.00	0.00	585,000.00
Wheatley, Prof Vincent	This project aims to investigate the benefits of expanding the operating envelope of scramjets to higher altitudes and speeds by enriching their fuel with oxygen. This is expected to enhance the performance and flexibility of hypersonic air-breathing engines designed to form the core of a more reliable and economical access to space system. Expected outcomes of this project are a validated understanding and mapping of how oxygen enrichment can augment scramjet thrust at high altitudes and speeds, and a performance evaluation of a launch system optimised for this approach. This could provide significant benefits to the performance of reusable, air-breathing launch technology, where Australia is leading the push towards commercialisation.							
	National Interest Test Statement							
	Australia is increasingly dependent on space-based systems for communications, navigation and remote sensing, yet access to space is expensive and not a sovereign capability. By using atmospheric oxygen, scramjet-powered vehicles have capacity for the technology required for rapid reusability, the key to a more reliable, economical and responsive launch system. The project aims to establish the benefits of oxygen enrichment for expanding the operating envelope of scramjets in both altitude and speed. The intention is to enhance the performance and flexibility of a scramjet-based launch system being developed by Australia's Hypersonix Launch Systems, and cruise vehicles in development globally. Commercialisation of this system in Australia would be a significant advantage in the burgeoning small satellite launch market, and securing a fraction of this market would have major economic benefits. Having technical leaders from key end-users as partner investigators provides a clear pathway to adoption of the research. This supports the development of sovereign industry capability in responsive access to space.							

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DP230102664	**Beyond structure - solving conformational dynamics for intractable proteins**	81,500.00	163,500.00	160,000.00	78,000.00	0.00	0.00	483,000.00
Furness, Dr Sebastian G	Proteins perform almost every task that enables the amazing complexity of cellular and whole organism physiology. These molecular machines perform this incredible array of tasks due to their ability to dynamically change shape. For the vast majority of these machines, we can only view a snapshot of the possible shapes they can adopt and can't monitor how they change from one shape to another, which is critical for their functioning. This project aims to develop and apply a completely new method to visualise dynamic changes in protein shape which is not possible with current techniques. This will allow us to provide a new description and understanding of the function of proteins, which is fundamental to all biology.							
	National Interest Test Statement							
	Our bodies run on nanoscale molecular machines. They make life work, contracting muscles, sensing signals from other cells as well as smell, taste, light, touch, sound. To achieve this, molecular machines perform nanoscale gymnastics; twisting, folding, & contorting themselves. Yet in most cases we've no idea how these contortions occur, or even what they involve. We aim to understand these gymnastics, so that in the future we can intervene when these machines go wrong (leading to disease), or design new molecular machines for light harvesting or sustainable chemistry. We're going to use newly discovered fluorescent chemicals & state-of-the art techniques to detect invisible nanoscale contortions in sensing molecular machines. This will provide fundamental knowledge that can be translated e.g. therapeutic design targeting these machines, with long-term implications in medicine. We also envision developing an understanding of these new fluorescent chemicals, which may allow these to become the next generation of solar collectors or photo catalysts for green synthesis.							
DP230102707	**Venom-derived blood-brain-barrier shuttles**	99,685.00	210,370.00	153,437.00	42,752.00	0.00	0.00	506,244.00
Muttenthaler, A/Prof Markus	This project aims to discover new venom peptides capable of crossing the blood-brain barrier and to develop non-toxic peptide-based brain delivery systems. It addresses long-standing challenges and knowledge gaps in the delivery of macromolecules across biological barriers. Expected outcomes include an improved understanding of the strategies nature exploits to reach targets in the brain, mechanistic pathways to cross biological membranes, and innovative discovery and chemistry strategies to advance fundamental research across the chemical and biological sciences. Anticipated benefits include technological innovations relevant to Australia's biotechnology sector and enhanced capacity for cross-disciplinary collaboration.							
	National Interest Test Statement							
	The blood-brain barrier controls the transfer of substances between the blood and the brain, protecting us from toxic compounds while allowing the transfer of nutrients and other beneficial molecules. We still know very little about how this barrier works which limits our capabilities to study the brain. Some molecules from animal venoms can cross the blood-brain barrier efficiently, and this project investigates how they are able to do so. This new knowledge will be used to develop non-toxic shuttles to transport molecular probes and therapeutics across the blood-brain barrier. We will ensure uptake of our research by sharing this technology with leading neuroscientists and the biotechnology industry to facilitate brain research and provide new avenues to tackle debilitating diseases, including brain cancer, Alzheimer's and Parkinson's. The project further highlights the benefits of Australia's biodiversity research that could lead to urgently needed breakthroughs for some of humanity's most challenging diseases and new advances in brain delivery technologies, a multi-million-dollar industry.							

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DP230102796	**Defining the molecular basis for Salmonella persistence**	89,314.00	191,352.50	205,445.50	103,407.00	0.00	0.00	589,519.00
Henderson, Prof Ian R	Salmonella infections in animals and humans place significant burdens on the agri-food and healthcare sectors. All mammals and avian species can become chronically infected with Salmonella and such chronic carriage is a reservoir for disease and outbreaks in other animals and humans. Significant gaps in our understanding of Salmonella infection remain, including the molecular mechanisms involved in establishing a chronic carrier state. We identified several Salmonella specific genes and subsequent murine studies revealed that a Salmonella mutant lacking these genes is attenuated in mice and especially in the gallbladder. In this project we seek to understand the molecular basis for attenuation and the contribution of each protein to disease							
	National Interest Test Statement							
	The world's food production and healthcare systems are in crisis. The widespread use of antibiotics in humans and the agricultural industry has led to the emergence of antibiotic resistant infections in animals and humans. New methods are desperately needed to prevent or treat these infections. Salmonella is a major cause of infection in animals and humans. Globally, Salmonella infections cost the healthcare and agricultural industries over >$15B US annually. It is a major contributor to antibiotic resistance. No vaccine is available to protect against all Salmonella infections. To solve this problem, this project will use new knowledge and techniques to develop a novel vaccine to prevent Salmonella infections in animals and humans. With a predicted global market of $850M US, this discovery will deliver a competitive advantage for the Australian livestock industry by reducing loss due to infections and emerging antibiotic resistance. Commercial development of the vaccine through the Australian biotech sector will generate high-tech manufacturing capability and skilled jobs.							
DP230102958	**Molecular definition of cellular states in the vascular endothelium**	65,969.50	164,259.00	170,670.50	72,381.00	0.00	0.00	473,280.00
Khosrotehrani, Prof Kiarash	The endothelium is the main cell type forming blood vessels and spans across multiple cell states from stem/progenitor to a variety of terminally differentiated cells. How each of these cell states are defined at the molecular level is not known preventing the optimal formation and integration of blood vessels in bioengineered tissues. Using innovative single cell gene expression and chromatin accessibility studies combined with innovative analysis, we propose to define and validate each cell state at the molecular level. This new knowledge would greatly enhance our ability to control the transition between cell states leading to a more widespread use of endothelial cells in bioengineering of tissues globally for many applications.							
	National Interest Test Statement							
	This project is about understanding how blood vessels are formed and can be engineered in tissues. It will use state-of-the-art genomic technology to separate the stem cells that form blood vessels from their more mature counterparts. This will address a major challenge in bioengineering blood vessels in a variety of tissues to enhance blood perfusion allowing larger size tissue artificial tissue constructs. This research will change the paradigm of tissue bioengineering for a range of industries, from pharmaceutical testing, to artificial meat or organs to veterinary medicine. It will improve conditions where blood perfusion is missing such as large bioengineered tissues, models of stroke or cardiovascular disease, therefore having major impact on health. It will also dramatically change tissue bioengineering by allowing the integration of blood vessels in artificial constructs ensuring their adequate perfusion. Findings from this project are likely to lead to intellectual property and to commercial outcomes in a range of industries to benefit the health and biotechnology sector.							
DP230103192	**Interfacial engineering of multilayered metal organic framework membranes**	65,147.00	131,044.00	130,969.00	65,072.00	0.00	0.00	392,232.00
Chen, Prof Vicki	Metal-organic frameworks are a popular class of microporous materials with tunable structural properties and functionalities. This project aims to investigate the designed synthesis of thin, hierarchically structured films of this material on membranes, which displays extraordinary ion selectivity and ion rectification properties. A better understanding of the interfacial properties will be gained through advanced characterisation, and with proper design and tuning of the film, will ultimately lead to the development of high performing ion-selective membranes that will be applied for energy storage and separation applications. This project is expected to benefit Australia's renewable energy and resource sectors.							

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(Columns 1 and 2)	(Column 3)	2022-23 (Column 4)	2023-24 (Column 5)	2024-25 (Column 6)	2025-26* (Column 7)	2026-27* (Column 8)	2027-28* (Column 9)	(Column 10)
	National Interest Test Statement							
	Demands for critical minerals and new energy storage devices such as batteries have accelerated as the world seeks to decarbonise its energy sector. This has led to pressure to efficiently extract critical minerals from new sources and to create better performing energy storage devices. This project will develop thin films (membranes) using a new generation of layered, porous materials which can precisely separate different metal ions, effectively “mining” critical minerals such as lithium from low grade and unconventional sources such as wastewater and seawater. The unique properties of these membranes also have the potential to improve battery lifetime and performance. The outcomes of this project will allow Australia to maximise both its mineral resources as well as its domestic manufacturing capabilities for the renewable energy industries. This project will leverage the partners of the recently awarded Critical Minerals Trailblazer hub as well as the networks of existing collaborators in battery technology to translate the outcomes to real world products and processes.							
	The University of Queensland	3,909,831.00	8,310,190.50	8,514,666.50	4,259,098.50	144,791.50	0.00	25,138,578.00
University of Southern Queensland								
DP230101152	**Degradation mechanisms of structural composites under extreme weather**	49,018.50	103,744.50	102,031.50	47,305.50	0.00	0.00	302,100.00
Manalo, Prof Allan	The changing weather patterns and increasing solar radiation in Australia have greatly impacted the durability of construction materials and caused substantial damage to critical infrastructure. This project aims to understand the synergistic effects of different environmental conditions on the degradation mechanisms of advanced polymer composites and to develop new models on the long-term performance for these materials. This project expects to generate new knowledge on polymer composites incorporating new classes of fibres, resin systems, and functional fillers. Expected outcomes include the discovery of new composite technologies for the longevity of Australian infrastructure - crucial to our economic prosperity and quality of life.							
	National Interest Test Statement							
	Infrastructure worth more than $226 billion including bridges, roads, rail, and commercial, industrial and residential assets across Australia are at high risk because of extreme weather events. This project will address the significant and urgent need for the adaptation and mitigation of existing and new infrastructure through the discovery of highly durable, fire resistant and high strength polymer composite materials optimized by understanding their behaviour under extreme weather conditions. The new knowledge and ideas from this research will be translated into novel technologies for civil infrastructure and will be made available for use by Australian composite companies so they can establish and grow, create new jobs, and fuel the growth of the national economy. These new, resilient and highly durable structural polymer composites will provide opportunity for Australia to lead the world in advanced manufacturing and applying sustainability and enhanced approaches to its infrastructure, providing economic and commercial benefits to current and future generations of Australians.							
DP230102828	**Securing Web-based Services by Policy Coherence and Proof-checking**	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
Li, Prof Yan	This project aims to develop a provably correct cybersecurity system for workflows, which enables organizations to provide flexible and more secure web-based services and business communication. The project expects to generate new knowledge, theoretic advancement and result in new technologies in the areas of internet of things and cybersecurity. The expected outcomes include a software tool with documentation, which helps organisations achieve operational excellence and security, and maintain a trusted environment for end users. This system will provide significant economic and commercial benefits to business and end users with highly secured web-services and improved productivity through a coherent framework and proof-checked workflows.							

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	National Interest Test Statement This project addresses the key National Science and Research Priority of Cybersecurity. It designs an innovative workflow architecture that guarantees cybersecurity in web services and business communication for all organisations and their end-users. Its expected outcomes include creating new knowledge as well as bringing economic, commercial, and social benefits to the Australia and international communities. All organizations face the challenge of either employing new workflows or replacing existing ones as they go online to expand their business and services. It is vital that these new workflows have no security gaps. This project will benefit organisations by guaranteeing correctness of their workflows. High-level cybersecurity is achieved through rigorous proof-checking in each basic dialog and ensuring policy coherence in the whole system. It helps organisations achieve operational excellence and security, and maintain a trusted environment for end users in a digital world.							
DP230103008 Wang, Prof Hao	**Carbon fibre thermoplastics as next-generation carbon fibre composites** By combining sizing, chemical grafting, and nano-reinforcement strategies, this project develops chemically and thermally robust thermoplastic interfacial sizing for carbon fiber/thermoplastic composites for rapid manufacturing. Thermostamped carbon fiber/thermoplastic composite prototypes will be used to verify the sizing. In order to demonstrate industrial viability, recyclability and reprocessability analyses will be conducted. This sizing method can enable high-performance thermoplastic composites in nonaerospace applications with its atomistic level modelling and comprehensive characterisation routine. A key objective of this study is to produce sustainably manufactured composite materials that are also commercially relevant.	64,191.00	130,964.50	135,427.00	68,653.50	0.00	0.00	399,236.00
	National Interest Test Statement Carbon Fibre Composites (CFCs) are extremely strong and lightweight materials used in manufacturing, particularly in the aerospace industry. For example, over 50 percent of the components in the Boeing 787 and the Airbus A350 are comprised of CFCs. Inhibiting the widespread use of CFCs in other industries is the high cost of production. In this project we will develop new CFCs with malleable polymer resin, enabling CFCs to be manufactured by rapid mass production. The new CFC materials can also be reprocessed and recycled to reduce cost and increase material sustainability. Rapid production and the reduced manufacturing cost will enable CFCs to be used beyond aerospace and in broader industries like automotive, wind energy, marine, oil and gas, and hydrogen storage. This expansion in application will help Australia develop a globally facing CFC manufacturing industry. With companies such as Boeing, Ford and Siemens already investing in Australia's advanced manufacturing capabilities, this project could potentially capitalise on these existing relationships, while at the same time nurturing an Australian composites manufacturing industry that will build sovereign capability and capacity.							
	University of Southern Queensland	183,209.50	374,709.00	377,458.50	185,959.00	0.00	0.00	1,121,336.00
University of the Sunshine Coast								
DP230101886 Clemente, Dr Christofer J	**Combining biomechanics and movement ecology of kangaroos and relatives** Kangaroos and their relatives are unique in their body form, hopping gait and by the fact that increased speed does not come at an increased energetic cost. This project aims to build 3D musculoskeletal models to understand how muscles and tendons interact, enabling greater distances to be travelled using less energy. Further, it will use animal tracking devices and machine-learning tools to quantify movements in the wild. This framework will provide novel insights into how energetics, morphology, and habitat have shaped the evolution of this unique group. This may open doors to a range of future ecological, physiological, and conservation studies and provide biological inspiration for energetically efficient robotic and assistive devices.	64,650.50	142,303.50	152,429.00	74,776.00	0.00	0.00	434,159.00

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	National Interest Test Statement							
	This project will provide insights into the biomechanical characteristics of kangaroos that underpin performance to improve our understanding of the locomotor ecology and evolution in Australia's most dominant mammal group. Kangaroos are important to study because their unique muscle-tendon design allows them to move faster without using more energy. Yet this system is not well understood. A unique dataset will be generated, combining biomechanical data with computer models to understand how muscles and tendons interact as they hop. We will determine how kangaroos use this system in the wild, using animal-mounted biosensors and machine-learning tools. This dataset will be used more broadly to inform conservation strategies for land management, and as bio-inspiration for assistive robotic devices. Innovations in assistive technologies have potential to reduce the burden of manual lifting in the workforce or enhance load carriage in the military. Our outcomes will be shared with engineers and rehabilitation scientists via collaborators to develop biologically-inspired assistive devices to aid human movement.							
	University of the Sunshine Coast	64,650.50	142,303.50	152,429.00	74,776.00	0.00	0.00	434,159.00
	Queensland	6,803,934.50	14,276,658.50	14,283,786.00	7,095,853.50	384,791.50	100,000.00	42,945,024.00

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South Australia								
Flinders University								
DP230100002	**Pair bonding: is it all in the brain?**	92,990.50	196,406.00	182,895.00	79,479.50	0.00	0.00	551,771.00
Gardner, Prof Michael G	This project aims to understand the interaction between classic pair bonding neural circuits, parasites, and the immune system in sleepy lizards. Social bonds are a cornerstone of human societies, especially true of the pair bond and this project expects to generate knowledge to help understand why healthy adult pair bonds are the single best predictor of longevity in humans. The expected outcomes of this project are to reveal the mechanistic basis of pair bonding by identifying the brain regions, cell types and neurochemicals that promote pair bonding behaviour — for the first time in a wild animal. This project should provide significant benefits by increasing our knowledge of how pair bonds promote wellness.							
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DP230100107	**Understanding vicarious trauma in Australian foster care**	33,564.00	62,205.00	54,141.00	25,500.00	0.00	0.00	175,410.00
Riggs, Prof Damien W	This project aims to investigate experiences of vicarious trauma in Australian foster care. This project expects to generate new knowledge about antecedents and mitigators of vicarious trauma, and will do so by using interdisciplinary approaches to understand the specific contexts in which vicarious trauma may occur. Expected outcomes of this project includes the generation of national data about vicarious trauma in foster care through the development of a new measure of vicarious trauma. This should provide significant benefits, such as providing a clear means to assessing vicarious trauma, and through the development of a mobile app that will enable foster families in Australia to monitor and report experiences of vicarious trauma.							
	National Interest Test Statement This project will look at how Australian foster families (inclusive of foster carers, adults who grew up in care, and adult birth children of foster carers) potentially experience vicarious trauma. Vicarious trauma occurs when one person is exposed to the trauma-related behaviours of another person, resulting in significant negative changes to their worldview. The project will result in an understanding of experiences of vicarious trauma in Australian foster care, a new way to measure vicarious trauma, and a mobile app that foster families can use to monitor the potential for vicarious trauma and to request support. These outcomes are important as they provide a proactive way of conceptualising and addressing vicarious trauma in Australian foster care, rather than the reactive approaches that currently exist. Proactive approaches to vicarious trauma in Australian foster care can help to reduce the economic costs of child protection by reducing foster carer attrition and mitigating the harmful effects of trauma on all parties, as well as improving the wellbeing of foster families.							

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DP230100288	**Young People with Disability & Young Carers: Opportunities & Contributions**	64,000.00	126,000.00	129,000.00	67,000.00	0.00	0.00	386,000.00
Redmond, Prof Gerard M	This project aims to examine opportunities that young people with disability and young carers (aged 12-24) value and access, and contributions they make to families, communities and society. Using novel conceptual framing, qualitative research and large-scale survey data, the project expects to provide new knowledge on how policy can support access to valued opportunities and contributions for young people with disability and young carers to support them to reach their full potential. Young people are centrally involved as co-researchers and the project is guided by a Policy Advisory Group. Benefits include evidence for a strengths-based policy approach to disability and care, longer-term economic gains and improved social cohesion.							
	National Interest Test Statement							
	One in five young people access disability support at school. One in ten provide care for ill or disabled family members. Most research on young people with disability and young carers has focused on their support needs, but this project will examine their positive engagement in education, employment, caregiving, volunteering and other forms of active citizenship. Young people with disability and young carers will work as paid community co-researchers to identify opportunities for engagement. Results will help governments and service providers make better policy. This will directly benefit young people with disability and young carers who will be able to access better education and training, better jobs and higher earnings. It will also benefit young people with disability and young carers through improved social opportunities, including increased participation and volunteering in sports and community clubs, increased influence in community organisations, and more voice in local, state and federal government bodies. They will enjoy higher self-esteem, confidence, social recognition and living standards.							
DP230100479	**High shear fluid flow driving carbon foundry for advanced manufacturing**	94,202.00	191,560.00	200,866.00	103,508.00	0.00	0.00	590,136.00
Raston AO FAA, Prof Colin L	This project aims to develop versatile continuous flow thin film microfluidic device technology for harnessing contact electrification generated by sub-micron high shear flows in fabricating novel and high-performance nano-carbons for which current methods are ineffective or impossible. This project expects to generate new knowledge on complex vortex fluid fields, their intricate interactions with external electric and magnetic fields and carbon nanostructure formation. Expected outcomes for this project include exquisite control on reforming nanocarbon with tuneable properties and unprecedented hetero-structures. This should provide significant benefits, such as in generating new processes and products for advanced manufacturing.							
	National Interest Test Statement							
	Recent developments in the creation of nanocarbon materials offer not only the most conductive material in the world enabling the efficient transfer of heat and electricity, but also the potential to replace conventional less efficient semiconducting material used in a wide range of electronic devices as touch screen displays, supercapacitors and solar cells. The global market for these materials is projected to be over $5 billion by 2026. The challenge and opportunity in nanocarbon manufacturing is to correctly control the properties of the materials produced. The project will capitalise on an Australian invented vortex device for precise preparation of carbon material with improved properties. The low cost, low energy usage, and small dimensions of the device are attractive features for new carbon material manufacturing. This project will place Australia at the frontier in advanced manufacturing of functional materials and benefit Australians by the development of environmentally sustainable technologies based on carbon materials, which have a range of applications, including in energy generation and storage, monitoring and improving the environment.							
DP230100587	**Unusual trisulfide chemistry**	65,160.00	133,091.00	137,433.00	69,502.00	0.00	0.00	405,186.00
Chalker, Prof Justin M	This project aims to investigate the mechanism of an unexpected reaction of trisulfides with common amide-containing solvents. Specifically, these solvents (such as dimethylformamide) were discovered to cleave S-S bonds in trisulfides and related polysulfides. This project expects to generate new knowledge in the understanding of the reaction mechanism and then use that understanding for useful chemistry. Expected outcomes of this project include a mechanistic understanding of a new reaction, and the use of this chemistry in polymer synthesis and polymer recycling. This project should provide significant benefits in new knowledge, as well as support new strategies in polymer synthesis and recycling to benefit the environment.							

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	National Interest Test Statement This project will investigate new methods to make and recycle rubber. Currently, rubber such as that found in car tyres is mostly sent to landfill. This is not sustainable and there is a need to develop new technologies to recycle rubber. This research will benefit Australian manufacturing and recycling in the area of novel plastics and rubber. Many Australian industries use rubber and rubber-like materials, so this project will also provide sustainable solutions for these companies. The benefits of using the novel rubber technology will be environmental (reducing waste) and economic (providing new rubber products). The technologies developed in this project will also be applicable to traditional rubber products such as waste tyres, providing a new method for recycling them and converting them into new products. Patents generated from the discoveries in this project may be licensed to Australian companies to facilitate uptake. The project team has an outstanding record in commercialising discoveries and will present at industrial trade shows to promote the technologies and findings.							
DP230100642 Jia, Dr Zhongfan	**Folding polymers for high-performance energy storage** This project aims to address the current bottleneck of energy storage capability in polymers by developing new compact structures through programmed polymer folding. This project expects to understand how structures determine electrochemistry properties by creating densely packed redox-active polymers to break the limits of charge transfer rates and storage ability. Expected outcomes include deep insights into fundamental electrochemical reaction mechanisms, laying a strong foundation for the applications of polymers from flexible electronic devices to micro-grid energy storage. This project should provide significant benefit in new knowledge and support advanced manufacturing using our high value-added materials.	85,410.00	172,739.50	109,264.50	21,935.00	0.00	0.00	389,349.00
	National Interest Test Statement Current rechargeable batteries primarily use lithium and cobalt compounds, which are both difficult and expensive to mine and refine. Ever-increasing costs and safety risks of using these batteries have hampered their use in Australia's renewable energy sector. While 90% of waste batteries in Australia go to landfill, the leaching of heavy metals into our land and water raises enormous environmental concern. This project will develop new metal-free polymer rechargeable batteries by modifying and testing the properties of organic-based materials. The new polymer batteries can replace millions of household metal-based batteries and eliminate waste battery pollution in Australia and around the world. The technology generated from this project will be patented, promoted through industry and technology exhibitions, and further deployed by Australian companies. This will benefit Australia's advanced manufacturing through which the next-generation of metal-free batteries will power emerging flexible and wearable devices as well as store energy for millions of home solar systems.							
DP230100906 Takarangi, Dr Melanie K	**The cost of keeping gruesome images from the world** This project aims to investigate one of society's most invisible 'frontline' trauma workforces—the online content moderators responsible for limiting the public's exposure to distressing and sensitive content on social media. Using a series of rigorous experiments, and cutting-edge psychological and physiological assessment techniques, the research will advance our understanding of the impact of indirect trauma on mental health. Expected outcomes include novel empirical evidence for preventative strategies that will predict, monitor and reduce negative mental health outcomes. This will provide significant global benefits to people with indirect trauma experiences, such as defence and forensic personnel.	47,647.50	98,482.50	105,004.50	54,169.50	0.00	0.00	305,304.00
	National Interest Test Statement This project investigates one of society's invisible 'frontline' global workforces— moderators who keep the internet safe by limiting people's exposure to content depicting the worst of humanity. Although we know 'indirect' forms of trauma (like viewing traumatic images) can be harmful, the content moderation role has received no scientific attention. We will develop methods to study content moderation, enabling us to identify its problematic features and evaluate strategies to monitor, predict and reduce the psychological harm moderators experience. These strategies will apply to other workforces (e.g., police), putting Australia at the global forefront for reducing social and economic damage from mental health problems in people routinely exposed to traumatic images. We will work directly with relevant organisations and individuals, including workers for social media platforms like Facebook, Police, Defence personnel and content moderators, to introduce effective strategies that protect them from psychological harms.							

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DP230100966	**Tackling Crystal Methamphetamine Supply in Rural and Regional Australia**	39,678.00	126,375.00	109,460.00	45,071.00	38,155.00	15,847.00	374,586.00
Hughes, A/Prof Caitlin E	This project tackles one of the leading drug policy and organised crime issues in Australia, namely the increased availability of crystal methamphetamine (ice) in rural and regional communities. The first study of its kind nationally, it will use an innovative combination of qualitative and quantitative methods across six communities in three states to uncover how ice infiltrates regional communities, the drivers and mechanisms and impacts thereof. Expected outcomes include a roadmap to reduce supply and harms, strengthened communities and enhanced international collaborations. With ice use and supply costing the Australian government $5 billion per year, the project stands to provide significant social, public health and economic benefits.							
	National Interest Test Statement							
	This project analyses one of the leading drug policy and organised crime issues in Australia, namely, the increased availability of crystal methamphetamine (ice) in rural and regional communities. The first of its kind nationally, the study aims to produce grounded and triangulated data about the mechanisms of ice supply to and within six communities across three states (South Australia, New South Wales, and Victoria). Drawing from ethnography, interviews, surveys, and social network analyses, the outcomes will significantly advance criminological knowledge about the causes and impacts of ice supply (social, health and economic) on rural and regional communities and generate new insights relevant to the mitigation of ice supply and associated harms. As strategic applied research, the project aims to improve responses at local, state and federal levels to the ice problem for rural and regional Australia. With the annual Australian enforcement, health and lost productivity costs of ice use totalling more than $5 billion, the projected benefits of the research are far-reaching.							
DP230101057	**The first English speakers in their own words**	17,329.00	36,590.50	43,941.00	24,679.50	0.00	0.00	122,540.00
Sebo, Dr Erin	This project aims to produce the first comprehensive study of the attitudes in the earliest English literature. The project expects to generate new knowledge about the first English speakers, what issues mattered most to them and how broad the range of attitudes was. Expected outcomes of this project include new approaches to studying the past, enhanced international collaborations and a public access to the project's data through an open access digital resource. This should provide significant benefits in terms of our understanding of the past and how it shapes attitudes in contemporary Australia.							
	National Interest Test Statement							
	This research represents the first major study of cultural attitudes in medieval English literature by developing new techniques to map direct expressions of opinion and new methodologies for studying the past. It will establish Australia's expertise in early English literature studies and drive future research by creating a publicly available digital resource. The study will benefit all Australians because, as a society of principally English speakers, it will transform our understanding of how the first English speakers perceived the world and reveal the issues that mattered most to them. ASIO’s Annual Threat Assessment assesses online activities as ‘the most concerning trend’ and medieval attitudes are known to be used online to drive extremism, so the study will also benefit all Australians as a resource to counter such misconceptions and promote greater social cohesion. It will also offer commercial and other content creators direct access to better data. The research will benefit effective contemporary communication as well as providing new insights into our past.							
DP230101689	**Veteran suicide: investigating the historical and social dimensions**	92,166.00	177,469.50	152,919.00	67,615.50	0.00	0.00	490,170.00
Wadham, A/Prof Ben	This project aims to address veteran suicide by conducting an historical and cultural analysis of the ways government, the military and the community have understood, governed, and serviced veterans from 1914-present. This project will generate new knowledge, moving beyond orthodox medical and cultural assessments to explore wider historical, cultural and sociological relations of veteran suicide, including civil military relations, and the influence of the veteran sector and families and community. The project will develop an innovative survey that will form the foundation of a longitudinal social health and wellbeing dataset on veterans, and contribute to policy and service provision to reduce veteran suicide and improve their wellbeing.							

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	National Interest Test Statement The Australian community have not been able to reduce veteran suicide incidents. This research supports the shift in the field of veteran wellbeing to a social health approach. The research uses historical, sociology and demographic methods to generate a long history of veteran suicide (1914-present). The research collects and analyses documentary evidence, life history interviews, as well as survey data. The research will provide a holistic picture of how veteran suicide has been conceived and addressed over time and will provide broad assessment of how effective disciplinary, policy and service provision models have worked. 80 sociological autopsies outline a life course approach which will contribute knowledge to policy and service provision. The data will be used to produce an innovative survey instrument for longitudinal data collection. The research draws heavily upon lived experience and has structures for co-design. The research analysis will be graphically and textually represented in novel ways that translate to policy and service provision. The interviews will form a web based testimonial site.							
DP230102484 Manwaring, Dr Rob P	**Hiding in Plain Sight: 'Associated Entities' and Australian Democracy** Associated Entities (AEs) are organisations that are formally linked to political parties. This project aims to examine how AEs interact with Australian democracy by investigating their impact on elections, the law, and party system dynamics. This project expects to generate new knowledge about the impact of these nearly 200 key political actors, with a particular focus on how they are able to elude significant scrutiny of their activities. Expected outcomes include a new typology of AEs, a new financial index to measure their impact, and proposals to improve their regulation. The key benefits generated include: a strengthened campaign finance regime, and enhanced transparency and integrity to Australia's democracy.	68,137.00	131,500.00	115,117.50	51,754.50	0.00	0.00	366,509.00
	National Interest Test Statement The project examines the role and impact of 'associated entities', which are organisations either set up, run by or affiliated to political parties. To date, we have little clear evidence or direct research of their influence on Australian democracy. The project will produce public and academic outputs which set out (1) how associated entities might undermine electoral competition (2) set out strategies to improve their regulation (3) directly address public concerns about the links between political parties and their funding. Key regulators and other stakeholders have identified a range of cocnerns about gaps in the regulatory environment, and this project can directly inform efforts to strengthen the current system. Key social and economic benefits will flow from this research as Australia's party finance regime can be strengthened. The project includes a key stakeholder forum (primarily representatives from the federal and state electoral commissions) to explore regulatory changes, and broker input in order to strengthen the link between citizens and political parties.							
	Flinders University	700,284.00	1,452,419.00	1,340,041.50	610,214.50	38,155.00	15,847.00	4,156,961.00
The University of Adelaide								
DP230100406 Binder, A/Prof Benjamin J	**Understanding the mechanisms that inhibit and promote biofilm expansion** Yeasts have been used for biotechnology throughout recorded history. They are important human pathogens, and major experimental models of eukaryotic cells. Although yeasts are some of the most studied organisms in biology, their modes of colony biofilm formation are not fully understood. Methods to investigate the environmental and genetic processes that drive colony biofilm formation will be developed in this proposed project. They will provide a deeper understanding of the mechanisms that inhibit and promote biofilm formation, and colonial morphology in the different modes of growth of Saccharomyces cerevisiae, with implications for this and other biofilm-forming yeasts of biotechnological or medical importance.	83,500.00	172,000.00	137,000.00	48,500.00	0.00	0.00	441,000.00
	National Interest Test Statement The growth of microorganisms on surfaces contributes to the spread of diseases and the contamination of food. This occurs through the formation of a structure called a biofilm, a community of microbial cells that adhere to each other and to a surface. Biofilms are very difficult to remove, which has negative economic and health consequences. For example, biofilm formation on food processing equipment is a major cause of contamination, threatening Australia's $110 billion food processing industry. The formation of biofilms on medical equipment can cause life threatening infections in patients who undergo invasive medical procedures. Using a combination of mathematical modelling and laboratory experiments, this project will identify the factors responsible for the formation of biofilms in industrial and medical environments. Working with the food and beverage, and the medical devices industries, this research will lead to improved control of microorganisms, the reduction of biofilm formation, and improved health, safety and economic outcomes.							

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DP230100497	**Mapping climate change vulnerability of older Australians to extreme heat**	80,895.00	154,077.50	149,672.00	76,489.50	0.00	0.00	461,134.00
Bi, Prof Peng	Exposure to extreme heat is associated with negative health outcomes and has been recognized as a global health challenge in the context of climate change, especially among older people. While the direct heat-related mortality for older people reached a record high of 345,000 deaths worldwide in 2019, which was 80.6% higher than the 2000–05 average, there has been no detailed study in Australia. This project is to have a national picture of the impact of extreme heat on the health outcomes of older people and associated healthcare costs at Statistical Area level 3 (SA3), to inform the design and implementation of tailored interventions to minimize the health risk and costs from extreme heat to protect the health of this vulnerable group.							
	National Interest Test Statement							
	Exposure to extreme heat increases the risk of negative physical and mental health outcomes, particularly among older people. Climate change and an ageing population are expected to exacerbate this global public health challenge and place additional pressure on health systems. This project will provide a comprehensive national picture of the impact of extreme heat on health outcomes and associated healthcare costs among older people by mapping and examining outcomes by geographical region across Australia; identifying and quantifying the contribution of extreme heat to these outcomes; and projecting future heat-related health burden under different climate change and demographic scenarios. Findings will inform health service planning and the design and implementation of tailored interventions to minimise health risks for older Australians and reduce healthcare costs. Researchers will collaborate with health service providers, social and emergency service leaders, and policymakers to translate findings into community adaptation approaches and healthcare workforce capacity building strategies.							
DP230100609	**Structural and molecular studies of endocrine disruption in Australia fauna**	78,479.50	212,328.00	203,106.00	69,257.50	0.00	0.00	563,171.00
Bruning, Dr John B	Contamination of waterways with compounds that disrupt hormone (endocrine) function is a major environmental problem and threat to the health and fertility of animals. Specifically, we lack an understanding of how these potent endocrine disrupting compounds function in native species. Using an innovative combination of structural and molecular biology approaches we will elucidate the mechanisms of action of environmental endocrine disrupting compounds in native aquatic species - model fish and the platypus; and develop novel technologies for their detection. This work will provide an understanding of the environmental threat of these pollutants to our unique wildlife and will guide future waterway management.							
	National Interest Test Statement							
	Chemicals derived from plastics, drugs, pesticides, and fire retardants can adversely alter a living being’s hormonal system. When released into the environment, they interfere with normal animal development, health, and fertility; these pollutants threaten all animal populations, particularly those in freshwater ecosystems where the chemicals accumulate to high levels. Australia’s unique and iconic native species are a vital part of our environment and national identity, with many species under threat. This research will provide insights into the mechanisms by which these pollutants affect Australian native species, including the platypus. Technology will be developed which is innovative, rapid, and low cost for detection in field. The pathway to adoption will include data sharing with the public and government to raise awareness of the threat of pollutant exposure and implementation of a future first-in-kind biosensor to monitor and manage these pollutants in freshwater to aid conservation of Australian native species.							
DP230100731	**Evolution of sensory systems in the dark biosphere**	64,703.50	140,060.50	148,592.00	73,235.00	0.00	0.00	426,591.00
Cooper, Prof Steven J	This project utilises a unique Australian model system based on multiple, independently-evolved subterranean water beetles to explore the adaptive and regressive changes in the genome that occur when surface species colonise subterranean habitats. We aim to characterise and investigate the evolution of chemosensory and circadian rhythm genes, which play critical roles in the fitness of animals, including the ability to find food and mates in a dark, thermally stable environment. Knowledge of chemosensory and circadian genetic systems and how they dynamically evolve is fundamental to a variety of fields, including the process of speciation and biological adaptation (for example, to permanent darkness, pollutants and insecticides).							

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	National Interest Test Statement This project will characterise the genes involved in smell and taste, and circadian rhythms (genes that set the biological clock of animals to a 24-hour cycle) of unique eyeless beetle species living in a dark groundwater environment. Using cutting edge genomic tools, it will identify these sensory genes for the first time in subterranean groundwater insect species and assess how they evolved to allow adaptation to the dark. The outcomes will provide valuable knowledge of how animals find their mates and food and adapt to changing environments (e.g., utilising new food sources or avoiding predatory species). The research will contribute to our understanding of fundamental evolutionary processes such as how new species evolve and biological adaptation, a field that has important implications for medical science (e.g., how viruses evolve and spread through communities). Further applications of this research by Australian government agencies and industries include the development of strategies to control insect pests (e.g., by using chemical baits as lures).							
DP230101513 Lambert, Prof Martin F	**Network Calming - Using Smart Sensors to Improve Water Asset Performance** Recent high-frequency monitoring in water distribution networks (WDNs) shows that pressure perturbations are significantly more dramatic than expected and cause pipe failures with highly disruptive consequences. This project aims to hydraulically calm WDNs to improve their performance, informed by smart sensors. The project will generate insightful knowledge of the hydraulic behaviour of real WDNs. The outcomes will be new strategies to identify, eliminate and suppress harmful pressure perturbations, leading to a reduced burst rate, extended asset life, improved system operation and advanced design principles. The resultant sustainable water assets provide significant economic and environmental benefits to the water industry and society.	79,793.00	135,852.50	115,679.50	59,620.00	0.00	0.00	390,945.00
	National Interest Test Statement Australia’s public health and economic prosperity rely on over 162,000 km of water mains. The current water network operation in the water industry and the performance of the networks lead to a rapid deterioration of the water asset condition with an increasing trend. The issue brings a major challenge: almost half of the assets with a total value of over $80b need to be replaced by 2050. The project will develop new strategies and techniques by learning from the historical pressure data to slow down the asset deterioration and guide the future water system design and refurbishment. With new strategies and techniques adopted, the lifetime of Australia’s aging water assets can be extended, which can save millions of dollars every year from pipe maintenance costs. Cities will see fewer pipe breaks, meaning less interruption to service and traffic, less property damage and less water loss. Australia will become a leader in this transferable technology, which has commercial potential globally.							
DP230101791 Thomas, Prof Anthony W	**A New Approach to the Structure of Atomic Nuclei** Starting at the quark level, we have derived a theory of nuclear structure, that in its initial application appears extremely successful. The aim of this project is to advance this revolutionary new approach to the theory of nuclear structure to the next level by exploring its predictions for a number of outstanding questions in modern nuclear physics. This includes the properties of superheavy nuclei, with atomic number beyond 100, including the potential existence of a new region of stability and complementing experimental searches underway internationally to discover the limits of stability with large neutron or proton excess, which is crucial to understanding the origin of the elements and may contribute new energy related technology.	64,554.00	129,108.00	129,108.00	64,554.00	0.00	0.00	387,324.00
	National Interest Test Statement Fundamental research in nuclear science has led to breakthrough discoveries in areas as diverse as energy production and medical imaging. This project will contribute to this important area by generating new knowledge about the structure and behaviour of atomic nuclei, the small dense regions at the centre of atoms. The knowledge gained will guide searches for new elements and contribute vital information to understanding how the known elements were formed. This deeper understanding of the structure of atomic nuclei will lead to more discoveries that could be adopted by national priority industries in the energy, security and defence sectors. This project will build national expertise in nuclear physics, maintaining the talent pipeline in Australia to contribute to the global effort and secure Australia’s reputation in this field. It will also contribute to the better understanding and acceptance of nuclear technology through careful communication of the results to the general public.							

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DP230101932	**How climate-resilient are our temperate fisheries species?**	79,698.50	189,974.50	175,748.00	65,472.00	0.00	0.00	510,893.00
Nagelkerken, Prof Ivan	This project assesses the resilience of our temperate fisheries species to climate change. Using natural warming hotspots and volcanic CO2 vents we study populations of fisheries species that are already pre-adapted to future climate, and therefore could act as key populations for replenishment of future fisheries stocks. An innovative and interdisciplinary approach combines the ecology, genetics, behaviour, and physiology of fisheries species to evaluate their climate resilience. An advanced food web model will be developed to forecast changes to fisheries production in a future world. This provides a much-improved forecast of climate adaptation and managing future biodiversity and fisheries species through resilient genes and populations.							
	National Interest Test Statement							
	Climate change is already affecting the health and biodiversity of our oceans, and the >85% of Australia's population who live within 50 km of the coast. Addressing the effects of climate change on our marine resources will be one of the great challenges of Australia's annual 100-billion dollar Blue economy. Our reliance on sustainable seafood production will depend on how climate-resilient our fisheries species are, but their scope for climate adaption remains unknown. Here, we study populations of fisheries species in climate-change hotspots, to uncover their potential as sustainable future sources of climate-resilient fisheries stocks. Discovery and preservation of such climate-resilient populations may provide a realistic approach towards climate-proofing our ocean's seafood production. Recreational and commercial fisheries contribute > 10 billion $ to Australia's economy and are critical for job security, tourism, and seafood production, but are being affected considerably by climate change. This project can provide solutions on how our productive oceans can adapt to the effects of climate change.							
DP230102027	**Production of C1/C2 Commodity-Chemicals via Efficient Electrocatalysis**	117,357.00	245,075.00	240,087.00	112,369.00	0.00	0.00	714,888.00
Qiao, Prof Shizhang	This project aims at sustainable and efficient production of methanol and ethylene glycol via development of revolutionary electrocatalytic processes that use renewables as energy input, water as oxidising agent and carbon dioxide-derived intermediates as feedstock. Outcomes include advanced knowledge of complex interface electrocatalysis and reaction-targeted catalysts with commercially relevant performance, achieved by combination of theoretical computations, atomic-level material design, in-situ spectroscopy tests and interfacial engineering. It will significantly benefit renewable energy use, commodity-chemicals manufacturing, together with carbon-footprint reduction to make Australia and the world carbon-neutral and sustainable.							
	National Interest Test Statement							
	Australia has a 2050 target to deliver net zero emissions. This project will address this ambitious target by developing new technologies to convert renewable electricity into transportable “green” chemicals and fuels without generating carbon dioxide emissions. By supporting this manufacturing transition from fossil fuels to renewable sources, this project will help Australia to develop its future renewable energy economy, and deliver economic and commercial benefits. By assisting Australia’s local manufacturing to become more technologically advanced, this project will significantly contribute to securing Australia as a world leader in renewable energy technologies. Reducing fossil fuel usage and carbon emissions will also have an impact on reducing air pollution and associated human health problems. It is anticipated that intellectual property developed during this project will be used by industry to play a key role in reducing carbon emissions in Australia and globally.							
DP230102151	**To what extent does Australian food policy consider its health impact**	85,500.00	183,500.00	215,500.00	117,500.00	0.00	0.00	602,000.00
Baum, Prof Frances E	This research will examine how public policies relating to food can be made healthier. The diet of Australians currently contributes to high rates of disease including diabetes, heart disease and the underlying issue of obesity. It will examine Australian agriculture and food processing, manufacturing and marketing and the environmental impacts of these sectors. The research will analyse policy documents and interview key people involved in each sector to determine their views on the ways in which our food supply affects our health. It will result in policy recommendations advising how the Australian food sector can be made more supportive of health and equity. Policy makers will be engaged with our findings through a Food Policy Summit.							

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	National Interest Test Statement Australia is fighting an epidemic of obesity. This epidemic affects most Australians but those in vulnerable socio economic circumstances are more severely affected . While we know that diet affects health, less is known how food-related public policies affect health. Our research will examine how agriculture, environment, food processing, manufacture and marketing public policies either contribute to or detract from the health of Australians. The project will directly provide: 1) Detailed analysis of how to make our food supply healthier which will result in a healthier workforce and population, reduced burden of chronic disease and healthcare costs and contribute to reversing health inequities; 2) Evidence for Australian governments to develop coherent policy and clear targets across the food system to improve population health, environmental protection and mitigate climate change; 3) Information to Australian citizens and non-government organisations to support their advocacy for healthier food; and 4) Provide the basis for healthier and sustainable consumer food choices.							
DP230102406 Wang, Prof Shaobin	**Integrated nonmetal-metal single-atom catalysis for selective synthesis** Single atom catalysts can achieve the maximum efficiency of active sites for a reaction. This project will develop integrated nonmetal and metal single atom-based catalysts for selective oxidation towards clean production and organic waste conversion to value-added polymers for carbon recycle. The project will result in new functional materials and green catalytic processes for chemical synthesis and waste reduction, and advance fundamental understanding of molecular structure of materials for catalyst design and process engineering for industrial applications. The outcomes will promote the development of chemical industry, waste recycle and green environment in Australia, making significant benefits to economics and society.	97,325.50	186,151.00	168,151.00	79,325.50	0.00	0.00	530,953.00
	National Interest Test Statement Persistent organic pollutants (POPs) in water are difficult to remove without the intensive use of chemicals that produce large amounts of toxic and hazardous wastes. The use of catalysts (e.g. heavy metals such as platinum and cobalt) can significantly improve the process. However, the existing metal catalysts are expensive, lead to secondary contamination, and require harsh conditions to work effectively. This project will build on previous successes to develop new green catalysts that not only remove the POPs, resulting in cleaner water, but also convert them into insoluble polymers for simple separation and recycling as value-adding materials. The new cutting-edge technology will be integrated at low cost into waste recycling and wastewater treatment plants and will support Australia's advanced manufacturing capability. This project will also provide critical knowledge to reduce carbon footprints and industrial waste streams to secure water safety and sustainability for Australia.							
DP230102476 Zhang, Prof Dabing	**Protecting cereal grain development at high temperatures** This project aims to investigate new temperature-responsive factors that regulate cereal grain development to protect grain production under heat stress. The new research will leverage international collaborations with access to cutting-edge genetic and technological resources, and refine novel X-ray imaging techniques in Australia, to observe how temperature affects flower structure and function in barley and rice. Favourable mutations that optimise plant yield and fitness will be defined and explored in other, more complex, cereals such as wheat. Expected outcomes will be fundamental breakthroughs in understanding how plants respond to, and buffer, the effects of heat to lead to translational breeding strategies that bolster grain yield.	119,350.00	243,718.00	254,887.00	130,519.00	0.00	0.00	748,474.00
	National Interest Test Statement Heat stress during grain development in cereal crops can dramatically reduce yield; temperature increases of only 2°C at the wrong time can cause yield losses of up to 50% in barley. This project aims to investigate new factors that protect the shape of the grain-bearing head (inflorescence) and grain-forming organ (pistil) of crops in response to heat. Starting with two genes that appear to protect grain yield under heat, this project aims to define their mechanisms of action in model crops barley and rice, and explore their applicability to other, more complex, cereals such as wheat and oats; these crops represent the vast majority of Australia's agricultural grain production and will be key to deliver on Australia's ambitious Ag2030 goals for $100B farm-gate value by 2030. This project will leverage strong international partnerships in the UK and Germany to deliver new breeding targets and potential patents/licencing opportunities, as well as training opportunities for six young researchers to build and strengthen Australia's reputation and research capacity in agricultural science.							

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DP230103060	**China’s changing internal migration: patterns, causes, policy implications**	60,643.50	123,427.00	116,967.00	54,183.50	0.00	0.00	355,221.00
Tan, A/Prof Yan	China’s massive internal migration is no longer simply rural–urban and circular but highly diversified. The project aims to unravel that transition: its patterns, causes, and effects. Using 2020 census data and major longitudinal datasets, a China variant of Zelinsky’s classic mobility transition theory will be developed and deployed to identify underlying mechanisms. Among expected outcomes are powerful methods for assessing spatio-temporal migration patterns and causes, applicable to many economies especially in the Asia–Pacific. Benefits should include a new evidence base for migration and related urban–rural policy in China; and for Australia, policy inputs to improve prosperity through better relations with our biggest trading partner.							
	National Interest Test Statement							
	This project targets new knowledge concerning migration and development, in the first instance through insights into massive and rapidly changing population movements within China. Capitalising on new theory and methodology, assembling and analysing first-rate evidence (from China's 2020 census, and more focused sources), this promises a dramatic advance in understanding of our main trading partner. Through journal and conference publications, a project symposium, and direct policy advice, findings on demographic and socioeconomic shifts in China's internal migration will help government agencies and industry in planning, responding effectively to changing Chinese demand for Australian goods and services, and improving our dialogue with the world's most populous nation. The project has broad relevance to developing greater appreciation of regional and global migration. This can contribute to wider knowledge fundamental to Australia's regional interests and positioning in the Asia-Pacific, especially in terms of Australia's role as a development partner and in regional alliances.							
DP230103062	**Discovery and directed evolution of small molecule biosensors**	78,705.00	167,855.00	182,657.00	93,507.00	0.00	0.00	522,724.00
Whelan, Dr Fiona W	This project aims to address the need for novel small molecule biosensing capability in diverse fields including food and wine production, environmental monitoring, biocatalysis, and diagnostics using a synthetic biology approach. The significance of this work is the development of new biosensors by a strong interdisciplinary team contributing bioinformatics to identify new biosensors, innovative protein engineering approaches, and cutting-edge directed evolution methodologies. Intended outcomes include enhanced institutional capacity for interdisciplinary collaboration; discovery of fundamentally important bacterial sensors; and development of synthetic regulatory circuits enabling outgrowth of non-biological biocatalysis industries.							
	National Interest Test Statement							
	Man-made environmental contaminants can be active at very low levels, and are difficult and expensive to detect. Protein-based sensors (“biosensors”) are a new approach to this problem, designed to give simple visual readouts when the target chemical is present, even at low levels. However, very few suitable sensing proteins currently exist. To address this gap, we will engineer biosensors of man-made chemicals with potential application in diverse fields including food and wine production, and environmental monitoring. As an example, this project aims to deliver new proteins that can bind to fungicide chemicals used in Australia’s $60 billion wine and horticulture industries. Our protein engineering system is designed to be versatile and responsive to the needs of industry. Invention of new proteins for incorporation into simple point-of-use chemical detection devices will be of long-term commercial benefit for Australia, with the market for biosensors projected to reach US$36 billion worldwide by 2027.							
DP230103210	**Androgen receptor: A master regulator of lipid metabolism**	125,000.00	232,000.00	182,000.00	75,000.00	0.00	0.00	614,000.00
Butler, Prof Lisa M	This project aims to understand how male sex hormones, or androgens, affect the amount and metabolism of fats in normal body tissues. By integrating our multi-disciplinary expertise in androgen action, molecular biology, metabolism and bioinformatics with novel techniques and instrumentation, this collaboration expects to generate the first detailed picture of how fat metabolism is controlled by androgens in humans, and how closely this relates to mice. Expected outcomes and benefits will be a new understanding of which aspects of fat metabolism are most influenced by androgens, and an ability to anticipate potential metabolic impacts of natural or pharmacological fluctuations in androgen levels in humans, laboratory animals and livestock.							

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	National Interest Test Statement							
	Thousands of Australians every year undergo manipulation of their male sex hormones (androgens) for cancer therapy, gender transition and muscle building. Androgens are also used as growth promotants for fish and livestock industries. Despite their widespread use, our knowledge of how androgens control metabolism is limited. This project will provide the first detailed insights into how androgens affect the composition and metabolism of fats in different organs of the body. The outcomes will help us to understand normal sex-specific differences in metabolism, and pinpoint aspects of human metabolism that are not well modelled in other species, placing Australia at the frontiers of metabolic and endocrine hormonal research. Our knowledge gain will inform the design and implementation of strategies to improve the metabolic health impacts of the increasing hormone use in Australians. There is also significant potential to provide economic benefit to agricultural industries, by informing on the optimal use of androgens to promote growth and body composition in fish and livestock.							
	The University of Adelaide	1,215,504.50	2,515,127.00	2,419,154.50	1,119,532.00	0.00	0.00	7,269,318.00
University of South Australia								
DP230100282	**Early career teacher induction: Supporting precarious teachers**	52,000.00	108,000.00	133,500.00	77,500.00	0.00	0.00	371,000.00
Sullivan, Prof Anna	This project aims to investigate the ways in which Australian induction policies support precariously employed early career teachers to effectively manage student classroom behaviour. This project expects to generate new knowledge of workforce development and induction experiences of early career teachers employed on casual and short-term contracts. Expected outcomes of this project include alternative policy and practice recommendations to support the transition of insecure replacement teachers within the profession. The benefits of this research include, improving teachers' classroom management practices; the retention of new teachers; improving teacher workforce development; and building a healthier education system.							
	National Interest Test Statement							
	The continuing teacher shortage crisis presents a significant barrier to Australia's commitment to create a world class education system. Left unchecked, this crisis threatens to turn into a major economic disaster as students are left unsupervised, unsupported and unengaged in our nation's classrooms. Most new teachers are employed casually or on short-term contracts and as such, they do not receive good induction support, particularly in the area of managing student behaviour. This research will use innovative methodology to establish a new knowledge base around the induction of precariously employed early career teachers, and contribute to the creation of alternative policy recommendations which support new teachers to successfully transition into the profession. The findings will support education systems to deliver effective induction processes which enhance teachers' classroom management practices; thereby enabling the retention of new teachers, increasing teacher workforce development and building a healthier education system.							
DP230100688	**Creating pH-sensitive self-healing concrete using sludge waste for sewers**	83,485.50	167,871.00	167,266.50	82,881.00	0.00	0.00	501,504.00
Zhuge, Prof Yan	In Australia, our 117,000 km of concrete sewer pipes are currently internally corroding at a depth rate of 1-3 mm per annum. The repair of deteriorated concrete is costly and often short-lived. Based on an advanced composite technology, this project will develop a pH-sensitive self-healing concrete that can repair itself without human intervention at the early stage of corrosion. Sludge waste from drinking water treatment will be utilised as a healing agent to mitigate the corrosion. Combined experiments and molecular dynamics simulation will uncover all aspects of the healing process to enable the practical application of this technology. The findings will extend the lifetime of concrete structures and promote a circular economy.							
	National Interest Test Statement							
	Australia is experiencing infrastructure deterioration, but repairs of deteriorated concrete structures are often short-lived. Concurrently, disposing of water treatment sludge in landfill may cause significant CO2 emissions and environmental pollution. This project aims to address these issues by developing a novel self-healing concrete that can repair itself without human intervention based on advanced composite technology. A pH-sensitive microcapsule shell will be created together with sludge waste as a healing agent core to mitigate microbially induced corrosion in concrete sewers. This project is innovative as previous studies focused on the mechanical force to trigger the shell to release the healing agent which is not suitable for sewers. The environmental benefit will be twofold: maintenance cost of sewer system will be reduced with enhanced sustainability and large quantities of waste sludge could be reused. This project provides an excellent example of circular economy development and 3Rs goals (reduce, reuse and recycle) will take a big step forward because this new concept.							

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DP230101122	**Build competency aware and assuring machine learning systems**	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
Liu, A/Prof Lin	Recent development in machine learning (ML) has seen ML models with extremely high prediction accuracy. However, to support human-machine partnership in decision-making in complex environments, beyond accuracy, it is essential for ML systems to be competency aware and reliable, and at the same time be exploratory. This project aims to develop novel techniques to equip a ML system with the ability to identify own competency, to justify its competency and decisions, to explore unknown situations and fully utilise existing expertise to deal with unknowns. The expected outcomes of the project will enable ML systems to become truely intelligent and reliable machine partners for human decision makers in a wide range of applications.							
	National Interest Test Statement							
	This project aims to develop novel techniques to equip machine learning systems with the capabilities to transform them from simple tools to partners of human decision makers in complex environments. Current machine learning research is focused on accurate predictions. However, to support decision making in complex environments with different types of unknowns, there is a great need for an end-to-end system which can detect, predict and explore various cases. Moreover, for a machine learning system to be a human partner, the system needs to be developed with the same abilities and spirits possessed by responsible and astute human workers. This project has great potential to enhance Australia's capabilities in artificial intelligence (AI). The research outcomes will provide game-changing machine learning techniques and systems to support decision making in complex environments faced by decision makers in a wide range of applications, such as cybersecurity, IoT, space, and public health. For example, the outcomes can be applied to industrial applications by our work with SmartSAT CRC, to enhance AI-based earth observations systems.							
DP230101758	**Families with multiple and complex needs: refocusing on early intervention**	87,500.00	181,500.00	186,500.00	92,500.00	0.00	0.00	548,000.00
O'Donnell, A/Prof Melissa	Families with multiple and complex needs have been determined to be a priority group in Australia (National Child Protection Framework 2021-31). This study will fill the evidence gap by determining the typologies of families with multiple and complex needs and child protection involvement who face intersecting risk factors (e.g. family violence, mental health, intergenerational trauma, alcohol/drug use, justice involvement, disability, poverty and housing insecurity). Intergenerational (child and parent) linked data in three states will be utilised to investigate these families longitudinal trajectories of system involvement and to identify opportunities for enhanced prevention, points of early intervention and service planning.							
	National Interest Test Statement							
	Families who are reported to child protection due to safety concerns typically have multiple and complex needs, including domestic and family violence, mental health problems, intergenerational trauma, alcohol and other drug use, criminal justice involvement, disability, poverty and housing insecurity. Child protection services cost billions of dollars per year and have life-altering impacts on families, yet these services are crisis-driven and delivered when children are deemed to be unsafe. This project will enhance understanding of families who come into contact with child protection services by analysing data collected through routine service delivery across three states. This data provides insight into how families experiencing different challenges utilize public services, the impact of early service provision and how services could be improved to be more timely and effective. Through briefings to government, the findings will inform the design and delivery of early intervention services.							
	University of South Australia	292,985.50	597,371.00	627,266.50	322,881.00	0.00	0.00	1,840,504.00
	South Australia	2,208,774.00	4,564,917.00	4,386,462.50	2,052,627.50	38,155.00	15,847.00	13,266,783.00

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Tasmania								
University of Tasmania								
DP230100162	**Contact Networks, Immunity, and Evolution in Competing Cancer Epidemics**	94,795.00	178,836.00	99,099.00	15,058.00	0.00	0.00	387,788.00
Hamede, Dr Rodrigo K	The project aims to evaluate evolutionary interactions between two transmissible cancer epidemics affecting Tasmanian devils and quantify their feedback on infection risk and epidemic behaviour. Using contact tracing and a phylogenetic framework we aim to quantify how tumour lineages evolve with each generation of infection and their effects on susceptibility to infection and disease progression. We expect to reveal the host immuno-genetic basis underpinning cancer suppression and the adaptive capacity of populations in response to infectious diseases. This should significantly improve our ability to understand and manage this and other epidemic outbreaks in wildlife, as well as advancing our knowledge in cancer ecology and evolution.							
	National Interest Test Statement							
	Emerging infectious diseases have potential to cause economic, social & ecological damage, with direct impacts on biodiversity, public health & agriculture. This project will use modern genomic tools & recent advances in automated data collection of wildlife from remote settings to generate, cheaper, more efficient, detailed estimates of how, when & where diseases are transmitted in the wild & determine how epidemiological processes affect the evolutionary rate of diseases. Our approach has direct implications for wildlife disease management, providing new & robust methods to understand disease risk & epidemic behaviour. The approach is not restricted to wildlife epidemics & can be adapted to trace infectious diseases in livestock & humans. Project outcomes will inform conservation strategies for the Tasmanian devil, a top predator & iconic, endemic species threatened with extinction by two transmissible cancers. The project team are members of the scientific advisory group for the Tasmanian government's species recovery plan, & project outcomes will therefore directly inform conservation policy & practice.							
DP230100226	**Eruption dynamics and tsunami potential from submarine volcanoes**	32,500.00	147,500.00	205,000.00	90,000.00	0.00	0.00	475,000.00
Jutzeler, Dr Martin	This project is based on recently acquired seafloor samples and geophysical data from extraordinary deposits at a modern submarine volcano. This project aims to determine the conditions that lead to explosive eruption underwater, the dynamics of associated sediment flows, and if these events can trigger tsunami. Expected outcomes include an unprecedented reconstruction of the architecture of submarine caldera volcanoes, new innovative models applicable globally for a richer understanding of volcanic tsunami and eruptions that shape the seafloor. This project will provide significant benefits through mitigation of global marine natural hazards, and by improving knowledge on the volcanic hosts of ore deposits.							
	National Interest Test Statement							
	Large scale catastrophic volcanic eruptions are recorded on the modern seafloor and in the rock record in Australia. This project uses recently acquired ship-based geophysics and seafloor samples to uncover the dynamics of these large volume eruptions and whether or not such events can trigger tsunami. The project will increase knowledge on volcanic hazards in our region to inform tsunami risk and mitigation policies. Additional benefits include enhanced exploration strategies where ancient volcanic rocks host valuable ore deposits in the Australian crust. This project represents considerable value for money as it leverages off samples and data acquired from a marine voyage in March 2022, and brings together international partners who will provide critical expertise to model eruption and tsunami dynamics.							

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DP230100267	**The Inception of Criminal Deportation in Colonial Australia**	31,622.00	61,750.50	73,250.00	43,121.50	0.00	0.00	209,744.00
Harman, A/Prof Kristyn E	This project aims to undertake the first comprehensive study of criminal deportation in colonial Australia. Expected outcomes include new knowledge on freely arrived colonists who were tried, sentenced to transportation, and criminally deported within the Australian colonies. The project spans the disciplines of history and criminology, developing a new methodological framework that aims to facilitate important insights on the societal attitudes, systems, and circumstances that lead to criminal deportation. This should provide significant benefits by articulating the unexplored deep history of Australian criminal deportation practices. The project also aims to preserve fragile colonial documents foundational to the nation's history.							
	National Interest Test Statement							
	Australia's convict history contains a little-known story of freely arrived colonists who were criminally deported within colonial Australia. Their experiences are key to understanding how Australia's approaches to migration and crime prevention developed, which shaped part of our national identity. The project aims to link previously unconnected paper and digital archival records to create a new, digital archive to tell this story. It expects to generate insights into the societal attitudes, systems, and circumstances that led to criminal deportation. It will also collaborate closely with libraries to achieve the digital preservation of fragile archives. Outcomes will be shared widely with the public through an online database and a digital exhibition hosted by UTAS showcasing the lives of everyday Australians in their historical context. Members of the public tracing their family histories will be able to access deep insights into the lives of historical individuals via the online database, while teachers will be supported by digital resources providing depth and nuance to the Australian curriculum.							
DP230100727	**The Dark-side of the Milky Way**	74,500.00	149,000.00	141,500.00	67,000.00	0.00	0.00	432,000.00
Ellingsen, Prof Simon P	Astronomers have long sought to determine the 3-dimensional structure of our Galaxy, the Milky Way, with limited success owing to its immense size and obscuration by dust at optical wavelengths. We know more about structure of tens of thousands of other galaxies than we do about the structure of the Milky Way on the far-side of the Galactic Centre. This program will use Australian infrastructure to make the most accurate distance measurements to date of the far-side of the Milky Way visible from the Southern hemisphere, completing the 3-dimensional picture of our Galaxy. These results will be leveraged to yield accurate distances, providing fundamental information on the stellar masses, luminosities, and ages.							
	National Interest Test Statement							
	The major outcome of this project will be a significant improvement in our knowledge of the structure of the Galaxy we live in, the Milky Way. We will use an innovative approach developed in Australia to reveal the spiral structure of the far-side of the Milky Way, more than 30000 light years away. To be able to answer fundamental questions about the formation of the earliest stars and galaxies we need to improve our understanding of our own galaxy as there are measurements we can only make here that are the foundation of our understanding. Australia has a long and distinguished history of major contributions to the study of the Milky Way, starting more than 60 years ago with pioneering mapping of hydrogen emission by J. L. Pawsey. The nation continues to invest heavily in radio astronomy infrastructure through developments like the Australian Square Kilometre Array Pathfinder (ASKAP) telescope. Beyond astronomy and its cultural value, the work undertaken in this project will provide benefits for spacecraft tracking and space domain awareness through development of new calibration methodologies. This project will also provide benefits for research end-users, such as the Australian Space Agency & Defence for spacecraft tracking & space domain awareness through development of new ultra-high precision calibration methods.							
DP230100764	**Zooplankton and ocean productivity in a changing climate**	46,969.00	135,539.50	158,808.00	70,237.50	0.00	0.00	411,554.00
Bowie, Prof Andrew R	The scarcity of iron in the Southern Ocean limits biological productivity and carbon uptake. There is currently very little Information on zooplankton iron content, yet available data points to high variability. This variability is leading to poor predictive outcomes for models of Southern Ocean iron and carbon cycling. Our project addresses this knowledge gap by quantifying zooplankton iron content and examining its biogeochemical and ecological impact on Southern Ocean productivity. Developing an understanding of how iron is cycled through zooplankton will provide significant benefits including improved global models used to quantify current and future patterns of ocean productivity critical for environmental and economic predictions.							

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	National Interest Test Statement							
	The vast Southern Ocean exerts a significant control over global climate as it absorbs two-thirds of ocean heat and half the carbon dioxide emitted by human activity. Marine plants or 'phytoplankton' are the foundation of the food chain and play a critical role in absorbing carbon dioxide and reducing the effects of climate change, yet their growth is limited by the availability of iron. Zooplankton, tiny animals that feed on phytoplankton, recycle iron but estimates of this process remain unclear. Currently, this leads to poor predictions of iron and carbon cycling needed for accurate climate models. This project will determine how zooplankton recycle iron to sustain phytoplankton growth and drive carbon uptake. The research will benefit Australia by providing new crucial data needed to refine global models that are used to understand current and future patterns of Southern Ocean productivity and Earth's climate. Data from this project will also benefit research end-users such as the Commission for the Conservation of Antarctic Marine Living Resources by helping decision makers set krill catch limits.							
DP230101368 Bestley, Dr Sophie	**Using animal-borne sensors to unravel East Antarctic coastal productivity** This project will examine the mechanisms underpinning the high productivity in Antarctic coastal polynyas, which are ice-free oases within the sea ice supporting abundant marine life. The study expects to generate essential new biochemical and biological observations using autonomous platforms to understand phytoplankton dynamics in these inaccessible habitats along Australia's Antarctic Territory. Expected outcomes include novel insight into the role of iron supply from melting glaciers in supporting marine production. This should reduce the high uncertainty in prognoses for polynya activity under anthropogenic climate change, and support Australia's international leadership in conservation and management of important Antarctic ecosystems.	222,960.00	369,463.50	180,859.50	34,356.00	0.00	0.00	807,639.00
	National Interest Test Statement							
	Tiny marine plants store CO2, a greenhouse gas that has a direct impact upon Australians' quality of life. Massive blooms occur every year along Australia's Antarctic Territory coastline but exactly where, and how much these microscopic climate engineers will contribute to mitigating CO2 emissions in the future is unknown. This is especially true for vast ocean expanses where sea ice makes observations from ships, floats, or satellites extremely challenging and expensive. Seals carrying mini-electronic sensors offer an ideal solution to help us measure the extent and effect of blooms in these inhospitable and climate-sensitive ecosystems. Innovative use of new sensors will provide cost-effective, real time, remote monitoring and translate long term to reducing uncertainties about Antarctica's capacity to absorb CO2 in the future. Partnering through CSIRO and the Australian Antarctic Program will ensure project outcomes are adopted into our future climate preparedness and serve to protect Australia's national interests in Antarctica.							
DP230102994 Doddridge, Dr Edward W	**Southern Ocean Sea Ice – what happened and what happens next?** This project will adress our lack of confidence in future projections of sea ice around Antarctica by elucidating the mechanisms controlling sea ice in the Southern Ocean. There is low confidence is current sea ice projections, limiting our ability to predict ice shelf melt and sea level rise. This project will lead to a detailed understanding of the future of sea ice in the Southern Ocean, improving our understanding of ocean dynamics, ice shelf melt, and sea level rise. The results from this project will enhance projections of sea ice, and therefore also ice shelf melt and sea level rise. Improved sea level projections will aid policy decisions for coastal communities.	54,000.00	137,000.00	148,000.00	65,000.00	0.00	0.00	404,000.00
	National Interest Test Statement							
	Sea ice that forms when surface ocean waters freeze, provides a critical habitat for krill, the base of the ocean food chain, with important economic and environmental benefits. Sea ice also stabilises ice shelves and remotely influences Australian climate. This project will assess the causes of recent unprecedented sea ice variability and change. Our results will improve projections of sea ice for the coming decades and century, leading to more accurate projections of Australian climate variability and sea level rise. Improved projections will inform fisheries policy and management. More accurate sea level rise and climate projections will benefit federal, state and local governments and planners, while protecting Australian sectors vulnerable to climate extremes, including coastal communities, agriculture, water management, and tourism. Our results will be of particular value to agencies involved in fisheries, sea level rise policy and weather and climate forecasting, including the Australian Fisheries Management Authority, Australian Antarctic Division, and Bureau of Meteorology.							

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DP230103006	**Improved management of marine habitats by learning from historical change**	143,732.50	225,057.00	169,149.50	87,825.00	0.00	0.00	625,764.00
Edgar, Prof Graham J	This project aims to greatly improve the cost-effectiveness of actions to protect and restore shallow subtidal marine habitats by quantifying the severity and distribution of recent human impacts. Environmental change will be quantified as the difference between contemporary and historical assemblages encompassing thousands of invertebrate species, and by reading historical chronicles coded by mollusc shells layered in sediments. The roles of different stressors (warming, dredging, eutrophication, introduced species, sediment runoff) will be distinguished. Expected outcomes include continental-scale understanding of factors that facilitate ecosystem decline and recovery, and of sites and species traits most affected by ongoing threats.							
	National Interest Test Statement This project aims to understand how Australian coastal bays and estuaries have been affected by human impacts over the past century by reading the history of environmental change in mollusc shell fragments deposited in sediment layers. We will reveal the footprint of change by comparing living mollusc communities with dead shells deposited at different sediment depths, dated using radioisotopes. Historical impacts of climate change, dredging, introduced pests, sedimentation and pollution can be distinguished as they affect mollusc communities differently. Project findings will be provided to environment managers, with information on the most important drivers of ecosystem decline; habitats and locations most affected by threats; species most in need of conservation safeguards; appropriate historical values that represent objective targets for ecosystem restoration; and environmental requirements for successful restoration. This could also lead to commercial benefits through improved shellfish production, tourism opportunities and reduced shore erosion; and social benefits through increased recreation.							
	University of Tasmania	701,078.50	1,404,146.50	1,175,666.00	472,598.00	0.00	0.00	3,753,489.00
	Tasmania	701,078.50	1,404,146.50	1,175,666.00	472,598.00	0.00	0.00	3,753,489.00

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Victoria								
Deakin University								
DP230100209	**Feedback literacy for effective learning at university and beyond**	40,800.00	100,985.00	103,310.00	90,350.00	47,225.00	0.00	382,670.00
Dawson, Prof Phillip J	This project aims to develop frameworks and strategies that help learners make the most of feedback across their studies and into their working lives. Using behaviour change techniques from the health and social sciences, the project expects to develop ways to support students and graduates to seek out and use feedback, and to manage their emotions throughout the feedback process. Expected outcomes of this project include evidence-informed strategies that individuals and institutions can use to develop life-long capabilities to make the most of feedback. This should provide significant benefits across all sectors of Australian society, where productivity, learning and wellbeing depend on healthy and effective engagement with feedback.							
	National Interest Test Statement							
	Most people have at some stage been hurt by feedback or, in many cases, not known how to use it as it was intended. This project will explore how to help people make the most of feedback in education and beyond. Difficulties with seeking and using feedback can harm productivity, well-being and mental health. This project aims to benefit Australia economically and socially by developing new approaches to help students and graduates seek, generate, and use feedback in work and learning settings. As well as making important changes to university courses to improve graduates' ability to use feedback, we will develop free frameworks, courseware and resources that will be made available to all Australians. We will design and deliver an online course for individuals to develop their feedback capabilities for work and learning, resources that trainers and coaches can use with staff in the workplace, and workshops for educators to improve students' feedback capabilities. By helping Australians make the most of feedback, the project has the potential to boost any individual's productivity, learning and wellbeing.							
DP230100257	**Civilisationist Mobilisation, Digital Technologies and Social Cohesion**	61,936.00	145,760.00	164,833.00	81,009.00	0.00	0.00	453,538.00
Yilmaz, Prof Ihsan	Civilisational populist rulers polarise societies mainly along religious lines. They also interfere with their emigrants, mobilising supporters against other expatriates. This project aims to advance knowledge of authoritarian states' transnational influence on social cohesion and inter-group conflict. By studying Islamist and Hindutva civilisationist mobilisations, their reach into their emigrants via digital technologies, and their impact on Turkish and Indian groups in Australia, the project aims to assist policy makers and community groups by generating conceptual frameworks, benchmarking data, and recommendations for making policies to deal with this phenomenon's negative effects and for developing intervention strategies							
	National Interest Test Statement							
	Authoritarian foreign governments increasingly seek to motivate loyal emigrants to support their repressive policies both at home and abroad. They seek to provoke action by their supporters against emigrants who hold opposing views to the government. In Australia, this leads to tension – even violence – between different migrant communities. This project will determine how foreign governments use polarising speech, religion and digital technologies to influence emigrant populations. The project will analyse the impact of this foreign interference on social cohesion and economic integration on a multicultural society such as Australia. Research findings will help governments counter such threats. The project also aims to produce social and economic benefits through policy briefings and recommendations, and workshops with policymakers, media, community organisations and affected communities to minimise the impact of foreign interference.							

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DP230100307	**Smart foliage: imparting intelligence to synthetic leaves**	40,000.00	82,500.00	85,000.00	42,500.00	0.00	0.00	250,000.00
Zhao, Dr Shuaifei	This project aims to develop an innovative “lab-on-a-leaf” platform technology based on smart membranes with switchable pores to enable hitherto unachievable control of gas and vapour transfer. The innovated membrane based technology can be used as a versatile platform for many important applications, such as desalination and carbon capture. This project expects to advance the knowledge in biomimetic design of synthetic leaves, and bring new membrane technologies to applications, such as desalination, solar energy harvesting, and evaporative cooling. This project should provide significant benefits for Australian manufacturing industry by addressing energy and environmental concerns and boosting national economic growth.							
	National Interest Test Statement							
	In recent years, Australia has suffered significantly from water scarcity and extreme weather conditions resulting from induced climate change. This project will help to mitigate both water scarcity and aspects of climate change by developing a smart membrane-based technology with the two-fold purpose of desalination and CO2 removal/conversion from the atmosphere. Significantly, the project will address the difficult issue of controlling gas and vapour transfer through conventional artificial surfaces using a series of smart membranes. It will also advance our understanding of fundamental processes such as photosynthesis and respiration in plant physiology, and improve desalination efficiency by mimicking nature to control vapour transfer. We will design devices that behave in the same way that a leaf does in nature to convert atmospheric CO2 into renewable fuel. This project will enable both clean water and clean renewable energy production, as well as enabling significant CO2 reduction from the atmosphere to generate significant economic and environmental benefits. This project should provide significant benefits for Australian manufacturing industry by addressing energy and environmental concerns and boosting national economic growth.							
DP230100538	**Australian Spirituality: Wellness, Wellbeing and Risks**	64,700.50	150,683.00	145,694.50	59,712.00	0.00	0.00	420,790.00
Halafoff, A/Prof Anna	While there has been significant research conducted in Australia on rising religious diversity and those who are non-religious, spirituality has not received the same scholarly attention despite its popularity. This is the first nationwide study of spirituality in Australia, investigating First Nations, religious, and holistic spirituality, their contributions to wellbeing, and their possible risks. It includes a national survey and interviews with spiritual persons, and case studies of sacred places around the country. This project also draws on the expertise of leading First Nations, Australian and international scholars, and will be of national benefit in its capacity to inform practices and policies for personal and planetary wellbeing.							
	National Interest Test Statement							
	The practice of spirituality in Australia remains little understood, despite its significance to First Nations peoples, its growing popularity, and an increased focus on spiritual wellbeing in the health, education and environmental sectors. There has also been a troubling uptake of conspiracy theories in spiritual communities, including opposition to vaccination, which were exposed during the COVID19 pandemic. This project is the first nationwide study of spirituality in Australia to investigate how spiritual individuals and communities approach wellness, wellbeing and science. Conducted by a team of leading First Nations, Australian and international scholars, it will comprise a national survey, interviews, studies of spiritual sites and an impact forum for stakeholders. This project will be of national social, cultural and environmental benefit, as it will inform community and government practices and policies on the value and risks of spirituality to wellbeing in the national priority areas of public health and environmental change.							
DP230100630	**Preventing Water Theft in the Murray-Darling Basin**	53,850.00	104,680.50	113,917.00	63,086.50	0.00	0.00	335,534.00
Walters, Prof Reece A	This Project aims to understand the complex interaction of socio-economic, legal and political factors that have enabled the theft of fresh water in the Murray-Darling Basin. By analysing the policies and regulations governing freshwater management, this project expects to generate new knowledge of the extent and types of water theft, offenders processed, penalties delivered, and the performance and operations of regulatory and enforcement agencies. The expected outcomes include new research strategies for water theft prevention. This will benefit national security and community health by contributing to a sustainable and equitable supply of fresh water.							

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	National Interest Test Statement Australia's Murray-Darling Basin is experiencing serious water theft. The impact of this substantial loss is affecting commercial activity, agriculture, biodiversity and cultural identity, as well as jeopardising the security of a vital future freshwater resource. At present, there is no systematic data collection on water theft in Australia, making it difficult to address the actions of perpetrators. This project will remedy that situation by creating a data theft classification and identifying mitigation and prevention strategies that will benefit all Australian water providers and consumers. This will be achieved by cataloguing and critically examining water theft activities and the negative environmental and economic impact this creates. Findings will be communicated through a digital, interactive Water Theft Archive in partnership with the relevant state and federal authorities. The project team will monitor, administer and manage Archive content to enhance policy development and crime prevention initiatives essential to Australia's national security, economic, social, and environmental objectives.							
DP230101533 Tytler, Prof Russell W	**Enacting Climate Change Education through representing scientists' practice** This research will work with scientists and teachers across three continents to translate contemporary climate-related research practices into a novel curriculum approach that emphasises deep science knowledge, skills, and values. It responds to a pressing national need to prepare students for a 21st century marked by complex work futures and major socio-scientific challenges related to climate change. The project will develop students' engagement with and competencies in the sciences for fast changing work futures, and decision making and action regarding environmental challenges. It contributes to an enhanced scientific workforce and a citizenry capable of responding to complex environment-related challenges.	62,500.00	127,750.00	127,050.00	61,800.00	0.00	0.00	379,100.00
	National Interest Test Statement This research involves working with scientists and teachers to develop school science curriculum sequences based on contemporary climate-related research. It will develop a Climate Change Education curriculum progression for science that emphasises deep knowledge of science and scientific practices and student decision making related to major 21st century socio-scientific challenges. These include biodiversity loss, energy futures, climate change, and frontier materials science. The research will focus on students' socio-scientific reasoning, critical and creative thinking, responsible citizenship and futures orientation. The research has economic, environmental and citizen well-being benefits concerning improving students' engagement with science-related pathways needed to drive national wealth creation, and a population that can productively respond to challenges in 21st century life and work and to the climate-related challenges we increasingly face. The international research team and advisory panel including national and international curriculum bodies will ensure wide dissemination of findings.							
DP230102083 Simnett, Prof Roger	**Evaluating innovative assurance practices for sustainability reporting** While entities are today accountable for and report on a broader range of social and environmental issues, such enhanced reporting must be credible to be relied upon. Evaluating settings where innovative credibility-enhancing mechanisms are proposed or disclosed, this project aims to explore the efficacy of these evolving mechanisms and their impact on information quality and users. This project is expected to make significant contributions in identifying and evaluating best practice credibility-enhancing techniques and informing policy and standard-setting options in Australia and overseas. The benefits include higher quality and more reliable disclosures resulting in better resource allocation decisions and informed policy determinations.	48,996.50	94,450.00	94,184.50	48,731.00	0.00	0.00	286,362.00
	National Interest Test Statement Australian investors are increasingly demanding credible disclosures about the social and environmental impacts of businesses, however there is a risk that this demand will not be met due to businesses lacking knowledge of the various approaches they can adopt to effectively enhance the credibility of their disclosures. This project will identify and test various leading-edge approaches, ranging from simple tailored director statements to more expensive independent audits. It will examine how and whether these approaches improve the reliability of social and environmental disclosures to inform investment decisions. By identifying and communicating to businesses the relative effectiveness of the various approaches, this project will support more reliable disclosures and improved, more socially responsible investment decisions. We will also inform Australian standard-setters/regulators of new insights from this project, providing an evidence-base for their current deliberations on reforms to auditing and assurance standards for sustainability reporting.							
	Deakin University	372,783.00	806,808.50	833,989.00	447,188.50	47,225.00	0.00	2,507,994.00

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La Trobe University								
DP230100110	**Impact of teacher shortages on teachers remaining in hard to staff schools**	60,500.00	151,000.00	166,150.00	75,650.00	0.00	0.00	453,300.00
Lampert, Prof Jo	This project aims to investigate the lived experiences of teachers in a time of unprecedented teacher shortages. While previous studies have examined the causes of teacher shortages, the project is significant in its review of the issues of teacher retention focusing instead on those teachers who remain. By addressing the problem of retention this way, the expected outcomes of this project include developing a much deeper understanding of how educational systems, as well as individual schools, can support those teachers remaining in the profession. This will provide significant benefits such as informing policy on how to facilitate greater teacher retention at a time when maintaining support for a declining teaching workforce is urgent.							
	National Interest Test Statement							
	The Australian Government reports unprecedented teacher shortages leading to a weaker and unskilled future economy, poor social and educational outcomes for young people with serious economic implications both in the immediate post Covid recovery and impacting long term issues of educational opportunity and achievement. This project offers new ways to investigate a crisis level problem unlocking the effect of teacher shortages on the work of those still teaching. The project has economic benefits, seeking to inform key stakeholders on teacher recruitment, attrition, and retention. Investing in a strong teacher workforce has clear economic benefits preparing young people to make future economic contributions. It has social benefits such as improving working conditions for quality teachers. It has cultural benefits as schools are crucial to thriving communities. By understanding the complexity of teachers' work, this research can be translated into policy recommendations addressing the social, cultural, and economic national interest informing governments and schools on how to support a struggling profession.							
DP230100152	**Early desert settlement of Arabia following out-of-Africa human dispersals**	71,840.00	173,718.50	101,878.50	0.00	0.00	0.00	347,437.00
Meredith-Williams, Dr Matthew G	This project aims to improve our understanding of the nature, timing and climatic context of early human expansion into SW Asia, from a new extensive archaeological complex with associated palaeoenvironmental sequences on the Arabian Peninsula – a strategic out-of-Africa migratory corridor. It will combine innovative approaches in archaeology, geochronology and palaeoenvironmental research to evaluate the environmental and cultural adaptability of early desert settlement, providing critical new insights into globally significant human dispersal debates spanning multiple continents, including Australia. The aim is a fundamental new perspective on long-term human occupation dynamics of deserts and new understanding of regional dispersals.							
	National Interest Test Statement							
	Relatively little is known about the long-term peopling of the world's deserts, including the earliest human settlement of Australia's arid interior. This project will provide a new perspective on the global dispersal history of our species, including the long-term human history of our own continent, by enhancing understanding of human expansions out of Africa and into SW Asia's deserts over millennia to million year timescales. This is one of the most significant research topics in human evolution and critical for understanding the shared ancestry of all Australians, no matter their recent origins. The project will produce major media interest and promote Australia on an intentional stage by driving strategic collaborations across 6 countries. Our strong training focus will benefit Australia by enhancing sought-after geoscience and archaeology expertise, and generating commercial growth opportunities in cultural heritage and mining sectors. By obtaining long-term climate change records we will help optimise modelling projections of future climate change impacts for vulnerable arid regions such as Australia.							

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DP230100498	**The Great Disruption of COVID-19: Re-imagining the work-family interface**	63,500.00	110,000.00	46,500.00	0.00	0.00	0.00	220,000.00
Cooklin, A/Prof Amanda R	This project aims to highlight new possibilities to re-imagine and reduce parents' work-family conflicts. Covid-19 brought an unprecedented disruption to Australian parents' work-care routines, with different effects for women, and those working 'at work' versus at home. Using mixed-methods approaches and multiple Australian datasets collected pre- and post-pandemic, this unique project intends to identify families who are at risk of longer-term scarring to family wellbeing from work-care conflicts; and critical workplace supports which may prevent this. Together, this urgently-needed evidence contributes to family-friendly work for diverse parents, employers and policy, protecting social and economic participation for Australian parents.							
	National Interest Test Statement							
	Conflicts between work and family demands are common social and economic problems for all parents in Australia. Reported by one in three before the pandemic, the extent to which they were worsened, sustained or relieved during the pandemic is unknown. Critically, how have families emerged from this momentous disruption to work-care routines? As workplaces and parents strive towards a new 'post-covid' normal, understanding of the work-family interface is needed to inform policy and workplace practice to support working parents, protecting family wellbeing. This project addresses this gap. With a particular focus on gender and job inequalities, this project intends to bring together national datasets and methods to gain evidence on which families fared well in combining work and care in the new and changing labour environment, and which families remained at-risk. This project will provide vital recommendations for parents and employers, with dissemination to stakeholders such as the Department of Social Services and Australian Institute of Family Studies, to support parents' social and economic participation.							
DP230100716	**Knowledge Graph-driven Software Vulnerability Risk Discovery and Assessment**	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
Cao, Dr Jinli	This project aims to alleviate cyberattacks which are increasingly being crafted to attack software vulnerabilities and weaknesses by utilising advanced knowledge graphs and deep learning techniques. This project expects to construct an innovative software vulnerability knowledge graph and develop advanced graph-based algorithms and models. Expected outcomes of this project include the enhanced capacity to defend against cyberattacks for both organisations and individuals in Australia and beyond, theory development in graph theory, refined graph neural network models and improved graph transfer learning algorithms.							
	National Interest Test Statement							
	Software vulnerabilities, also known as flaws, bugs or weaknesses, are common in modern information systems. These vulnerabilities put critical data of organisations and individuals under cyber threats. In Australia, more than 67,500 cybercrimes caused over $33 billion in losses in 2021. This project aims to develop a theoretical framework with risk discovery, prediction, and assessment solutions for software vulnerabilities against cyberattacks. The outcomes of the project include an open-access vulnerability graph database as a digital infrastructure for the global cybersecurity community, novel graph mining and knowledge discovery algorithms for better decision-making on vulnerability remediation, mitigation, and patching. These outcomes will be targeted at researchers and practitioners in organisations such as Westpac, Optus, Data 61 and ACSC for adoption. The project will also enhance the cybersecurity of Australia's health care, finance, manufacturing, and professional services industries.							
DP230100927	**Using AI to reveal the true extent & context of alcohol exposure in videos**	55,000.00	105,000.00	100,000.00	50,000.00	0.00	0.00	310,000.00
Kuntsche, Prof Emmanuel	This project aims to extend an artificial intelligence algorithm to automatically identify and quantify alcohol prevalence in videos. The project is expected to generate significant new knowledge about alcohol's exposure in these videos' social, emotional, and environmental contexts. The expected outcomes include a more efficient and automated method of revealing alcohol pervasiveness and its context in the 1000 most watched videos in Australia, making costly manual coding redundant. Anticipated benefits include enabling governments to better monitor compliance to alcohol product placement guidelines and increased public awareness of the frequency and harmful effects of being exposed to alcohol in videos.							

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	National Interest Test Statement Alcohol-related harm to individuals, families and communities costs Australia an average of $66.8 billion per year. The normalisation of harmful drinking behaviours is inadvertently heightened through watching its use and consumption on our screens. This project will extend an existing artificial intelligence algorithm to enable it to automatically identify and quantify alcohol's presence in social, emotional, and environmental context of the 1000 most popular videos in Australia (films, sports, etc.). Outcomes of the project include developing the most comprehensive, accurate and up to date understanding of the amount and context of alcohol exposure in videos. This will enable governments in Australia and internationally to better monitor compliance to alcohol product placement guidelines and increase public awareness of the frequency and harmful effects of being exposed to alcohol in videos. The algorithm can be extended to automatically quantify exposure to other harmful products in videos, such as tobacco and will make manual coding redundant, saving time and cost for future research.							
DP230100967 Brophy, Prof Lisa M	**Taking control: variations in forced psychiatric treatment in the community** This interdisciplinary project aims to produce a comprehensive understanding of the drivers underpinning variations in the use of legal orders to enforce psychiatric treatment in the community without consent. Australia's rate of use of these controversial orders is very high and there are unexplained variations in rates of use within and between jurisdictions, with some minority groups disproportionately affected. Uncovering this knowledge will act as a form of procedural justice for those who have had their human rights limited by compulsion. This knowledge is expected to lead to innovations in law and policy, with subsequent organisational and system improvements, generating profound benefits for those affected by forced treatment.	116,268.00	249,173.00	207,814.00	74,909.00	0.00	0.00	648,164.00
	National Interest Test Statement This project analyses the wide variation in rates of enforced psychiatric treatment without consent across Australia with the burden disproportionately borne by marginalised groups. These variations suggest that the use of these powers in the community may not be strictly linked to perceived health benefits but is driven by factors including resources, organisational culture and discrimination. It will explain the real-world drivers that underpin the use of these powers to enable more equitable mental healthcare through innovation in law and policy, and organisational and system improvement. This work aligns with the 5th National Mental Health Plan to implement the United Nations Convention on the Rights of People with Disabilities. It also aligns with the Productivity Commission Inquiry into Mental Health 'priority reform' to reduce adverse consequences of mental health treatment, and the National Science and Research 'Health' priority: "better models of health care and services that improve outcomes, reduce disparities for disadvantaged and vulnerable groups, increase efficiency and provide greater value".							
DP230101056 Poon, A/Prof Ivan K	**Formation and clearance of endothelial cell-derived exophers** This project aims to investigate how cells that line the blood vessels release cellular wastes and their subsequent removal by immune cells. It is critical that cellular waste are removed in a timely manner as their accumulation inside the cell can interfere with normal cell functions. The intended outcome of the project is to generate fundamental new knowledge of the mechanisms by which cellular waste are efficiently removed. Expected outcomes encompass a paradigm-shift in understanding how cells that line the blood vessels dispose unwanted cellular contents. This should provide significant benefits including understanding how these specialised cells maintain the integrity of blood vessels and communicate with immune cells.	72,820.00	144,663.00	122,625.00	50,782.00	0.00	0.00	390,890.00
	National Interest Test Statement The economic burden of infectious and cardiovascular disease costs Australia more than $10 billion annually in lost lives, pressure on health services and lost ability to engage in work. New methods to monitor progression and severity of these diseases will lead to better patient care and outcomes. A number of infectious and cardiovascular diseases can cause stress on cells that line the blood vessels (called endothelial cells), resulting in the formation and release of defective materials from these cells. This project aims to investigate how endothelial cells release cellular waste into the blood and subsequently removed by cells in the immune system. This will generate new knowledge of how cellular waste is distributed and removed rapidly in the blood, with significance in fields of research including cell biology and biochemistry. The project will in future inform new medical diagnostic and/or prognostic approaches for infectious and cardiovascular diseases. Findings shared with clinical researchers has the potential for commercialisation of new diagnostic products, reduced disease and improved health.							

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DP230101438	**Plastic brains: Neural adaptations to changing environments in reptiles**	72,500.00	145,000.00	142,500.00	70,000.00	0.00	0.00	430,000.00
Crowe-Riddell, Dr Jenna M	The project aims to quantify brain anatomy on an unprecedented scale in comparative neurobiology. Focusing on Australia's diverse and extensive collection of reptiles, including goannas, dragons and venomous snakes, the project expects to generate new knowledge on the evolution of brains as these animals adapted to new habitats and climates. Data will be collected by cutting-edge micro-CT technology and advanced phylogenetic techniques, which will be complemented by detailed neuroanatomy. Expected outcomes include enhanced understanding of the effects of temperature on brains, and a large database of 3D digital anatomical models. A major benefit includes a greater ability to mitigate the effects of environmental change.							
	National Interest Test Statement							
	Climate catastrophes and habitat destruction have devastating impacts on many species; however, some species readily change in the face of environmental adversity. Understanding what makes some animals more 'adaptable' to change than others (evolvability) is key for conserving iconic Australian species. This project aims to understand evolvability in lizards and snakes by studying clues in the brains of preserved animal specimens held in museums. The project will unlock new data from these specimens and create a suite of digital 3D models of reptile brains using state-of-the-art CT scanning technology. Museum collections are an irreplaceable asset for tracking how species respond to changing environments, but they are largely inaccessible and degrade over time. By uploading 3D digital replicas of specimens to free online databases, and through outreach with school children, this project will increase public accessibility and the longevity of Australian museum collections, providing significant social and environmental benefits.							
DP230101792	**From mainstream to margins: The denormalisation of underage heavy drinking**	38,500.00	96,000.00	108,500.00	51,000.00	0.00	0.00	294,000.00
Pennay, Dr Amy E	This mixed-methods study aims to investigate changes in, and contemporary experiences of, heavy drinking for underage young people in Australia. The project expects to generate new knowledge on whether and how processes of 'de-normalisation' are shaping heavy drinking practices and experiences of social inclusion for underage young people. Expected outcomes of the project include the development of a contemporary theoretical model of underage drinking. This should provide significant benefits such as advancing understanding of the social and structural factors shaping heavy underage drinking practices. Findings can be used to inform policy directions aiming to holistically maximise health and social wellbeing for young people.							
	National Interest Test Statement							
	This project will investigate whether heavy drinking has become de-normalised for underage young people, and understand the implications of de-normalising processes for young heavy drinkers. It is socially and economically important that investment in policies addressing underage drinking is channelled appropriately and policies do not exacerbate health inequality. The study will identify the social and structural factors that shape the ways in which underage heavy drinkers consume alcohol, and in turn, inform the implementation of equitable social and alcohol policies that are best placed to minimise problems and maximise social wellbeing. Findings will inform the types of interventions that are best suited to fostering social inclusion, wellbeing and health, for example, through identifying which social, cultural, environmental, policy and economic levers might address harmful drinking practices among young underage heavy drinkers. Findings will be presented to key stakeholders (e.g., policy makers, advocacy groups, community-based organisations) to maximise the translational potential of the project.							

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DP230101795	**Next generation high throughput lipidomics using adaptive modelling**	106,325.00	237,705.50	178,248.00	46,867.50	0.00	0.00	569,146.00
Huynh, Dr Kevin	This project aims to develop a unique high-throughput method to capture the lipidomic profile of human plasma suitable for large human population screening. Lipids are fundamental to every biological system, but our understanding of their regulation in humans have been largely superficial. By incorporating a new lipidomics approach, with genomic data, this project aims to expand our understanding of human biology by identifying regulators of lipid metabolism. The large diversity in humans necessitate sufficient sample sizes to identify true genetic regulators, but to date techniques capturing phenotypic data (lipids) have been largely limited. It is anticipated that this study will identify new regulators of lipid metabolism in humans.							
	National Interest Test Statement							
	Human metabolism is a process by which our body converts food into energy and new compounds to support maintenance, growth and development. Our metabolism is controlled by a complex, and poorly understood, interaction between our genes and environment (diet and lifestyle). Problems with our metabolism can lead to a range of diseases including diabetes, heart disease and dementia. The discovery that high blood cholesterol can lead to heart disease revolutionized its diagnosis and led to a range of highly effective drugs (statins) that have dramatically improved disease treatment. Cholesterol is only one of the many thousands of lipids (fats) involved in our metabolism that can impact health. Our understanding of how circulating lipids are metabolised is currently limited by our ability to measure these in large numbers of people. This project will develop new technology that will enable scientists to screen hundreds of lipids from a drop of blood in minutes. This technology will improve the understanding of human metabolism, and lead to new ways to identify, prevent and treat many common diseases in future. This new approach will revolutionize the lipid biology field and will be utilised by both industry and research laboratories to better understand lipid biology in humans.							
DP230102088	**Shaping International Law in Global Transformations: Australian Experiences**	75,905.00	148,036.50	163,247.50	169,557.00	78,441.00	0.00	635,187.00
Chiam, Dr Madelaine S	This project aims to examine how Australia influences the development of international law in times of global transformation. The project proposes to develop a new analytical framework to understand how and why Australia has succeeded (or failed) in shaping the development of international law in four key periods of global transformation. Expected outcomes include empirical studies evaluating how, why and to what extent Australians managed to shape international law during these periods. These outcomes should provide benefits in the form of evidence-based proposals to enhance Australia's capacity to influence the development of international law in times of global transformation.							
	National Interest Test Statement							
	This project investigates how Australia has contributed to the development of international law in times of global transformation. Expected outcomes include a new analytical framework to measure how Australia has influenced the development of new international law in global transformations, and detailed empirical studies of how and why Australia succeeded or failed to shape international law in four periods of global transformation: post-World War I, post-World War II, post- Cold War and post-11 September 2001. As a trade-dependent regional power with global interests, Australia gains national economic, social and commercial benefits from an effective rules-based international order. The research benefit Australian diplomats and policy-makers in understanding, guiding and strengthening the rules-based international order during global transformations. Project findings will be used to develop evidence-based proposals to enhance Australia’s capacity to influence the development of international law during future global transformations.							

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DP230102606	**Trust in Pacific Healthcare: Transforming research, policy and practice**	71,263.00	114,035.00	78,350.00	35,578.00	0.00	0.00	299,226.00
Taylor, Dr John P	Medical trust is vital to building positive healthcare engagement and improving health outcomes, yet is poorly understood in non-Western contexts. Focusing on crises of trust related to type 2 diabetes and COVID-19 interventions in the Pacific, this collaborative project aims to examine the social and cultural dynamics of medical (mis)trust in Vanuatu, Fiji, and Samoa. Providing the first cross-cultural study of medical trust, an international team of researchers will generate interdisciplinary scholarly outputs, policy resources and a documentary film. Findings will assist healthcare professionals and communities strengthen trust relationships and ultimately achieve improved health engagement and delivery in the Pacific and beyond.							
	National Interest Test Statement Community mistrust in biomedical knowledge and health systems can impede the success of public health interventions, yet the social and cultural dynamics that define medical (mis)trust are under-researched. This project investigates the role of trust in shaping community uptake of interventions for two interlinked pandemics in the Pacific: type 2 diabetes and COVID-19. Spanning Fiji, Vanuatu, Samoa and the Pasifika diaspora in Australia, this comparative project will generate a practical knowledge base concerning medical trust, and redefine the way in which medical trust is both studied and nurtured in the Pacific and globally. This research will contribute substantially to Australia's national interest by better targeting Australia's massive regional health security aid budget (est. $375m over the next 5 years plus $305m in COVID-19 response). Developing a systematic approach to understanding the lived experience of health-seeking, treatment and care for both metabolic diseases and COVID-19, it will inform the design of locally appropriate strategies to improve health resilience and outcomes.							
	La Trobe University	879,421.00	1,824,331.50	1,565,813.00	699,343.50	78,441.00	0.00	5,047,350.00
Monash University								
DP230100081	**Driving Towards Greener and Safer Roads using Big Spatiotemporal Data**	55,000.00	115,000.00	120,000.00	60,000.00	0.00	0.00	350,000.00
Cheema, A/Prof Muhammad A	This project aims to design novel techniques for using big spatiotemporal data to reduce the impact of road transport on the environment and improve road safety. This project expects to address key challenges and lay scientific foundations of using the big data for developing a next-generation eco-friendly navigation system and increasing situational awareness for road transport safety. Expected outcomes of this project include novel big data management and analytics techniques, and new edge computing models for vehicular networks. The success of this project should bring several key benefits including reducing greenhouse gas emissions on roads, facilitating urban planning, and improving road safety.							
	National Interest Test Statement Greenhouse gas emissions and accidents are two of the most critical issues in road transport. This project will harness the big data obtained from ubiquitous smartphone sensors to reduce the impact of road transport on environment and to improve road safety. Specifically, novel techniques will be designed that exploit the big data to create a next-generation eco-friendly navigation system which will not only significantly reduce the greenhouse gas emissions but will also result in fuel saving. The project will also systematically study the citywide impact of the adaption of eco-friendly navigation on traffic, environment and road safety thus helping in urban planning and decision making. Furthermore, the project will use the big data to improve road safety by automatically identifying risky road conditions and unsafe driving behaviors, and sending real-time alerts to potentially affected vehicles. Computational models will be developed to meet the demands of time-critical road safety applications. We expect to collaborate with major logistics companies and road transport departments for research translation.							

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DP230100154	**Carbon in a Bubble: Cavitation in Ionic Liquids**	75,000.00	145,000.00	140,000.00	70,000.00	0.00	0.00	430,000.00
Duke, Dr Daniel J	This project aims to investigate the potential of pressure-driven phase change as an energy-efficient mechanism for removing dissolved gases from low melting point salts, by advancing understanding of the cavitation behaviour of ionic liquids. This project expects to generate new knowledge in the area of fluid mechanics through an innovative combination of advanced computational simulations and synchrotron X-ray measurement techniques developed by the investigators. Expected outcomes of this project include expanded understanding of the physics of ionic liquids, and the ability to engineer more efficient gas separation systems. The project aims to benefit the chemical and energy sectors through improved energy efficiency.							
	National Interest Test Statement							
	This project aims to reduce the cost of capturing greenhouse gases emitted from power plants by replacing the expensive gas separation machinery available today with innovative new designs that are cheaper and simpler. Existing approaches to capturing emissions from power plants are expensive because the fluid which absorbs greenhouse gas from the exhaust must be continuously heated and cooled. This requires extra energy, increasing the cost of electricity significantly. This project will develop an innovative yet simple nozzle system with no moving parts that traps the gas in microscopic bubbles rather than relying on high temperatures. By better understanding the factors that influence the behaviour of these bubbles, the project will deliver new component designs which can be commercialised and scaled up for use in existing power plants. This will benefit Australians by putting downward pressure on both electricity prices and greenhouse gas emissions, and position Australia as a leader in innovative clean energy technologies.							
DP230100170	**Resonant tender X-ray scattering of organic semiconductors**	68,500.00	137,000.00	137,000.00	68,500.00	0.00	0.00	411,000.00
McNeill, Prof Christopher R	This project aims to establish resonant tender X-ray scattering as a mature technique for unravelling the complex microstructure of organic semiconductor layers. By understanding and exploiting the resonant interaction between organic semiconductors and X-rays tuned to appropriate absorption edges, new information about the molecular packing of these materials will be obtained. The expected outcomes are new experimental methodologies and analysis tools for determining the complex structure of technologically relevant materials. Benefits include understanding of the properties of solution-processed semiconductors enabling the design of high performance materials with applications in energy, electronics, lighting and health.							
	National Interest Test Statement							
	This project aims to develop new ways of using X-rays to study the next generation of electronic materials that are flexible and stretchable. X-rays quickly and easily reveal the crystal structure of materials, which provides information about the origin of material properties. Conventional X-ray analysis works best for solid, perfectly arranged crystals, but struggles to provide information about flexible materials that have a moderate level of disorder. To empower X-ray analysis of flexible materials, this project will exploit X-rays whose frequency is specially tuned to resonate with atoms in flexible materials, rather than relying on a solid crystal structure. This new analysis will be leveraged to intentionally design new materials with desired properties, strengthening Australia's leading position in the development of next generation electronic materials with application across a broad range of fields including flexible low-cost solar panels and wearable electronic devices. Benefits include understanding of the properties of solution-processed semiconductors enabling the design of high-performance materials with applications in energy, electronics, lighting and health. The research will be shared with Australian industry.							

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DP230100241 Flynn, A/Prof Asher L	**Sexualised Deepfakes: Predictors, Consequences, Responses and Prevention** Artificial Intelligence is changing how perpetrators sexually abuse. Yet little research has explored this, and laws and digital platforms are failing to keep pace. This project aims to identify the predictors, harms and consequences of sexualised deepfakes (a form of Artificial Intelligence-Facilitated Abuse) and produce evidence to inform legal, technological and social responses to this growing problem. Expected outcomes include increased understanding of the drivers of abuse, the development of improved prevention resources and social, technological and legal responses for digital platforms, organisations and government. Expected benefits include improved laws, policies and practices to prevent Artificial Intelligence-Facilitated Abuse.	55,423.00	110,652.00	80,589.50	25,360.50	0.00	0.00	272,025.00
	National Interest Test Statement Responding to technology-facilitated abuse is an Australian government priority. Artificial Intelligence is transforming the way abuse can occur, making it easier to abuse and harm others. This includes sexualised deepfakes where machine learning is used to create highly realistic but entirely fake pornography, such as digitally swapping the face of someone performing a sex act. Technology to produce images impossible to detect as fake is expected to be freely available by 2023. This problem threatens the wellbeing and cybersecurity of Australians at individual, societal and economic levels, leading to fraud, bribery, sexual abuse and reputational harm. This project aims to ascertain the predictors, nature and consequences of Artificial Intelligence-Facilitated Abuse and inform law, digital platform policy and social practice. The research seeks to provide government and policymakers with evidence of what social, technological, and legal interventions could be used to prevent this abuse. The project aims to provide social and economic benefits to Australia by finding ways to reduce this form of cybercrime.							
DP230100245 Davis, A/Prof Mark D	**The sociology of health data for sexuality and gender diverse people** This project aims to investigate the sociological dimensions of digital health data for sexuality and gender diverse people with complex health needs. It employs qualitative and co-design methods to engage with sexuality and gender diverse people, advocates, clinicians, decision-makers, and health data designers. The project expects to generate much-needed knowledge about the participation of sexuality and gender diverse people in health data systems, with respect to trust, disclosure, stigma and prejudice. Expected outcomes include insight for enhancing health data systems for sexuality and gender diverse people. This project should provide significant benefits for the promotion of inclusive, safe and useful health data systems.	57,945.00	135,642.00	129,850.50	52,153.50	0.00	0.00	375,591.00
	National Interest Test Statement My Health Record and related health data systems are increasingly important for the provision of cost effective and safe health care in Australia. The Australian government has a significant economic investment in My Health Record and similar health data systems. However, participation in health data systems is lower in sexuality and gender diverse people with complex health needs due to fear of prejudice and misuse of personal data. Missing data means that sexuality and gender diverse Australians will not fully benefit from health data systems. This project seeks to find ways to strengthen the safety and trustworthiness of health data systems for sexuality and gender diverse people. The project will help inform the development of inclusive, safe and useful health data systems that will contain more comprehensive health data for the benefit of all Australians.							

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DP230100585	**Redesigning workers' compensation using participatory systems modelling**	89,000.00	196,500.00	198,000.00	90,500.00	0.00	0.00	574,000.00
Collie, Prof Alex	This project will use participatory system modelling techniques to develop and test new approaches to the design and delivery of workers' compensation in Australia. The project responds to the substantial evidence that Australia's workers' compensation systems are failing to achieve their social and economic objectives. We will actively engage people with lived experience of work disability to co-design an alternative workers' compensation system. The outcomes of this system will be assessed using agent-based modelling, and compared to the current state. The study will provide a vision for an alternative approach to workers' compensation that supports the social and economic participation of Australians with work disability.							
	National Interest Test Statement							
	The project seeks to design and test a new approach for supporting Australians with work-related injury and illness, through workers' compensation. The approach will be based on lived experience of people with work-related injury and illness, their families and carers. The project responds to growing evidence that our workers' compensation systems are not achieving their social or economic objectives. The project will produce a computer simulation model of the new approach and compare the social and economic impacts of this model with a computer model that describes the current state. Every year, Australia spends >$10 billion on workers' compensation benefits and services and ~250,000 Australians make new compensation claims. The project will provide an alternative vision for system design and management that improves outcomes for workers and their families at the least cost to government and employers, and the evidence to support that vision. Findings will inform future policy development in workers' compensation systems, as well as the regulation and operation of workers compensation systems.							
DP230100594	**Invisible labour: Principals' emotional labour in volatile times**	56,010.00	106,025.00	136,156.00	86,141.00	0.00	0.00	384,332.00
Wilkinson, Prof Jane	Schools face a major principal recruitment and retention crisis due to intensified workloads and the emotional labour of managing diverse communities. This project aims to improve leadership preparation and development for school principals to help them manage complex emotional workload demands. The project expects to generate new knowledge about principal workforce development and to create a framework for policymakers that identifies the knowledge and practices required to develop leaders' emotional skills and build bridges across diverse communities. Anticipated benefits include reduced principal turnover, improved teacher retention, improved student outcomes and greater social cohesion.							
	National Interest Test Statement							
	This project will investigate the nature, scope and scale of the new, intensified emotional demands on principals' work arising from their leadership of increasingly diverse and polarised school communities. It will generate a robust evidence base and set of theoretical and practical tools to better understand, prepare and support principals and systems to productively manage these new and intensified forms of work. Australia's aspirations to "increase productivity" and "achieve sustainable economic growth" depend on improved "national well-being". Quality educational leadership is instrumental in achieving these aims. The attraction and retention of high-quality educators into the principalship and lower turnover accrues significant social benefits: positively impacting teacher retention, school-community engagement and students' outcomes, particularly those from marginalised backgrounds. The project will foster healthy and resilient communities by reducing the significant social costs associated with high principal turnover, stress and burnout and has direct economic benefits in reducing turnover costs.							

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DP230100613	**A Universal Power Law for Growth and Diversity of Dinosaur and Bird Beaks**	77,843.00	155,686.00	155,686.00	77,843.00	0.00	0.00	467,058.00
Evans, A/Prof Alistair R	Universal rules that govern how animals grow have tremendous power to explain the highly complex processes of growth and development. The project investigators have recently discovered a new rule of growth that controls how teeth, horns, claws and beaks are generated in animals. This project aims to use this new rule to examine the evolution and diversity of beaks in birds and dinosaurs. By combining 3D modelling, biomechanics and genetic analysis of bird beak development with the study of dinosaur fossils, this project expects to reveal the underlying processes controlling the growth and evolution of beaks. The anticipated goal of this project is to show the power of new theoretical models to explain the diversity of life.							
	National Interest Test Statement							
	This project will investigate a new law of growth discovered by us that controls the shape of structures such as teeth, claws, horns, thorns and beaks in animals and plants. This project will explore in detail how this law applies to the evolution of beaks in dinosaurs and modern birds over millions of years. The advances of this project will generate better predictive models of animal and plant growth and generate considerable public attention due to the significant cultural interest in dinosaurs. Yield in agriculture and aquaculture systems is dependent on growth processes, and the basic biological understanding generated by this project will offer targets to be used by plant and animal breeders and geneticists to improve crop and livestock production, and by biomedical scientists to enhance growth processes in regenerative medicine.							
DP230100657	**Determining the links between size and function in phytoplankton**	70,000.00	133,500.00	126,000.00	62,500.00	0.00	0.00	392,000.00
Marshall, Prof Dustin J	Marine phytoplankton are responsible for around 50% of the carbon fixation on planet. This project will examine how phytoplankton size declines will alter marine food webs and carbon sequestration. Changes in nutrients and temperature will cause phytoplankton to be smaller but the consequences of these changes are uncertain because of a lack of knowledge regarding how changes in cell size affect function within a species. This project will evolve 20 species of algae to be different sizes and estimate the consequences of these size changes for biological functions. The project will then use these data to refine global models of carbon budgets, leading to better predictions about how the global carbon pump will change.							
	National Interest Test Statement							
	Australians rely on the ocean for food, and recreation. Small single-celled plants called phytoplankton are essential for marine food chains, and for aquaculture, but they also cause harmful algal blooms. Australia's marine environment is changing more rapidly than most places on earth and, because our coastal waters are particularly low in nutrients, phytoplankton might be particularly vulnerable to climate change. This project will evolve phytoplankton to adapt to future ocean conditions and in doing so, will identify strains that are tolerant to higher temperatures and more productive in culture. Such information is essential for "future proofing" Australian fisheries and aquaculture under future climates. This project will also develop new methods for aquaculturists to use selective breeding techniques to improve current and future yields of phytoplankton species used in Australian aquaculture.							
DP230100995	**Fundamental research advancing remanufacturing with a 3D printing technique**	80,000.00	162,500.00	165,000.00	82,500.00	0.00	0.00	490,000.00
Yan, A/Prof Wenyi	3D printing manufactures items directly from a computer model. This project aims to develop a computational tool for applying direct laser metal deposition, a 3D-printing method, to repair metallic components and develop a way to predict the remaining life of the remanufactured components. The tool should optimise use of this printing method and improve the quality of repaired components. The research expects to validate the tool for simulating the printing process, provide a better heat treatment during repair, and allow safe prediction of the service life of repaired components. This research should benefit the Australian manufacturing industry and reduce resource use by helping apply this 3D printing method in remanufacturing.							

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	National Interest Test Statement							
	The repair and remanufacture of industrial products play an important role in reducing human impact on the environment through reusing materials, and are more efficient and cost-effective than recycling. This project will develop a theoretical computational tool and a framework to optimise the processing parameters of direct laser metal deposition, a key 3D printing technique for remanufacturing of metallic components. The technique is more precise, and repairs can be stronger than with traditional repair methods such as welding. These applied outputs should improve the quality and safety of remanufactured components and allow prediction of the remaining service life of the repaired components, which will provide evidence to increase uptake of the technique and confidence in the remanufactured components for both manufacturers and customers. Developing this agile approach to remanufacturing could contribute to revitalising Australian manufacturing in areas like repair and maintenance in the aviation and rail industries. It could also open up new global markets while contributing to the circular economy.							
DP230101068 Parkington, Em/Prof Helena C	**Understanding uterine contractility for reducing newborn lamb mortality** The project aims to elucidate the mechanisms underlying normal and dysfunctional uterine contractions in labouring ewes. Significantly, ~20% of newborn lambs die within days of birth, costing the Australian sheep industry more than $780 million annually. Difficult lambing is the leading cause of lamb mortality and weak uterine contractions are the most important contributor to difficult labour (dystocia). Intended outcomes include a better understanding of dysfunctional labour contractions in sheep, and this knowledge could then contribute to the identification of more specific targets for genetic testing for dystocia. The benefits should include more specific aids for selective breeding programs for improved productivity and profitability.	86,505.00	173,010.00	182,010.00	95,505.00	0.00	0.00	537,030.00
	National Interest Test Statement							
	In 2022, the sheep industry is expected to contribute $5 and $3.2 billion to the Australian economy for meat and wool, respectively, involving 1/3 of our farmers and employing an additional 200,000. Newborn lamb loss (~20%) has been identified by Meat & Livestock Australia (MLA) as costing the Australian sheep industry in excess of $780 million annually. Dystocia, defined as “difficulty in lambing requiring assistance", has been identified as the leading cause of newborn lamb mortality. A 2018 study concluded that “ewe risk [for dystocia] was difficult to predict”. Weak uterine contractions are the most important contributor to a difficult labour. Our knowledge of how uterine smooth muscle contracts in an effective manner at labour in sheep is limited and this hampers our ability to predict and/or treat dystocia. We will address this issue by determining mechanisms that underlie normal and dysfunctional labour contractions in sheep. Our results will identify markers, potential therapeutic targets, as well as genes that could aid in the selection of breeding sheep for improved productivity and profitability.							
DP230101142 Valencia, Prof German E	**Extracting subtle hints for new phenomena at the Large Hadron Collider** This project aims to investigate the detailed nature of the Higgs theory which underpins the mass of elementary particles. The project aims to increase the understanding of particle interactions in the context of precise measurements of the properties of the Higgs boson that will come out of the experimental program at the large hadron collider. Expected outcomes include the development and application of methods to address existing gaps in the framework that confronts theory and experiment and to efficiently explore its high dimensionality. The benefits of conducting this research in Australia include the development of intellectual culture and the training of early-career researchers as flexible problem solvers in academia or beyond.	50,000.00	102,500.00	105,000.00	52,500.00	0.00	0.00	310,000.00
	National Interest Test Statement							
	This project aims to provide a detailed study of the Higgs boson which plays a primary role in our understanding of fundamental questions, such as the origin of particle masses and whether our universe is stable. The project will enhance the framework that confronts theory with experimental results at the large hadron collider. This project, by participating in the research program of the large hadron collider, will improve our understanding of fundamental particle physics and further enhance Australia’s high energy physics presence on the global stage. The project will establish new tools, including visualisation techniques to better understand models and data in high dimensions. These tools could benefit other fields that encounter high dimensional problems, such as cybersecurity, the study of biological processes and drug research, or finance as they will assist in dealing with large amounts of data more efficiently. More immediately, the project will provide outreach activities aimed to attract young students into science and mathematics and to inform the general public about the fundamental laws of nature and the importance of basic research.							

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DP230101176	**Exploiting Geometries of Learning for Fast, Adaptive and Robust AI**	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
Phung, Prof Dinh Q	This project aims to uniquely exploit geometric manifolds in deep learning to advance the frontier of Artificial Intelligence (AI) research and applications in cybersecurity and general cognitive tasks. It expects to develop new theories, algorithms, tools, and technologies for machine learning systems that are fast, adaptive, lifelong and robust, even with limited supervision. Expected outcomes will enhance Australia's capability and competitiveness in AI, and deliver robust and trustworthy learning technology. The project should provide significant benefits not only in advancing scientific and translational knowledge but also in accelerating AI innovations, safeguarding cyberspace, and reducing the burden on defence expenses in Australia.							
	National Interest Test Statement							
	This project aims to advance Artificial Intelligence (AI) theory to enable machines to learn faster and be more trustworthy. Intelligence is about change, adaptation, and consistency, aspects that current AI systems, grounded in deep neural networks (DNN), are unable to deal with systematically. By better understanding geometrical properties and structures of DNNs and tools to study them, this project will create new learning systems that are trainable with limited annotations, adaptive and robust. We subsequently apply the developed algorithms to understand and analyze images, improve our cybersecurity capacities in detecting vulnerabilities, and defending against sophisticated AI-based attacks. These developments will benefit Australia in staying at the forefront of the AI revolution and competitiveness, safeguarding the country’s cyberspace and reduce the burden on defence expenses.							
DP230101234	**Understanding the role of digital technologies in addressing loneliness**	82,232.50	150,979.50	136,009.50	67,262.50	0.00	0.00	436,484.00
Petersen, Prof Alan R	This sociological project aims to develop a new approach to understanding the role of digital technologies in efforts to overcome loneliness. The team expects to generate new knowledge of how digital technologies are used by people who feel lonely and applied in policies and programs, using an innovative approach to explore different views, gaining the essential knowledge for assisting lonely Australians, and building much-needed research capacity in the sociology of loneliness and digital technologies. This should provide significant benefits such as a deep understanding of the sociocultural factors that influence people’s use of digital technologies to address loneliness, and evidence-based support for effective strategies and policies.							
	National Interest Test Statement							
	Nearly six million Australians are affected by loneliness, with significant related socioeconomic costs due to work absences, productivity loss, and healthcare needs. This project will investigate the role of digital technologies in helping the public, policymakers, researchers, and service providers to address Australia’s increasing loneliness and associated socioeconomic burdens. The research will provide new evidence on the utility of different digital technologies for different groups and needs. The findings will assist Relationships Australia, Ending Loneliness Together, Department of Health and Aged Care, and peak patient organisations to develop loneliness strategies tailored to the specific needs of diverse Australian social groups and populations. By working with service providers, community organisations and government agencies tasked with addressing loneliness, the project will develop practical measures that will help to reduce loneliness in Australians, particularly among younger and older people as well as remote populations, while also reducing the associated social and economic burden.							

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DP230101327	**Dark-field: A new kind of x-ray imaging**	99,500.00	169,500.00	138,500.00	68,500.00	0.00	0.00	476,000.00
Morgan, Dr Kaye S	This project aims to develop new x-ray imaging capabilities that look inside an object and map out those details that are too small to be seen directly, by extracting the dark-field which is produced as x-ray light scatters. Dark-field images can reveal tiny cracks in manufactured parts, discover powdered explosives or drugs during security screening, and detect changes in the size of the many tiny air sacs in the lungs. Expected outcomes of this project include new instruments and methods of analysis that will allow x-ray dark-field imaging to be quantitative and widely adopted. These methods should benefit non-invasive multi-scale imaging at the Australian Synchrotron and equip x-ray imaging in industry, security and healthcare.							
	National Interest Test Statement							
	X-ray imaging capabilities are being transformed with a new approach known as x-ray dark-field imaging. This powerful imaging method shows up tiny details that were previously invisible in X-rays, such as the air spaces that make up the lungs, small cracks in manufactured parts, and powdered substances like drugs in security screening. Early demonstrations have required expensive equipment in specially designed precision laboratories, limiting the use of x-ray dark-field imaging. Using new mathematics, this project will design low-cost, robust x-ray dark-field imaging set-ups for widespread use, and develop methods to extract quantitative measurements, such as the size of the lung air spaces. These developments will allow quantitative x-ray dark-field imaging to be installed in factories, airport security checkpoints, and hospitals, supporting Australian manufacturing, security, and healthcare.							
DP230101350	**Labour Market and Health Dynamics of Australia's Front Line Workers**	107,494.00	196,494.00	176,500.00	87,500.00	0.00	0.00	567,988.00
Shields, Prof Michael	Australia’s front line workers are there in times of greatest need, but face significant health risks. These risks are expected to increase with the predicted growth in natural disasters, and these concerns have been heightened by the COVID-19 pandemic. This project will apply econometric methods to population-based administrative data to study (1) the determinants and patterns of recruitment and retention into these occupations, (2) how labour market and health outcomes are impacted by exposure to major disasters; and (3) the impact of the pandemic on labour market and health outcomes. The project will provide insights that can inform policies designed to protect the health of front line workers and meet future workforce demands.							
	National Interest Test Statement							
	Front-line emergency and medical workers are facing ever more demanding circumstances with an increasing frequency and severity of natural disasters such as floods and bushfires, in addition to pandemics. This places a greater strain on workers that can impact their health, and may lead them to leave their professions. This project will analyse population and survey-based data focusing on issues of recruitment and retention, and both physical and mental health in these occupations. The findings will support policy development that could lead to stronger career trajectories, improve recruitment and retention in the sector at a time when there is rapidly growing demand, and holistic planning to support front-line workers during and after active service. This project will directly contribute to the National Action Plan for Mental Health of Emergency Services Personnel.							
DP230101377	**Ultrathin Gold Nanocrystal Conductors for Wearable Epidermal Biofuel Cells**	77,857.50	162,857.50	168,500.00	83,500.00	0.00	0.00	492,715.00
Cheng, Prof Wenlong	This project aims to fabricate ultrathin, soft yet stretchable gold nanocrystal conductors to push the thickness limit of next-generation soft bioelectrodes for fabrication of wearable epidermal biofuel cells. This will generate new knowledge and patentable technologies related to design/fabrication of soft nanocrystal conductors, bioanode and biocathode, which require to be thin, soft, conductive and biocompatible. Expected outcomes of this project include enhanced national capacity in disruptive wearable bioelectronics, strengthening international collaborations, unskilled workforce training, as well as advancement of Australian knowledge base in the fields of nanotechnology, materials science, energy, biosensors and bioelectronics.							

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	National Interest Test Statement							
	This project aims to push the thickness limit of bioelectrodes for next-generation wearable tattoo-like energy devices that can convert human sweat into electrical power. Traditional bioelectrodes are typically thick, rigid, and bulky, therefore, incompatible with soft biological systems such as human skin. By synthesising high-quality gold nanomaterials, this project will design and fabricate ultrathin bioelectrodes which can be used for fabricating wearable biofuel cells to power biosensors. The project will generate new knowledge, contributing to advance Australian world standing in the fields of nanotechnology and bioelectronics. The wearable bio-powering technologies to be developed may translate into new Australian industrial opportunities benefiting sectors such as remote healthcare, human-machine interface, soft robotics and artificial intelligence.							
DP230101395	**Biomolecular condensates in mRNA-regulation in germ cells**	100,655.50	204,061.00	201,811.00	98,405.50	0.00	0.00	604,933.00
Boag, Dr Peter R	This project aims to investigate how cells form microenvironments that are enriched for specific biological functions. Using a powerful combination of cutting-edge in vitro and in vivo experiments, the project will generate new knowledge in the emerging area of liquid-liquid phase separation. We will analyse the formation of germ granules that are required for fertility. The expected outcome is a transformational understanding of how liquid-liquid phase separation occurs in cells which, in the longer term, will have applications in biotechnology and disease treatment.							
	National Interest Test Statement							
	Living beings are composed of cells, and each cell is organised into compartments with different functions, in which different chemical reactions occur. Some of these compartments form via a process called “liquid-to-liquid phase separation”. This project will increase our understanding of how these compartments form, including how molecules are attracted to them, with the aim of devising a general set of rules for how compartments form by phase separation. This new knowledge would allow bioengineers to harness this process, paving the way for many applications. For example, these compartments could be artificially produced and used to generate molecules and materials with unusual properties. This outcome could open up a new area for Australia's biomaterials biotechnology sector. In addition, defects in phase separation can lead to neurodegenerative and infectious diseases. This new knowledge could be used by industry partners to identify how to alter phase separation processes and therefore develop new treatments, contributing to human health and providing socioeconomic benefit for Australia.							
DP230101406	**Defining how signalling pathways cooperate to regulate organ size**	62,549.00	127,378.50	130,821.50	65,992.00	0.00	0.00	386,741.00
Harvey, Prof Kieran F	Control of organ size is essential for organ function and organism viability, and varies greatly across the animal kingdom. This project aims to understand how three important signalling pathways co-ordinately regulate organ size during development and also limit aberrant growth. By applying genomics, genetics and bioinformatics techniques, this project aims to discover a core set of growth genes that are regulated by different signalling pathways and the mechanism by which transcription of these genes is repressed in order to eliminate faulty cells. Intended benefits are creation of jobs, new knowledge on fundamental principles of life and the stimulation of new research into organ size control.							
	National Interest Test Statement							
	Size is one of the most obvious differences between organisms on Earth. Despite this, it is not clear how size is controlled. This project aims to better understand how organs (e.g., limbs, the liver, kidneys) grow to the right size as animals grow. It also aims to define how organs stay at the correct size and how they identify and remove damaged cells. Investigating key pathways should allow us to uncover a core set of genes involved in growth and to understand how these genes are turned off to eliminate faulty cells. This information could be harnessed by biotechnology companies to turn genes of interest on or off in tissues inside and outside the body. The outcomes of this project could therefore ultimately be applied to improve human health and optimise food production, including through controlling tissue engineering, developing cancer therapeutics and promoting growth in livestock.							

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DP230101481	**The Benefits of Utilising Visual-Spatial Representations of Numbers**	46,000.00	98,500.00	77,500.00	25,000.00	0.00	0.00	247,000.00
Hopkins, Dr Sarah L	The aim of this project is to investigate how visual-spatial representations of numbers enhance practice to promote the use of retrieval-based over counting-based strategies for children learning early arithmetic. About one-third of Australian children stay reliant on counting strategies for basic arithmetic, despite these being associated with lower achievement in mathematics in later years. Expected outcomes of this project are new understandings of how problem-answer associations can be strengthened in memory and the development of tools to promote retrieval-based strategies. Potential benefits include children who are better prepared to take on higher-level mathematics in secondary school and, subsequently, more numerate citizens.							
	National Interest Test Statement							
	A scientific workforce with a strong background in mathematics and citizens who are competent to reason with quantitative information are needed to ensure Australia's economic, environmental and social long-term needs. Raising achievement levels in mathematics among Australian students requires sustained attention as many students continue to experience an erosion of confidence and fewer opportunities for success with mathematics as they progress through to higher year levels of school. This project will support teachers to build young children's early number knowledge and repertoire of efficient strategies for basic arithmetic, in ways that have not been tried before in classrooms, to ensure children's future success and engagement in higher-level mathematics.							
DP230101490	**Harnessing Business Insights from Unstructured Customer Data**	75,000.00	126,500.00	79,610.00	28,110.00	0.00	0.00	309,220.00
Ludwig, Prof Stephan	Resulting from customers' widespread uptake of online channels to buy and communicate has been a surge in online reviews and social media posts. This textual information offers a viable alternative to surveys that Australian businesses currently conduct to obtain customer insights. However, these reviews are unstructured and require substantial pre-processing to extract underlying customer perceptions. Therefore, this project aims to develop a novel machine learning approach to quantify the business-relevant information contained in textual information shared by customers online. This alternative approach will provide significant cost-saving benefits for a range of Australian companies, such as retailers, hotels, airlines and restaurants.							
	National Interest Test Statement							
	There is an abundance of customer feedback about Australian businesses available in online reviews and social media posts, and this has accelerated due to a surge in online shopping during the COVID-19 pandemic. However, this textual information is voluminous, unstructured, and does not always reflect opinions of all customers. Consequently, online customer feedback requires significant computational processing to ensure it accurately portrays underlying customer perceptions. Many Australian companies, especially small ones, do not have the capability or resources to meaningfully interpret online customer feedback, thereby missing a cost-effective way of utilising customer perceptions. This project aims to develop a novel machine learning approach to organise and quantify the business-relevant information contained in textual information shared by customers online. A key outcome is the development of a web application to quantify customer perceptions using online feedback. This automated approach provides Australian businesses with a significantly cheaper alternative than current marketing research methods.							
DP230101552	**A platform technology for developing mesoporous polymer particles**	66,000.00	142,500.00	146,000.00	69,500.00	0.00	0.00	424,000.00
Thang, Prof San H	This project aims to apply polymerisation-induced self-assembly process to develop triggerable mesoporous polymer particles as advanced functional materials for various applications. By combining this scalable process and automated synthesis technique, mesoporous polymer particles that can disassemble in response to external triggers, such as light, redox conditions and enzymes, will be developed. The knowledge gained from this research will allow researchers to fully understand the formation and evolution mechanism of inverse bicontinuous structures observed in nature and produced in synthetic labs. Importantly, the applications of these novel stimuli-responsive particles as nano-carriers and templating scaffolds will be investigated.							

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	National Interest Test Statement Porous materials can absorb and retain fluids, and familiar examples include sponges, sandstone or human lungs. This research focuses on polymers that are porous, forming structures with tiny, molecule-sized channels. Such polymers can host and transport other active species within, and when exposed to external stimuli such as heat, light, or enzymes, they fully degrade to release these carried loads. These polymers have many applications in controlled delivery of drugs, smart coatings, and energy storage materials, but are currently difficult to fabricate. This project aims to develop automated technology to produce porous polymers more easily. The technology will be scalable and sustainable, increasing our capacity to make such polymers and tailor them to specific applications. Through collaboration with industry partners, we will pursue applications in drug delivery to reduce side effects and within the energy sector to make more efficient battery materials.							
DP230101614 Voelcker, Prof Nicolas H	**Dynamic Microcages for Cells: Advanced Tools to Interrogate Cell Mechanics** This project aims to develop a suite of movable micro/nanostructures with integrated mechanical and biological sensors, which will be interfaced with cells to investigate how those cells respond to their surrounding physical environment. Expected outcomes are new technologies in micro/nanofabrication, sensing, and advanced imaging, and deep understanding of the biological processes that control tissue formation and repair. These outcomes would impact how 3D microsystems are developed and applied, informing the design of advanced in-vitro cell culture systems. Significant benefits are expected in 3D nano-microengineering, and in generating new knowledge underpinning future advances in stem cell and tissue engineering technologies.	78,155.50	157,602.00	160,459.50	81,013.00	0.00	0.00	477,230.00
	National Interest Test Statement This project aims to used advanced manufacturing technologies to develop miniaturised sensors that can detect changes in the structure of human cells. These sensors will tell us new and important information on how individual cells respond to their surrounding environment without the need for expensive animal or human studies. This will provide better understanding of how tissues develop, how they change under different conditions, and the processes that control repair. With the knowledge gained, it will be possible to design new cellular therapies, or to screening libraries of novel compounds, such as in the pharmaceutical industry and personalised medicine, benefitting our ageing population. These developments will benefit Australia by creating knowledge and technologies that will give Australian cell therapy and tissue engineering companies a competitive advantage and create highly skilled jobs.							
DP230101764 Shi, Dr Qianqian	**Design of 2D Soft Plasmonic Photocatalysts for Artificial Leaves** The project aims to fabricate 2D soft plasmonic photocatalysts with leaf-like structures and functions for solar-to chemical energy conversions. The proposed 2D photocatalysts expect to change the traditional way of designing artificial photocatalysts. Expected outcomes of this project include fabrication of 2D soft plasmonic photocatalyst with large-area, ultrathin thickness, and high flexibility, understanding their plasmon-enhanced photocatalysis mechanisms, and construction of artificial leaves to perform the solar-to-chemical conversions, which can provide significant benefits, such as creating new-generation of soft energy devices and advancing Australian expertise in photochemistry, self-assembly, and functional nanomaterials.	43,984.00	117,180.50	150,308.50	77,112.00	0.00	0.00	388,585.00
	National Interest Test Statement This project aims to design and fabricate a new generation of artificial leaves which are thin, soft and flexible for efficient solar-to-fuel conversion. Traditional solar harvesting materials are typically rigid, which greatly hindered their ability to mimic the structure/functions possessed by natural leaves. For example, the widely used roof top solar panels can only receive sunlight from a certain angle, and its efficiency drops off tremendously once the sun moves to a different spot. To tackle this challenge, this project will design soft artificial leaves which are expected to be able to install on almost any type of surfaces and harvest low intensity sunlight to convert chemical reactions efficiently. This will deliver a new market in the chemical manufacturing sector powered by abundant Australian sunlight and minimise global carbon emission, contributing to the net zero goal by 2050. These developments will benefit Australia through creating next-generation soft and sustainable energy devices that will ultimately bring economic and environmental benefits to Australian renewable energy industry.							

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DP230101879	**The viral fusosome: a modular machinery for cargo delivery to target cells**	81,219.00	163,401.00	170,842.50	88,660.50	0.00	0.00	504,123.00
Coulibaly, A/Prof Fasseli	The delivery of proteins, RNA and DNA into cells is a critical process in normal cellular biology, virus infection and biotechnology applications such as gene editing. Enveloped viruses achieve this maneuver with exquisite efficiency and specificity using a complex machinery mediating their fusion with cellular membranes for stealth genome delivery. Remarkably, all characterised viral fusion proteins belong to only 3 classes defined >16 years ago and sharing surprisingly conserved mechanisms. We identified a novel class of fusion proteins with unique architecture in ubiquitous insect viruses. The Project will elucidate the structural and functional hallmarks of this fusion machinery providing a platform for its engineering.							
	National Interest Test Statement							
	Cells constantly shuttle molecules across the cell membrane while carrying out their normal activities. When viruses infect cells, they hijack this process to deliver viral genetic material into cells. These delivery strategies used by viruses can be harnessed for applications such as vaccines and gene editing. However, delivering molecules to the right cells in the right amounts is a major challenge. Recently, we discovered a new type of delivery machinery in viruses that infect insects. This project will define how this machinery works and develop tools to manipulate it. Bioengineers will be able to use these findings to create nanoparticles that efficiently deliver molecules directly into specific cells to correct defects or reprogram the cells for beneficial activities. These nanoparticles could therefore be used to better control agricultural pests and improve animal health. This technology could bolster Australia's biotechnology sector, with these delivery technologies predicted to have a global market of $1 billion by 2028.							
DP230102073	**In depth characterisation of the gamma delta T cell immune synapse**	101,559.50	208,077.50	208,036.00	101,518.00	0.00	0.00	619,191.00
Gully, Dr Benjamin S	This project aims to comprehensively characterise the activation principles of gamma delta T cells. These cells have an understudied but central role in vertebrate immunity and development. A missing piece of the puzzle is how gamma delta T cells sense stress and how this signal leads to activation. Expected outcomes include the generation of fundamental knowledge in immunology and structural biology. This proposal uses high-skilled techniques, including cryo-electron microscopy and single-molecule imaging and holds ancillary benefits to postgraduate students. Anticipated outcomes include influential publications, building a critical mass of expertise in Australia and fostering international collaborations with Australia at the epicentre.							
	National Interest Test Statement							
	The immune system contains a variety of cell types with specific roles. One of these cell types, gamma delta T cells, is a unique type of white blood cell. These cells conduct surveillance of epithelial tissues, which line all of the body's surfaces, and find 'stressed' cells that are not properly functioning. This project will increase our understanding of how these cells detect stress signals and are switched on, leading to an immune response. This knowledge will offer new tools that could be used to turn on or turn off gamma delta T cells, which are not only present in humans but also abundant in sheep and cattle. The outcomes could be used by biotechnology companies to develop gamma delta T-cell immunotherapies, for humans and animals. This research will therefore lay the groundwork to position Australia at the international forefront of novel T-cell-based therapies, contributing to both health and the Australian economy.							
DP230102077	**A theory for the vertical structure of tropical atmospheric circulations**	57,167.50	117,497.00	112,729.50	52,400.00	0.00	0.00	339,794.00
Singh, Dr Martin S	The vertical structure of atmospheric circulations is a key determinant of rainfall patterns and climate, but model projections do not agree on how it will change in a warmer world. This project aims to discover the processes that control the vertical structure of tropical atmospheric circulations. It will combine theory development, analysis of observations, and targeted modelling to generate new knowledge of the mechanisms affecting atmospheric circulations as the climate changes. This will allow for process-based identification of the most reliable climate models, facilitating increased confidence in future projections. More accurate tropical climate projections will benefit decision making for resource management in northern Australia.							

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	National Interest Test Statement							
	Changes in future rainfall patterns on our warming planet are driven by changes to atmospheric circulations - the characteristics of where and when air rises and descends through the atmosphere. But our understanding of the structure of atmospheric circulations remains poor, and this leads to large uncertainties in future projections of rainfall in regions such as northern Australia. This research will improve our understanding of the mechanisms controlling the vertical structure of tropical atmospheric circulations and use this new understanding to evaluate the ability of state-of-the-art climate models to reproduce these mechanisms. Such evaluation contributes to the reduction in uncertainty in climate projections for northern Australia, ultimately providing guidance for decision making in government and industry in areas such as resource and water management. This research therefore contributes to the Australian Government's Practical Research Challenge of developing improved accuracy and precision in predicting and measuring the impact of environmental changes caused by climate and local factors.							
DP230102150 Grinter, Dr Rhys W	**Hitting bacteria with a Bam: Lectin-Like Antimicrobials as New Antibiotics** Antibiotic resistance in disease-causing bacteria is a rapidly growing problem, making the development of new antibiotics of critical importance. This project aims to develop naturally produced lectin-like protein antibiotics as novel antimicrobial agents. To achieve this, the project will produce an extensive library of these antibiotics and test them for potency and specificity. Using cutting-edge techniques, it will determine how these antibiotics kill cells on a molecular and cellular level. It is anticipated this research will create the tools and knowledge required to exploit lectin-like protein antibiotics to fight bacterial infection, which will lead to their use in the prevention of crop and livestock losses due to disease.	102,528.00	207,986.00	206,335.50	100,877.50	0.00	0.00	617,727.00
	National Interest Test Statement							
	This project aims to develop lectin-like protein antibiotics to treat bacterial infections in plants, animals, and humans. There is a growing crisis of infection caused by antibiotic-resistant bacteria. We desperately need new antibiotics to treat these infections. Lectin-like protein antibiotics are highly potent and have demonstrated potential in treating bacterial infection, however, our poor understanding of how they kill bacteria is a roadblock to their further development. This project expects to produce a detailed understanding of the mechanism of these antibiotics. Further, it will develop an extensive library of these antibiotics and engineer novel variants, creating key tools for their development. It is anticipated that this project will benefit Australia economically and socially through direct commercialization and by lowering the burden of bacterial disease. In pilot studies, lectin-like protein antibiotics have been used to prevent bacterial infection in both plants and animals. The knowledge and tools this project aims to produce are required for the translational use of these antibiotics.							
DP230102188 Deguchi, Dr Kengo	**How do vortices live in spatio-temporally complex flows?** The project aims to understand the fundamental mechanism of vortices occurring in flows involving spatio-temporal complexity, by using the combination of dynamical systems theory and asymptotic analysis. This innovative combined mathematical analysis will be coupled with sophisticated computations to be enabled by the international interdisciplinary collaboration between the Mathematics and Engineering at Australia and Japan. The expected outcomes are breakthroughs in the fundamental understanding of turbulence. This should lead to significant insight into better turbulent modellings used in, for example, wide range of engineering, physiological and geophysical flows.	65,000.00	132,500.00	132,500.00	65,000.00	0.00	0.00	395,000.00
	National Interest Test Statement							
	This project will investigate turbulent flows, which occur when a liquid or gas moves in complex ways, often forming eddies, such as air passing over an aeroplane wing or water moving through a pipe. Such processes are ubiquitous in nature, engineering, fluid transport, aerodynamics, and the atmosphere. Existing turbulence simulations are expensive and often require sacrificing accuracy. This project will overcome these difficulties by using mathematical tools to analyse the precise role of turbulent eddies of various sizes. The outcome of the analysis will be used to develop new computational methods to predict key properties of turbulent flows and control strategies to modify them. The resulting methods should enable the design of efficient medical devices and aircraft, as well as accurate climate change models. The research will be disseminated widely through industrial partners including our long-term collaborator AIRBUS and more recent collaborators at Boeing in Melbourne.							

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DP230102209	**Self-Interacting Random Walks**	67,500.00	135,000.00	135,000.00	67,500.00	0.00	0.00	405,000.00
Collevecchio, A/Prof Andrea	This project aims to study the growth properties of a class of self-interacting processes defined on Euclidean lattices. This project expects to determine whether a shape theorem holds for once-reinforced random walks, and establish conditions for their recurrence/transience. It also expects to obtain new and very precise estimates for the local time of simple random walks. Expected outcomes of this project include solving long-standing open problems in the field of reinforced random walks, and the development of novel methods for their study. This should provide significant benefits not only to the field of mathematics, but also to the myriad of applied disciplines where self-interacting processes are utilised.							
	National Interest Test Statement							
	Many natural phenomena can be modelled by randomly moving objects that interact with their environment, such as an ant wandering randomly, but laying pheromones as it moves so that it prefers to revisit previously traversed paths. There are well-developed models of random phenomena evolving over time, with applications in science, engineering, medicine, economics, and beyond. However, including interactions with the environment constitutes a significant departure from established models, and raises new challenges. This project will apply new mathematical techniques to address such random processes. A deeper mathematical understanding of them will shed light on a variety of practical questions that fit into similar models, including the formation of bacteria colonies, the management of transport networks, and the efficiency of learning algorithms used in artificial intelligence. Results will be shared with partners in industry and other disciplines, with the potential to lead to practical outcomes, such as pharmaceutical advances and software development.							
DP230102304	**Resilient design of energy pile foundations toward zero carbon buildings**	92,000.00	179,000.00	174,000.00	87,000.00	0.00	0.00	532,000.00
Bouazza, Prof Abdelmalek	This project aims to investigate the complex thermo-hydro mechanical interactions affecting the effectiveness of energy pile foundations for improved energy efficiency of new buildings. Using cutting-edge micro to field-scale methods, this project expects to underpin the development of experimentally validated predictions of the geotechnical performance of energy piles. Expected outcomes of this project are the establishment of new approaches to improve the resilient design of energy pile foundations, provision of new recommendations for their design and increased integration for zero carbon buildings. These outcomes will contribute significantly toward strategies to decarbonise energy systems in buildings to meet carbon neutrality goals.							
	National Interest Test Statement							
	The project aims to develop fundamental knowledge needed to improve heat transfer predictions in pile foundation systems, which have dual functions of load bearing and heat transferring (i.e., energy piles), used in constructing buildings to improve energy efficiency. By improving our understanding of how heat transfer and water flow occur in soils can improve the energy efficiency of energy piles. We aim to ensure that buildings, responsible for about 40% of the global energy consumption and about one-third of global greenhouse gas emissions, reduce their carbon footprint using low emissions technologies in their foundation systems (i.e. energy piles). Improving buildings' energy and carbon performances will play a significant role in helping Australia meet its 2030 Paris Agreement emissions reduction target and contribute to the decarbonisation of the building sector by 2050. This project will benefit the Australian construction industry by giving them a superior understanding of energy piles performance and tools to use in design and specifications and enhancing their international competitiveness.							
DP230102412	**The Role of Lck/CD8 Association in Negatively Regulating T cell Activation**	136,219.00	278,894.50	289,008.50	146,333.00	0.00	0.00	850,455.00
La Gruta, Prof Nicole L	This proposal aims to advance our fundamental understanding of how T cell recognition of antigens translates into a T cell activating signal. The proposal will establish whether the major T cell coreceptor also acts as a negative regulator of T cell activation in vivo when antigen recognition is unorthodox. It will also determine whether certain subsets of T cells naturally lack coreceptors in order to facilitate unorthodox antigen recognition. Thus, the proposal will significantly advance our understanding of, and establish new paradigms around, the regulation of T cell activation. Expected long term benefits outside the scope of this proposal include improved immunotherapies and vaccines designed to elicit or suppress T cell responses.							

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	National Interest Test Statement							
	T cells are an important class of immune cells. They protect animals and humans against diseases caused by pathogens such as bacteria and viruses. They also have a vital role in the body's response to vaccination. Before they can carry out these functions, T cells must first be turned on. This happens when a T cell detects a threat such as a pathogen, but how this happens is not well understood, including how specific molecules inside and outside T cells interact. This project aims to gain a better understanding of how T cells are turned on and how this process is controlled. This knowledge will offer new tools to regulate T cells, which could be used by biotechnology companies to design better strategies for generating optimal immune responses. The outcomes of this project could therefore influence the development of vaccines, immunotherapies and related products targeting, for example, infectious diseases, contributing to both human and animal health.							
DP230102695 Wong, A/Prof Lee H	**Histone H3.3-dependent transcriptional control and B cell differentiation** This project aims to investigate the fundamental way cells assemble transcriptional machinery to turn on genes and retain transcriptional memory. This project expects to generate new knowledge in the areas of both chromatin biology and immunology, using interdisciplinary approaches. Expected outcomes of this project include an enhanced capacity, through institutional and international collaborations, to determine whether the rapid transcription and function characteristic of immune memory in response to stimuli is due to histone H3 variant and its associated nuclear bodies. This should provide significant benefits, such as understanding epigenetic mechanisms that underlie transcription initiation and maintenance across many species.	89,271.50	176,792.00	177,712.00	90,191.50	0.00	0.00	533,967.00
	National Interest Test Statement							
	In each cell of an organism, the genetic code is the same. As the organism grows, different types of cells develop, because different parts of the genetic code are turned on and off at specific times and places. This project aims to investigate how cells assemble certain factors that turn on genes and how the cells retain a memory of this. This research will increase our understanding of how genes are controlled, how a cell is directed to develop into a particular cell type, and how an embryo develops. More specifically, it will define this process in a specific type of immune cell called a B cell. The knowledge from this project could be used by bioengineers and industry partners in applications that involve controlling how cells develop, such as growing replacement tissues outside the body. In the long term, it could lead to the design of better vaccines that provide long-lasting B cell antibody responses in animals and humans, providing future benefits to prevent infectious diseases and for Australian industries that rely on animal health for food production.							
DP230102725 Marques, A/Prof Francine Z	**Unravelling the maternal gut microbiome as a driver of fetal development** This project aims to experimentally determine how changes in the maternal gut microbiota impact the phenotype of the offspring. This innovative project uses an interdisciplinary approach combined with novel models and the latest generation technology for genome sequencing. Expected outcomes include extensive new knowledge of how the gut microbiota communicates with the host during pregnancy and the impact this has on the gastrointestinal, immune, cardiovascular and reproductive systems. Our findings should yield information that may ultimately be translated into products that augment agricultural production, providing significant benefits.	143,409.50	283,739.50	323,310.00	182,980.00	0.00	0.00	933,439.00
	National Interest Test Statement							
	This project aims to understand how the microbes that inhabit the mother's gut help digest food. A key nutrient that feeds these microbes is dietary fibre. We seek to understand if fibre intake during pregnancy, acting via gut microbes, improves the overall health and breeding capacity of descendants. This project will inform the design of new fibre diets to improve productivity and efficiency of livestock animals. It will also generate insights into how gut microbes communicate with different parts of our bodies. This is important because there is a rising global demand for efficiently produced meat. The advances from this project will help us identify new ways to meet this demand via changes in maternal diet, which may have a key impact in enabling earlier and longer breeding of livestock. As a result, this project will enable intellectual property with significant commercialisation value for the livestock industry through collaborations with Australian livestock stockfeed manufacturers.							

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DP230102776	**Structure and dynamics of class B1 G protein coupled receptors**	130,425.00	254,849.00	258,015.00	133,591.00	0.00	0.00	776,880.00
Wootten, A/Prof Denise L	Cells within our body require cell surface proteins (receptors) to convert extracellular stimuli into an appropriate biological response. G protein-coupled receptors are the largest group of cell surface receptors. This project focuses on a subset of these receptors that have diverse and important functions in the central nervous system and the periphery, however there are many unanswered questions regarding the structure of these proteins, and how they regulate cellular signalling. The primary outcomes of this project will provide detailed mechanistic insights on how receptors bind their stimuli and how this results in in their activation to mediate fundamental signalling that is important for all living organisms.							
	National Interest Test Statement							
	G-coupled protein receptors (GPCRs) are a group of proteins on the surface of human cells and are how cells interact with each other and the outside world. Because they are the frontline of how cells signal, communicate and adapt, they are an extremely attractive candidate for pharmaceutical intervention of a multitude of diseases. However, the detailed mechanism as to how these crucial signalling proteins work is still barely understood; it is this understanding which has the potential to radically transform how future pharmaceutical drugs are developed. This project will leverage absolute cutting-edge technologies to interrogate these proteins at their molecular level. The scientific techniques pioneered in both electron microscopy and mass spectrometry will be broadly applicable to the future Australian pharmaceutical drug development research. Moreover, this project will add valuable methodology to this technology platform in Australia, enabling Australian researchers to further probe the molecular nature of these vital cell signalling proteins.							
DP230102777	**The physiological importance of GLP-1R and GIPR dimerisation**	90,682.50	180,773.00	202,282.00	112,191.50	0.00	0.00	585,929.00
Wootten, A/Prof Denise L	Cell surface receptors are vital for relaying information from hormones to the cell to influence cell function, and ultimately physiological responses. Receptors can form oligomers with other receptors, but whether this can influence cellular and physiological responses is not yet defined. This biology-based project aims to bridge this knowledge gap by studying the dimerisation between two related receptors involved in whole body metabolic homeostasis. Our team will deliver new knowledge into the disciplines of pharmacology, cellular biology, metabolism and physiology, and provide interdisciplinary research training to students and junior scientists, and strengthen research collaboration within and outside of Australia.							
	National Interest Test Statement							
	In mammals, metabolic function is controlled by groups of hormones. Hormones trigger processes that maintain health by binding to structures on cells called “receptors”. There are particular types of receptors involved in regulating metabolism, such as maintaining an appropriate level of glucose. These receptors can directly interact with other receptors of the same type, or of different types. The particular make-up of these groups of receptors can change the physiological outcome triggered by hormone binding. There is a crucial knowledge gap in understanding how this takes place. This project will determine how different receptors arrangements regulate metabolic processes. These insights will be important for understanding receptor and hormone function. The new knowledge generated will be of fundamental importance to pharmacology, cellular biology, metabolism and physiology. The findings generated will inform approaches to deliver new types of drugs for the management of metabolic diseases such as diabetes. This research will be of benefit to Australia’s biotechnology and pharmaceutical sectors.							

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DP230102854	**Defining novel immune checkpoints controlled by stromal cells**	102,426.50	172,902.50	142,505.50	72,029.50	0.00	0.00	489,864.00
Degli-Esposti, Prof Mariapia A	This project seeks to use innovative approaches to elucidate the mechanisms that define the earliest steps required to generate immune responses. The proposal builds on discoveries, including novel preliminary data, from a team with world-leading expertise in immunology, virology and stromal cell biology. The expected findings will provide fundamental insights into novel cellular and molecular interactions between stromal tissue components and immune cells that initiate and regulate immune responses. Expected benefits include fundamental advances in knowledge, as well as insights that will ultimately benefit biotechnology and therapeutic applications, and in this way support research priorities linked to advanced manufacturing and health.							
	National Interest Test Statement							
	T cells are part of the immune system and are important defenders against threats such as viruses and bacteria. To respond, T cells must be turned on. A key step in this process is when T cells interact with the cells that detect the threats, which are called dendritic cells. We recently found that this interaction is affected by a third cell type, called stromal cells. This project will define how stromal cells affect the responses of T cells. Investigating these early steps of the immune response will improve our understanding of the molecules that are involved, and how some viruses hide from the immune system. Through industry collaborations, this knowledge will be used to develop and improve vaccine design and therapies that rely on T cells being turned on or off. Such therapies can be applied to animals, including livestock, as well as humans. The outcome of this research could therefore ultimately benefit Australia's primary industries and health sectors.							
DP230103014	**Beautiful strings**	67,952.50	175,975.50	219,006.00	110,983.00	0.00	0.00	573,917.00
Skands, Prof Peter Z	This project aims to carry out several key experimental measurements, in tandem with substantial theoretical work, to improve the understanding and physical modelling of processes involving b quarks, also called beauty quarks, which are of intense current interest for experiments across the globe. Key theoretical innovations include novel treatments of electromagnetic corrections, novel theoretical formulations of the dominant physical paradigm of string fragmentation, and optimisations of key associated algorithms to enable new applications of broad relevance. Experimental measurements will be carried out to validate the new theoretical developments and use them to minimise theoretical uncertainties.							
	National Interest Test Statement							
	In basic science, subtle differences between theory and experiment can herald the discovery of new natural laws, with implications for deep questions asked by adults and children alike: what is the universe made of, and what are the laws that govern it from beginning to end? Complex data sets, like those of modern particle physics, call for sophisticated computer simulations to reliably interpret the results. This project will produce a set of new computational models that will allow to tell the "new" from the "known" more decisively, to address the big questions with greater confidence. The project targets specific areas in which tantalising differences have been observed, which will lead to newspaper headlines if confirmed. Particularly efficient methods will be developed, which reduce computational resource requirements, and which have downstream applications in data science. As these are communicated in multidisciplinary settings, they can benefit other simulation-heavy disciplines such as finance and risk modelling, with efficient models leading to reduced environmental and economic costs.							
DP230103037	**Mapping Australians' Media Use and Civic Attitudes**	67,500.00	142,500.00	143,908.00	68,908.00	0.00	0.00	422,816.00
Andrejevic, Prof Mark B	This project would address the need to better understand how patterns of media consumption in Australia are correlated with knowledge about current events, civic attitudes, and political polarisation. It would provide the first empirical study of the relationship in a fast changing media environment between the ways Australians access information about the news, their knowledge of current events, and their expressed civic values. Significant benefits include a greater understanding of how Australians use the media to stay informed and how these practices shape values of crucial concern to democratic participation and deliberation. The findings would be shared through white papers, academic and public-facing publications, and workshops.							

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	National Interest Test Statement							
	The increasing spread of false information online and associated increases in political polarisation are corrosive to Australian civic and political life. Calls to regulate media platforms such as Facebook and YouTube in order to address this problem raise untested questions about the relationship between changing patterns of media use, political extremism and social fragmentation. This project aims to provide the first systematic study that investigates the relationship between Australians' media use, their knowledge of current events, and civic attitudes and values. Results from the project will help inform the Australian public, government, policy makers, journalists, and regulatory bodies including the Australian Competition and Consumer Commission. The project will help inform policy making and regulation to better serve Australian social and political needs. The project's findings will be shared publicly through public workshops, online resources, and mainstream media communications.							
DP230103080 Greening, A/Prof Chris	**Extracting energy from air: mechanism of a bacterial hydrogenase** The atmosphere has recently been shown to be a key source of energy for diverse soil bacteria. Bacteria use complex enzymes, namely Huc-type hydrogenases, to harvest atmospheric hydrogen directly from air to support growth and survival. However, little is known about how Huc functions within and outside cells. By synergising expertise in microbiology, biochemistry, and chemistry, we will resolve the mechanism, assembly, and integration of Huc, including the basis of its remarkably high affinity and oxygen insensitivity compared to previously studied hydrogenases. This project will enable biotechnological applications, as the first study of an enzyme that extracts energy from air, and has broad ecological and biogeochemical implications.	119,426.00	251,322.00	227,622.00	95,726.00	0.00	0.00	694,096.00
	National Interest Test Statement							
	The soil contains large numbers of bacteria, which carry out important tasks, such as making nutrients for plants. Recently, soil bacteria were found to make energy from the air: they make a molecule that allows them to take hydrogen from the atmosphere and use it for energy. This project will increase our knowledge of how this molecule works, including how it turns hydrogen into energy, how individual copies of the molecule interact with each other and work together, where the molecule is located in a bacterial cell, and which other pathways related to energy production it might interact with. Through a productive collaboration with a biotechnologist, this knowledge will be harnessed to engineer this molecule as a biocatalyst, with the aim of producing energy from hydrogen in the air. This research could ultimately lead to this molecule being used to produce renewable energy to power our homes and to reduce carbon emissions in sectors such as transport and infrastructure. This work will also contribute to Australia's developing hydrogen industry and therefore has significant economic potential.							
DP230103088 Thrane, Prof Eric	**A Transdimensional Approach to Gravitational-Wave Astronomy** This project uses ripples in the fabric of spacetime—gravitational waves—to understand the cosmos and the fundamental nature of reality. We aim to discover new sources of gravitational waves from exploding stars. Using gravitational waves from colliding black holes, we aim to uncover new physics beyond Einstein's theory of general relativity. To achieve these goals we will develop tools from the cutting-edge of data science.	65,000.00	130,000.00	135,000.00	100,000.00	30,000.00	0.00	460,000.00
	National Interest Test Statement							
	This project is about ripples in the fabric of spacetime called gravitational waves. Using observations of gravitational waves, we aim to uncover new physics beyond Einstein's theory of gravity. We will achieve this by developing a new technique from data science called transdimensional sampling. This technique has been successfully employed in a variety of fields, from astrophysics to climate change to medical science. As scientific models become more complicated, it is poised to become indispensable. This project will create publicly available transdimensional sampling software, enabling scientists and engineers to analyse data with new, more sophisticated models, particularly those required to generate new knowledge about the cosmos. These powerful data-analysis tools will be made broadly available through pre-existing collaborations with industry, particularly data science companies. Uptake of these new models in the finance and banking sector, for example, could lead to more accurate predictions from complex financial datasets, to underpin improved investment decision making.							

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DP230103097	**Imaging mammalian organogenesis with adaptive optics**	110,750.00	219,000.00	226,400.00	118,150.00	0.00	0.00	674,300.00
Combes, Dr Alexander N	Optical and computational barriers to analysing cell movement have limited our understanding of mammalian organogenesis. We have built a super-resolution spinning disk confocal microscope with adaptive optics and developed machine learning-based image processing and cell segmentation workflows to overcome these long-standing barriers. We propose to combine these cutting-edge live imaging and analysis approaches to characterise the role of cell movement in mammalian organ formation and develop advanced cell segmentation and tracking methods for use in the scientific community. We anticipate this project will generate fundamental insights into how cells interact to build complex organs.							
	National Interest Test Statement							
	Cells are the building blocks of all living things. They work together to build tissues, organs and body systems. However, the way in which cells grow, change and come together to create organs is not well understood. This project will develop microscope technology that will allow cells to be viewed as they move and form one organ, the kidney. The outcomes will include a set of general principles about how cells move and form organs, including which factors affect a cell's role in an organ and the overall architecture of an organ. This new knowledge could be used by bioengineers to develop ways to grow cells and tissues outside the body. Such advances in tissue engineering ultimately pave the way for many industrial and biomedical applications: for example, artificial replacement organs and tissues could improve health, and artificial meat could provide an alternative food source.							
DP230103127	**Understanding why mammalian eggs have so much mitochondrial DNA**	61,970.50	136,941.00	140,941.00	65,970.50	0.00	0.00	405,823.00
Adhikari, Dr Deepak	During oocyte growth there is massive increase in the replication of mitochondrial DNA so that each ovulated egg has 200,000-400,000 copies of the mitochondrial genome. This mitochondrial compliment will provide the template for all mitochondrial DNA in the subsequent organism. The established role of mitochondria is to provide energy in the form of ATP, but they are also known to be highly adaptive to the metabolic and energetic state of the cell. In this project, we will use genetic approaches to decrease the amount of oocyte mitochondrial DNA by 90%. We will examine how this influences mitochondrial organisation, oocyte metabolism and embryo development. This new knowledge will provide insights into animal breeding and human health.							
	National Interest Test Statement							
	In mammals, eggs are fertilised by sperm and become embryos. Many factors influence whether an embryo is healthy. Eggs contain very large numbers of mitochondria, a type of mini organ (organelle) that produces energy within cells and has other important functions. This project will investigate how mitochondria in eggs influence the development of a healthy embryo. More specifically, this research will increase our understanding of how the number of mitochondria in an egg affects how the mitochondria are organised within the egg, how the egg uses and produces energy, and how an embryo develops. This knowledge could be harnessed by veterinary reproductive technologists, as part of breeding and cloning strategies for improving livestock quality. Understanding the factors that control mitochondrial quality might also provide insight into mitochondrial disease and ultimately pave the way to using mitochondrial replacement therapy.							
DP230103185	**High activity catalysts for CO2 recycling to valuable chemical products**	91,012.00	180,763.50	173,711.50	83,960.00	0.00	0.00	529,447.00
Tanksale, A/Prof Akshat	This proposal targets the development of novel porous solid catalysts, containing highly dispersed metal clusters that provide exceptional activity for the conversion (recycling) of carbon dioxide to fuels and other higher value chemical products. These novel materials will improve the productivity and/or reduce the energy required to facilitate the CO2 conversion, thereby reducing costs for industry, whilst also providing environmental benefit by carbon dioxide utilisation.							

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	National Interest Test Statement This project seeks to create new materials (catalysts) that will substantially improve the ability to utilise carbon dioxide emissions by converting them to valuable fuel and chemical products. The high activity catalysts produced will enable reduced capital and operating costs associated with these chemical conversion processes. It will also provide the prospect of new business ventures for the preparation of these novel materials. The ability to recycle carbon dioxide to hydrocarbon products will also help to reduce the nation's dependency on fossil fuel resources and simultaneously help reduce carbon dioxide accumulation in the atmosphere. The ability to produce hydrocarbon fuels using local carbon dioxide resources will assist to improve national security around liquid fuels supply.							
DP230103193 Carroll, Prof John	**How are sperm mitochondria eliminated after fertilisation** The fact that mitochondria are inherited exclusively through the maternal germ-line is fundamental feature of sexual reproduction in all but a few organisms. This uni-parental inheritance is thought to prevent genetic conflict between different mitochondrial genomes. The mechanisms controlling uniparental inheritance involve eliminating the sperm mitochondria soon after fertilisation. We will investigate 2 possible mechanisms, (1) active destruction and (2) passive dilution. The results will help explain how heteroplasmy is avoided in order to maintain the fitness of organisms including animals and humans. The results will have long term insights into improving breeding in agriculture and in the prevention of mitochondrial genetic disease.	70,998.00	143,496.00	143,496.00	70,998.00	0.00	0.00	428,988.00
	National Interest Test Statement In mammals, an embryo is formed when an egg is fertilised by a sperm. Most of the genetic material is in a compartment called the nucleus: the egg provides half, and the sperm the other half. Eggs also contain numerous mitochondria, a type of mini organ (organelle) that produces energy within cells. Mitochondria have their own genetic material, but this is inherited only from the mother. It is unclear how mammals eliminate the sperm mitochondria after the egg is fertilised. This project aims to gain a better understanding of how mammals inherit a uniform set of mitochondria from a single parent, which is important for healthy embryos. This knowledge will inform our understanding of how mitochondria are regulated, including in response to stress and other challenges from the environment. The research findings could be used by veterinary reproductive technologists to inform breeding and cloning strategies for improving livestock quality. In addition to benefiting the agriculture sector, the findings could ultimately pave the way to preventing mitochondrial disease by using mitochondrial replacement therapy.							
DP230103211 Turner, Prof Stephen J	**Visualising chromatin changes in 3 dimensions: super to ultra resolution** Packaging of genomic information into the nucleus of a cell necessitates the formation of tightly compacted and highly organized genomic structures within the nucleus, a configuration that is inherently repressive for gene transcription. Hence, mechanisms that alter the spatial organisation of DNA are critical to enable a variety of genome functions, including DNA transcription. This proposal will utilise novel adaptations of super resolution microscopy to visualise in 3 dimensions how changes in chromatin modifications impact genome spatial organisation within the nucleus, and how this then links to cellular differentiation. This will provide a picture of how spatial organisation within the nucleus supports general cell differentiation.	95,000.00	192,500.00	197,500.00	100,000.00	0.00	0.00	585,000.00
	National Interest Test Statement This project will investigate how cells in the immune system develop. It will identify how the location of genetic material in each cell affects the role it takes on, and which markers influence where the genetic material is located. Because immune cells detect and respond to infection, a deeper understanding of how specific immune cells develop could be harnessed by biotechnology companies to design and engineer specific cell types for use in immunotherapies. These processes are also likely to be used by many body systems and cell types and therefore could be harnessed for broader tissue engineering applications, such as stem cell therapies, wound repair and food production, contributing directly to animal health, advanced manufacturing, and economic productivity in Australia.							
	Monash University	3,739,671.00	7,530,478.00	7,521,173.00	3,760,366.00	30,000.00	0.00	22,581,688.00

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RMIT University								
DP230100260	**Scalable Stream Processing in Hybrid Edge-Cloud Infrastructures**	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
Tari, Prof Zahir	This project aims to develop a new computational paradigm to ensure low-latency services for streaming applications across heterogeneous Edge devices while satisfying high-throughput and scalability requirements. This project is of high significance for generating new knowledge in the area of real-time streaming using innovative algorithms that overcome the limitations of remote Cloud and distributed Edge computing. Expected outcomes include novel programming abstractions, performance models, and control mechanisms to address complex problems for incremental and iterative computations in hybrid Edge-Cloud infrastructures. This should provide significant benefits, one of which is the optimised utilisation of limited computing resources.							
	National Interest Test Statement							
	The use of sensors in remote patient monitoring, livestock tracking, and industrial automation is predicted to become a $10 billion market in Australia by 2030. However, this potential is unlikely to be realised because of an inability to process the vast amounts of data these sensors generate. This project aims to solve this problem by developing a software platform that will allow much faster analysis of sensor data stored in cloud computing services. The platform can be readily adopted by Australian industry and government agencies and incorporated into their data management and analysis systems, enabling them to serve end users by dealing with diverse sensor data accumulated from personal use and industrial practices. For example, it will benefit the Australian agricultural industry by more accurate tracking of the health, vaccination status and location of livestock. In healthcare it will improve the real-time monitoring of the elderly and those suffering from chronic diseases. In industry it will assist in optimising supply chains and transportation fleet management.							
DP230100265	**Youth, religion and sexuality: digital media, school cultures, exemptions**	51,051.00	84,449.00	68,402.50	35,004.50	0.00	0.00	238,907.00
Hickey-Moody, Prof Anna C	This project aims to understand the knowledges and practices about sexuality and religion that form the everyday worlds of young people who are religious. This should provide significant new knowledge about a key time in the development of a young person's identity via a nationwide, deep yet comparative approach. Expected outcomes include strategic health policy and curriculum development advice that responds to current debates around religious exemptions to anti-discrimination law and creates better education and health care for religious and LGBTIQ+ youth. Benefits will include increased wellbeing for religious LGBTIQ+ youth, conservatively religious and newly arrived youth communities in Australia.							
	National Interest Test Statement							
	By comparing experiences of religious youth in private and state schools, this project provides an understanding of how religious young people navigate conflicting discourses about sexuality, religion and public debates about religious exemptions. We will improve understandings of cultural diversity in Australia, resulting in better practices of care for religious youth. The research will promote safety and inclusion of LGBTQIA+ young people through advice to the Department of Education at Federal and State levels. The research will examine the relationship between homophobic or transphobic sentiments in religious and state educational contexts, creating new strategies to prevent bullying that will be employed in schools across SA, Victoria and NSW. We will engage directly with religious and government schools, state and federal government bodies to develop health and physical education curriculum and policy advice that will improve health education, religious education and education policy development. Australia will benefit through a safer, more inclusive environment for young people of all backgrounds.							

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DP230100548	**Multilayer Graphene Based Anti-Corrosion Polymer Coated Structures**	83,888.00	175,707.50	182,174.50	90,355.00	0.00	0.00	532,125.00
Yang, Prof Jie	This project aims to develop a novel multilayer graphene/polymer coating for structures exposed to corrosive environment with graphene concentration varying layer-wise to eliminate galvanic corrosion yet maintain all unique advantages owing to graphene inclusion, thus offering a cost-effective design solution with significantly improved anti-corrosion performance and remarkably enhanced safety and durability for structures. Expected outcomes of this project include an innovative design, experimental data on corrosion prevention, development of reliable simulation techniques and design procedures for the proposed coating. This should provide huge benefits to Australian civil, offshore and marine engineering industry and national economy.							
	National Interest Test Statement							
	Corrosion not only possesses a serious threat to structural safety but could also result in a massive economic impact with huge costs equivalent to 3.4% of global GDP each year. Steel which is commonly used in construction of offshore structures is highly susceptible to corrosion-induced damage and failure when exposed to marine environment. To date, corrosion protection of offshore steel structures is still very challenging. The purpose of this project is to develop a novel graphene-based multilayer anti-corrosion coating by innovatively employing the concept of functionally graded materials with the aim of significantly prolonging the service life of offshore structures. The outcomes from this innovative research will provide Australian building industry with highly efficient and cost-effective solutions to corrosion protection thereby enhance their competitive edge in design and construction of offshore structures. The new knowledge from this research will greatly contribute to the safety and durability of offshore infrastructure as well as bring huge benefits to national economy with enormous savings.							
DP230100709	**Surface ligation of nanomaterials for biomedical applications**	62,802.50	130,306.00	135,205.00	67,701.50	0.00	0.00	396,015.00
Yarovsky, Prof Irene	The project aims to explore the synergistic effects co-ligands for target recognition and biofouling protection in nanoparticle surface patterns to enable practical atomic scale precision engineering of efficient and biofouling resistant nanosensors. The project will fundamentally characterise interfacial interactions and dynamics of ligated nano-surfaces and biomolecules via advanced computer modelling. Outcomes should include practical molecular design guidelines for functional ligands and predicted optimal patterns for combining functional and antifouling ligands on gold nanomaterials for biosensing technologies. The advanced predictive modelling capabilities will facilitate future practical engineering of efficient biomedical devices.							
	National Interest Test Statement							
	Sensors that detect disease-associated molecules in biological fluid samples, such as blood or urine, are crucial to modern medical diagnosis. However, one major issue in the use of these sensors is contamination by other molecules in the fluids, reducing their capability for accurately diagnosis. This powerful Australia-UK collaboration will combine theoretical and experimental research to develop the knowledge required to develop contamination-resistant materials for use in diagnostic sensors. The outcomes will be new material designs and practical guidelines for developing new nanomaterials. These designs and guidelines can be easily adapted by the Australian medical devices industry, leading to significant economic benefits through the development of the next generation of biosensors. More accurate disease diagnosis will lead to earlier and more appropriate treatments, improving the health of Australians and reducing costs in the healthcare sector caused by the greater level of care required to treat diseases only detected at a more advanced stage.							

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DP230100870	**Addressing Online Hostility in Australian Digital Cultures**	69,874.50	139,749.00	151,894.00	82,019.50	0.00	0.00	443,537.00
Cover, Prof Rob	This project aims to provide a comprehensive account of Australians' experiences of online hostility, abuse, trolling and extremist hate speech, which have increased over the past decade. The research expects to analyse the experiences of diverse Australian online users, moderators and stakeholders, to determine their practices, attitudes, and innovations, and their perceptions on how to address this social problem. Expected outcomes of this project include enhanced understanding of the support needs and remedies to online hostility among a diverse cross-section of Australians. This will provide significant benefits by providing roadmaps for improved intervention, support, regulation and education on digital communication in Australia.							
	National Interest Test Statement							
	Changes to the culture of online engagement have meant most digital users are now exposed to unprecedented high rates of digital hostility and hate speech. This project will analyse the experiences of Australian digital users, moderators and policy personnel to determine how to address this social problem. We expect this project will provide enhanced understanding of the issues, support, and remedies to digital hostility. This research provides significant social and cultural benefits to Australia by providing practical user-driven recommendations to regulators and platforms, ensuring that Australians can participate in digital culture without fear of digital hostility and be well-supported in times of online adversity. Through a program of engagement including stakeholder workshops, videos, and multi-sector national symposiums, the project will deliver advanced knowledge that will help Australia's digital users and workforce to maintain wellbeing and resilience in the face of hostility, and assist platforms and regulators to perform a continuing role in fostering ethical digital cultures.							
DP230100983	**Break the deadlock in corrosion research to prevent infrastructure collapse**	56,691.00	116,031.50	119,200.50	59,860.00	0.00	0.00	351,783.00
Li, Prof Chun-Qing	Corrosion destroys one-quarter of the world's annual steel production and costs the Australian economy $30 billion each year. This project targets a crucial missing link in understanding the structure and dynamics of the atomic lattices of corroded steel and the degradation of its mechanical strength. By combining advanced electrochemical and mechanical measurements with dynamics simulation of atomic lattices of corroded steel, this project will produce the first concerted picture of corrosion induced strength degradation with a particular focus on real industrial conditions. This promises to guide the ongoing diagnosis of corrosion damages to steel, effectively preventing the collapse of corroded infrastructure.							
	National Interest Test Statement							
	This project investigates the cause and prevention of steel corrosion damages to corroded infrastructure. It addresses a major knowledge gap in steel corrosion, the relationship between the degree of corrosion and degradation of mechanical properties of corroded steel, so as to identify and predict the critical point at which the infrastructure collapses. Expected outcomes of the project include a corrosion diagnostic technique and enhanced capability to prevent collapses of corroded infrastructure. The research can benefit Australia economically by preventing accidents of corroded infrastructure - saving billions of dollars; socially by mitigating disruptions caused by infrastructure collapse - assuring the quality of life; environmentally by resource savings due to extended service life - preserving nature; and commercially by increasing confidence in using steel products - improving trade. The research will be shared with Australian industry end-users, e.g., structural engineers and asset managers, to enable its adoption in diagnosis and prevention of unexpected collapse of corroded infrastructure.							
DP230101107	**Accelerated Finite-time Learning and Control in Cyber-Physical Systems**	74,435.00	155,370.00	160,935.00	80,000.00	0.00	0.00	470,740.00
Yu, Prof Xinghuo	Efficient learning and control in cyber-physical systems such as smart grids and robotic systems are very important for achieving economic and social benefits. This project aims to establish a breakthrough accelerated finite-time dynamics theory and technology to assist in delivering efficient learning and control. Expected outcomes include new distributed accelerated finite-time dynamics based learning and control algorithms and tools for optimal operations in cyber-physical systems. This should provide significant benefits including a practical technology for industry applications in smart grids and robotic systems, and training of the next generation engineers in this technology for Australia.							

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	National Interest Test Statement							
	Fast responses are desired in industrial systems for performing mission-critical tasks such as quickly restoring a power supply and allowing industrial robots to swiftly reach objects. This project aims to develop new algorithms that can be used to reliably speed up these responses in complex situations, for instance power grids under extreme weather conditions and robots in hazardous environments. These algorithms will be developed and tested in the research laboratories at participating universities and applied in the ongoing and new collaborative projects with industry partners. Proof-of-concept tools will be built and tested, ready for commercial implementation after the completion of the project. These tools can be used to improve the reliability of the Australian electricity system, especially as power is increasingly being generated by renewables, and by Australian industries looking to reduce costs through automation, by improving the effectiveness of factory robots.							
DP230101331 Spencer, Prof Sarah J	**Visualising Retinal Microglia as a Window into Brain Inflammation** This project aims to use the unique autofluorescence signature of immune cells, microglia, imaged in the retina, as an index of brain inflammation. This project expects to provide the fundamental knowledge to allow us to image microglia non-invasively and identify the presence of brain inflammation without needing to access the brain-proper. Expected outcomes include full characterisation of microglial autofluorescence in the retina and how it relates to brain inflammation. This should provide significant downstream benefits for the detection of inflammatory brain disease well before visible symptoms develop with substantial benefit for livestock, pets, zoo and conservation animals, as well as research knowledge.	55,000.00	110,000.00	105,000.00	50,000.00	0.00	0.00	320,000.00
	National Interest Test Statement							
	Brain disease is difficult to detect, particularly in animals that cannot communicate their symptoms. Most brain diseases cause inflammation that activates the immune cells of the brain, known as microglia, to combat the disease. When microglia are activated, they change their brightness (fluorescence), and this can be observed in a non-invasive exam of the retina of the eye. This project will develop a rapid testing platform to detect microglia brightness in the eye, triggering targeted testing to identify the cause, key examples being prion diseases, dementia and brain cancers. The platform can be readily commercialised by the Australian medical devices industry as a diagnostic device for use in the field. The technology will benefit Australian agriculture and veterinarians, allowing rapid identification of brain disease in livestock and pets. Improving the diagnosis of prion diseases in livestock, for example, will reduce the risk of transmission to humans. The technology will also benefit conservation efforts, helping ensure the health of endangered Australian animals used in breeding programs.							
DP230101407 McCulloch, Prof Dougal G	**Synthesising novel phases of carbon by shear-induced phase transformations** Carbon forms the hardest known solids and offers the opportunity for new materials with outstanding properties. The aim of this project is to establish a new technology for synthesising dense, diamond-like carbon materials without the need for high temperatures. The approach uses shear stress caused by non-hydrostatic compressions to drive phase changes in solids. Guided by modelling and using novel experimental techniques, this project seeks to understand and then exploit this remarkable phase change phenomenon. Expected outcomes include hard and tough coatings for high performance tools, impermeable encapsulations to enhance the longevity of bionic implants and a possible explanation for the mystery of deep earthquakes.	83,000.00	187,000.00	203,500.00	99,500.00	0.00	0.00	573,000.00
	National Interest Test Statement							
	The hardness and stability of diamond makes it highly useful in a diverse range of applications, including machining, mining, and medical implants. This project seeks to develop new materials that are harder and tougher than diamond, leading to more reliable medical devices, and more efficient tools for industry and minerals extraction/processing. The outcome will be a longer and a better quality of life for Australians and more productive manufacturing capacity for new Australian enterprises. Studying materials produced under the extreme conditions found on Jupiter and Saturn will lead to opportunities for Australia in space exploration, putting Australia at the forefront of new space technologies. The materials produced in this research can be readily adopted by industry through the replacement of existing low quality machining tools and shorter lifespan, less reliable prosthetics.							

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DP230101650	**Rational design of array-based nanozyme sensors**	42,370.00	87,490.00	91,490.00	46,370.00	0.00	0.00	267,720.00
Bansal, Prof Vipul	The project aims to obtain a deep understanding of molecular interactions at the nano-bio interface, and use this knowledge to develop a robust sensor technology for the rapid detection of foodborne pathogens in complex samples. The project proposes to employ an innovative approach that mimics the senses of smell and taste, where an array of aptamers are expected to work in synergy to precisely identify a target, providing an edge over current sensing technologies. Expected outcomes include a ready-to-go analytical tool for the detection of food contaminants. This should provide significant economic, health, and social benefits through supporting Australian food and health sectors, and the potential commercialisation of sensor technologies.							
	National Interest Test Statement							
	The high complexity of foods poses a major challenge in confidently detecting food spoilage and infectious organisms in the food, as the food itself can mask the presence of bacteria, viruses and diseases. This project will develop a highly sensitive sensor technology that can reliably detect different foodborne pathogens and diseases by investigating the interactions between sensors and food. The sensors generated by this research can be used by food suppliers at their manufacturing sites and incorporated into food packaging to visually indicate food quality. The use of these sensors will enhance food safety for Australian consumers. Additionally, the sensors will help prepare Australia for potential future threats to our food, environment, and health. Translation of the sensor technology will be achieved by co-developing them with Australian industries and biosecurity agencies.							
DP230101712	**Improving the stability of biomolecules using ionic liquids**	48,500.00	132,500.00	171,000.00	87,000.00	0.00	0.00	439,000.00
Greaves, A/Prof Tamar L	This project aims to address critical issues in studying proteins outside their native environments by developing new solvents that will increase their stability and solubility. The project expects to create new knowledge in our understanding of solvent chemical properties through a novel approach using high throughput robotics, synchrotron analysis of protein structures and Molecular Dynamics simulations. The expected outcome is a set of design rules for creating new solvents. This should benefit many research and industrial applications, including determining protein structure for the development of new drugs and biocatalysts, and cryopreservation of protein-based pharmaceuticals.							
	National Interest Test Statement							
	Medicines and vaccines like the Covid-19 vaccine often have poor shelf-lives, and sometimes need to be kept well below freezing temperature. This makes them hard to manufacture, store and transport. Chemicals can be added to address this, but it is challenging to find suitable ones. We have shown that some special salts are in fact suitable chemicals with the potential to stabilise medicines and vaccines. In this project, we will test hundreds of salt combinations to find those that improve the shelf-life of medicines. We will also determine how and why they work, allowing us to design the best salts for specific medical applications. Designing stabilising salts for medicines will solve a key problem for the bioprocessing industries that make, purify, store and/or transport medicines and vaccines. The salts produced from this project will be made in Australia and adopted by industry through incorporation into existing drug and vaccine formulations. This will benefit Australian chemical and pharmaceutical industries and provide cheaper medicine costs and greater accessibility for remote and rural communities.							
DP230102101	**Designing liveable neighbourhoods to support healthy ageing**	60,121.50	127,621.50	142,760.00	75,260.00	0.00	0.00	405,763.00
Gunn, Dr Lucy D	This project aims to identify whether neighbourhood liveability influences healthy ageing, and the extent to which this association is modified by individual preferences and socioeconomic disadvantage using longitudinal analyses. The research expects to generate new knowledge on urban design that supports healthy ageing, which is mostly derived from cross-sectional studies. Expected outcomes include evidence-based recommendations for informing urban design and health policies to support healthy ageing and ageing in place, which is a key government agenda in Australia. This should provide benefits such as the delivery of high quality liveable environments that support healthy ageing and reduced aged care expenditure.							

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	National Interest Test Statement							
	Australia's older population is expected to double by 2057 and new evidence is needed on how changes to places and neighbourhood design impact health outcomes. This project will identify features of the built, social, and natural environments that support healthy ageing in older adults over time to provide recommendations on how we can support the long-term health of older Australians. Throughout the project lifetime, researchers will engage and test findings with older people and the general public, government policymakers and planning professionals through in-person workshops and conferences, guidance notes, scorecards, webinars, academic and social media articles before producing policy briefs for stakeholders. The new knowledge will shape improved urban design and health policies, promotion of healthy ageing in the community, and help decrease future needs and healthcare costs for residential aged care. This project aligns with national priorities directed at improving health outcomes in vulnerable populations and providing resilient urban infrastructure in Australia for the long-term.							
DP230102307	**High specificity nanosensors for glycobiology**	86,729.50	174,181.50	116,787.00	29,335.00	0.00	0.00	407,033.00
Blanch, Prof Ewan W	This project aims to develop high specificity glycosensors for identifying and characterising carbohydrates. These glycosensors are expected to generate detailed information on carbohydrate stereochemical structure and how this controls protein-carbohydrate binding and other interactions fundamental to biochemical processes. This innovative nanotechnology aims to deliver a new capability for understanding cellular recognition and antigen binding mechanisms. The expected outcomes are new tools for glycobiology and research into carbohydrate structure-function relationships, strengthening Australia's global reputation in nanosensors with an incisive analytical technology for biomedical sciences and the many industries utilising carbohydrates.							
	National Interest Test Statement							
	The cells of all forms of life, including bacteria, fungi, plants and animals, contain sugars. These sugars play key roles in the progression of numerous diseases such as cancer, infection and diabetes. There are currently no sensors that can detect sugars within cells. In this project, we will create a new class of sensor that can detect sugars in cells by investigating their unique shapes, enhanced by interactions with silver nanoparticles. These new sensors will have many applications in the biomedical and biotechnology industries including as new diagnostics for cancer, infection and diabetes, and for the analysis of sugars in foods such as grains. Benefits to the Australian public include heathier aging through diagnosis of disease and improved nutrition. Our sensors have the potential to be translated into a variety of healthcare and agriculture settings to provide rapid means of detecting biologically important sugars. These sensors could be adopted as rapid diagnostics for healthcare professionals, and as quality control for food products.							
DP230103075	**Ageing in and through Data: What data can tell us about ageing**	39,544.50	68,094.00	66,397.00	37,847.50	0.00	0.00	211,883.00
Hjorth, Prof Larissa	As the first generation to age in a data-rich world, this project asks: What insights can data (i.e. computational information) give us about ageing, ageing well and ageing in place (i.e. at home)? And what escapes data and why? By taking up the UN Healthy Ageing challenge, this project combines ethnography, data sensing and creative practice to provide insights—opportunities and limitations—into how we might age well and in place. Expected outcomes include data visualisation, ethnographic mobile storytelling, art exhibition, codesign workshops and symposium. These outcomes will activate public debate and provide alternative futures for ageing well in a data-saturated world.							
	National Interest Test Statement							
	This project will explore the link between data, technology and ageing well—specifically, the opportunities and challenges for data to support healthy ageing. With a growing crisis in access to quality aged care, this research will provide vital evidence on how technology can most effectively assist Australians as they age in their own homes. The research will provide social, cultural and technological insights into Australians' experience of ageing, identifying ways that technology can assist older people in areas of mobility and healthcare to social connection and security. The findings will take the form of resources (reports, exhibitions, online media and workshops) to raise public awareness around the implications of ageing in a system and culture where all information is rendered data. Online documentaries and art exhibitions will bring to light lived experience lessons. The research, created with and for older Australians, will be shared with key industry (i.e. U3A and councils), policy makers and government via workshops to inform models for sustainable ageing and data literacy.							
	RMIT University	889,007.50	1,838,500.00	1,864,745.50	915,253.00	0.00	0.00	5,507,506.00

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Swinburne University of Technology								
DP230100796	**Co-designing and co-evaluating technology experiences in residential care**	78,609.50	159,725.00	164,633.50	83,518.00	0.00	0.00	486,486.00
Pedell, Prof Sonja	This project aims for meaningful experiences and skill development by older adults living in residential care using technologies. Based on the interests, abilities and everyday context it is important to introduce technologies in a way that supports agency and confidence. Through co-design and co-evaluation we develop a process to explore technology choices and learning. We will (i) generate guidelines for introducing technology, (ii) develop methods and success criteria for the co-evaluation of the process, and (iii) gain in-depth understandings of how facilitation and technology uptake are enacted in a range of residential settings. Older adults in residential care will benefit through increased digital equity and technology adoption.							
	National Interest Test Statement							
	Our proposed project aims to increase uptake of technology by older adults in aged care settings. The project will deliver a process for introducing technology to residents in a participatory way based on their individual skills, interests and needs. We will develop new and inclusive methods and guidelines involving all stakeholders for both setting technology adoption goals collaboratively and evaluating success criteria through co-design . The project will benefit older adults in residential care, their family and other supports, health care professionals, aged care providers and city councils by providing a structured uptake process that allows for strategic planning for successful technology adoption by older adults in an Australian context. The outcomes of the research should result in increased equity in technology use and better quality of life in aged care through introducing technologies in more targeted and positive. We expect that research could be generalised to other groups that are marginalised in Australia with respect to technology uptake.							
DP230100991	**Efficient and secure data integrity auditing on cloud**	74,435.00	156,370.00	166,370.00	84,435.00	0.00	0.00	481,610.00
Chen, Prof Jinjun	Data auditing presents a promising way for verifying user data integrity on cloud, i.e., whether user privacy sensitive data such as identity information on cloud is modified or lost. Current auditing approaches lack sufficient efficiency and security. This results in that they cannot provide timely warning and precaution on potential data loss threats. This project aims to systematically investigate this significant challenge and expects to establish innovative research and solutions for enabling efficient and secure data integrity auditing on cloud. The project outcomes will help to safeguard Australian community in fast-growing cyber world, and benefit to fast-growing user privacy sensitive data hosting and applications on cloud.							
	National Interest Test Statement							
	This project falls within Australian Cybersecurity priority about efficient and secure data integrity auditing on cloud. With more and more user privacy sensitive data such as identity information being hosted on cloud, users are increasingly worrying about their data integrity, i.e., whether their data is modified or lost in cloud. Loss of user privacy sensitive data can cause serious economic, commercial and social consequences such as cyber bullying or fraud. Current approaches for verifying data integrity lack sufficient efficiency and security, hence cannot provide timely warning and precaution for removing potential data loss threats. As such, this project aims to develop innovative research and solutions for efficient and secure data integrity auditing on cloud. This will lead to timely warning, and further significant reduction or avoidance of data loss incidents and corresponding cyber bullying or fraud events. This project will help to safeguard Australian community in fast-growing cyber world.							

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DP230101474	**Understanding the drivers and motivators of extremist violence**	119,232.50	255,795.00	229,082.00	176,545.00	84,025.50	0.00	864,680.00
Shepherd, A/Prof Stephane M	Despite intense interest in the issue, our understanding of and ability to respond to extremist violence is limited. This innovative program of research is designed to establish an empirical foundation for understanding and responding to extremist violence in Australia. It aims to examine risk and protective factors for such violence, the needs of those susceptible to committing such acts, and the effectiveness of intervention. Findings are expected to inform health, national security, social welfare, and justice agencies in their pursuit to identify those at risk of offending, address their clinical needs and manage the risk of harm they pose to society and to themselves.							
	National Interest Test Statement							
	Extremist violence poses a significant threat to Australian national security and community safety. Our understanding of the factors underpinning violent extremist offending is limited. Analysing the factors that heighten an individual's propensity for extremist violence is critical for preventing or responding to it. This project will identify these factors and examine the vulnerabilities of those susceptible to committing such acts. It will determine effective interventions and inform the provision of appropriate clinical services while protecting civil liberties. Building on recent Australian public inquiries and with unprecedented access to community- and prison-based individuals at risk of extremist violence, the research will strengthen national security and improve clinical and criminal justice knowledge and risk management. We will share findings with the national intelligence community, law enforcement, clinical and social welfare agencies, frontline workers and policymakers to enhance their ability to predict, prevent and mitigate the risks of violent extremist harms.							
DP230101775	**Revealing the Unseen Universe with Gravitational Lensing**	105,000.00	220,000.00	225,000.00	110,000.00	0.00	0.00	660,000.00
Glazebrook, Prof Karl	This project will analyse new Australian led observations from the Hubble Space Telescope of light being bent around massive galaxies by gravity. To analyse these images we must develop advanced physical models and statistical techniques. This analysis will give us highly magnified views of early galaxy evolution revealing physical details otherwise impossible to see. It will also allow us to put constraints on the nature of invisible dark matter with the possibility of detecting warm dark matter signatures and enable us to probe the expansion of the Universe, testing whether the unseen dark energy is evolving in time. The Hubble sample is much larger and a major advance on previous work, and enables breakthrough science in these areas.							
	National Interest Test Statement							
	Currently we are limited in how much of the Universe we can see. This restricts our understanding of how galaxies are formed and how the Universe is expanding. Dark matter that drives galaxy assembly and dark energy that drives the expansion and fate of the Universe simply cannot be seen. By using the Hubble Space Telescope to observe how dark matter and dark energy bend light, and by developing advanced statistical modelling techniques, this project will allow us to find, investigate and determine the nature of the unknown dark matter particle and how the universe is expanding under the influence of dark energy. It will also offer us a magnified view of galaxies in the early universe revealing their structure and composition. Statistical modelling techniques utilising new methods of machine learning will solve problems previously thought too difficult. These will have application in any sector requiring the application of data science methodologies such as health data modelling and remote sensing. The breakthrough, scientific results of this project will generate intense global interest.							
DP230101790	**Cost-effective Edge Service Provisioning in the Last Mile of 5G**	64,435.00	132,370.00	138,370.00	70,435.00	0.00	0.00	405,610.00
He, A/Prof Qiang	This project aims to deliver a suite of novel approaches for enabling cost-effective last-mile service provisioning in the 5G mobile edge computing (MEC). This project is the world's first attempt to systematically tackle the critical service provisioning challenges in the last mile where base stations link users to MEC applications. It offers a practical solution for provisioning software vendors' MEC services cost-effectively. This project should drive Australia's 5G transition and innovations, promote its post-COVID economic recovery and resilience by enabling various real-time mobile and IoT applications, e.g., telehealth, remote learning/working, industry 4.0, and ensure its pioneering position in the global 5G research.							

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	National Interest Test Statement The Australian population is becoming increasingly reliant on the mobile network and mobile technology. The quality and diversity of mobile applications play a significant role in people's experience in life, work, and study. This project will help software providers transition their services to the 5G network to enable unprecedented real-time information sharing, rapid decision making and immersive online collaboration. It will deliver a framework and a suite of integrated tools to help software vendors implement and manage their 5G services with ease, which is crucial to Australia's expected $67 billion 5G-driven GDP growth by 2030. Providing a cost-effective way to deploy, deliver and protect 5G services will accelerate Australia's growth in the digital economy. This project will allow businesses in many of Australia's key industries, e.g., health care, smart transportation and advanced manufacturing, to take full advantage of Australia's considerable investment in 5G infrastructure while consumers enjoy an enhanced user experience.							
DP230103161 Labbe, A/Prof Ivo	**Unveiling the dead and dusty Universe with the James Webb Space Telescope** This project aims to find the earliest dead and dust obscured galaxies in the Universe. Understanding their astrophysics, explosive growth, and demise have long been among the most important unsolved mysteries of astronomy. Decades in the making, the imminent availability of the James Webb Space Telescope mid-2022 marks a watershed moment. This project uses guaranteed access to the revolutionary space telescope to discover the first dead galaxies and unveil the previously hidden "dusty" galaxies and shed light on their suspected evolutionary link. The project is expected to significantly enhance Australia's international standing through leadership in use of the world's flagship scientific facility.	75,000.00	147,500.00	112,500.00	40,000.00	0.00	0.00	375,000.00
	National Interest Test Statement The James Webb Space Telescope (JWSWT) has revolutioned space sciences. This project leverages an $18M award from NASA to use observations with the JWSWT to discover the first mature galaxies formed after the Big Bang. Revealing galaxies previously obscured by dust, it will increase our understanding of their origins, evolution and extinction and document the first chapter of our cosmic origins. Involving 50 researchers from leading institutes in the USA, Europe and Israel, it will increase global networking opportunities for Australian students and researchers. The high-profile discoveries will be shown with this international community and will inspire and attract young Australians to take up careers in science and technology. It will train Australian students and develop new methods in space-based data analysis and support the key national investment strategy of the Australian Space Agency and contribute directly to 3 of the 4 Strategic Pillars of the Australian Civil Space Strategy 2019-2028: develop international collaborations, increase national capability in space, and inspire all Australians.							
	Swinburne University of Technology	516,712.00	1,071,760.00	1,035,955.50	564,933.00	84,025.50	0.00	3,273,386.00
The University of Melbourne								
DP230100018 Thai, A/Prof Huu-Tai	**Fire engineering of prefabricated structural systems of modular buildings** With the speed and cost benefits, modular construction is considered a game-changing solution in response to pandemics and natural disasters, and tackling the affordable housing crisis on a large scale. However, its uptake has been hindered due to recent fire incidents of modular buildings. This project aims to develop novel fire experiments and advanced modelling techniques to evaluate the fire performance of modular buildings. Computational tools and fire safety design guidelines will also be developed to enable modular buildings to be built safer and more economically. This project will promote the widespread adoption of modular buildings to benefit end-users and the wider society, especially the housing sector and low-income households.	119,607.00	189,842.50	140,403.00	70,167.50	0.00	0.00	520,020.00

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	National Interest Test Statement							
	Modular construction is expected to shape the future of the building and construction industry in Australia, but its current uptake has been hindered due to recent fire incidents. This project evaluates the fire performance of modular buildings to ensure the fire safety of this construction method. Expected outcomes including computational tools and technical guidelines will enable structural engineers to predict the fire performance and develop cost-effective solutions for fire safety design of modular buildings. This will enable modular buildings to be built safer and more economically than current practices allow, and more importantly promote the widespread adoption of this modern construction method to benefit end-users. This project will benefit Australia economically, socially, and environmentally as modular construction offers economical, swifter, and greener benefits over traditional onsite construction. It will also assist Australia in tackling social and affordable housing shortages, enhancing emergency responses to pandemic situations and natural disasters, and achieving net-zero emission targets.							
DP230100033	**Megalithic Connections: Imperilled Cultural Heritage in Laos and India.**	58,226.50	111,971.00	103,198.00	107,200.50	95,374.50	37,627.50	513,598.00
Shewan, Dr Louise G	This interdisciplinary project aims to document and explore the cultural connections between the geographically disparate megalithic cultures of Laos and India and create an enduring digital record of these threatened cultural assets. Integrating archaeological science and pioneering data capture technologies, the project will create globally significant new knowledge; advance heritage management processes including transferrable exploratory technologies; and help underpin economic, social and cultural benefit in these regions. With an increasing awareness of the need to conserve global cultural assets, Australia will take the lead in developing breakthrough technological solutions and new cross-country research and practitioner capability.							
	National Interest Test Statement							
	The remote mountains of Laos and Northeast India, located 1200 km apart, boast nearly identical stone objects from the megalithic period, but little is known about who created them or how they are culturally related. This project will build knowledge about the significance of these sites and their cultural connections. These valuable heritage assets are vulnerable to damage (including looting and unexploded ordnance) and new ways to preserve them are needed. We will integrate innovative archaeological methods and computer modelling techniques to create an enduring digital record as a matter of urgent priority to assist in conserving the sites. Using immersive visualisation and robotics, we will create a virtual reality research environment and develop interactive museum exhibitions for public display in Laos, India, the UK and Australia. Our international collaboration will boost Australia's cultural relations and public diplomacy in Asia, and our transferable methods can be used by managers of heritage sites in Australia to conserve important local sites and promote cultural tourism.							
DP230100147	**Mitigating bias in statistical analyses of data collected over time**	71,000.00	142,500.00	141,500.00	70,000.00	0.00	0.00	425,000.00
Delaigle, Prof Aurore M	This project aims to develop innovative nonparametric distribution and regression curve estimation techniques from data collected over time. These curves are key statistical tools for describing populations, but often, their estimators are inefficient when the data are massive, growing and change over time, or too restrictive when the data exhibit measurement errors and a fraction of them are equal to zero. The project expects to develop novel, less restrictive and more realistic nonparametric curve estimation methods in these complex settings. Outcomes include new practical statistical methods and software to benefit experts in diverse fields from nutrition and epidemiology, to environmental science and digital platforms, amongst others.							
	National Interest Test Statement							
	This project will develop innovative statistical theory and tools that are less biased, more flexible, reliable, fast and resource-efficient than those currently used by experts to analyse their time-collected data. While these breakthrough methods will have reach across multiple sectors, the project targets in particular applications for policy and practical responses in 2 key areas of national interest: nutrition and rapid response scenarios such as a global pandemic. First, to reach Department of Health goals to improve Australians' nutrition-related health outcomes, experts need access to better statistical tools than the biased ones currently in use. Second, the collapse of the PCR testing system when group testing became impossible in 2022 stressed the major role of efficient group testing strategies and reliable estimations of disease prevalence from group testing data under rapidly changing conditions. This project, which will deliver novel theory and new practical open-access software, will help experts with faster and better-informed decisions, yielding economic and social benefits for Australians.							

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DP230100207	**Nature’s advanced optical materials and their role in thermal management**	91,934.50	183,245.50	172,752.00	81,441.00	0.00	0.00	529,373.00
Stuart-Fox, Prof Devi M	This project aims to discover the nano-structural properties of beetles than enable effective management of solar and thermal radiation in different environments. A further aim is to reveal how these composite biological materials combine thermal control with desirable mechanical properties, such as strength and flexibility. Passive control of radiative energy is critical for both animal survival and for the design of many manufactured materials, particularly in a warming world. This interdisciplinary project will provide new knowledge of the different ways that biological materials mediate radiative energy exchange with the environment. This knowledge is essential for the design of bioinspired, energy-efficient, multi-functional materials.							
	National Interest Test Statement							
	Designing manufactured materials that reduce heat absorbed from the sun is increasingly important in a warming world. Animals have evolved sophisticated ways to absorb or reflect sunlight and radiate heat from their bodies, but the precisely how this happens remains largely unknown. This project integrates biology and physics to discover the nano-structural properties of beetles (one of the most successful and diverse animal group on earth) that enable effective control of solar absorption and heat radiation in different environments. We will identify and define the optical and mechanical properties of the outer shield of selected beetles from different environments in Australia to understand how they manage heat transfer while achieving desirable mechanical properties – being strong, flexible and light weight. Future industry partners could apply this understanding to manufacture new multifunctional materials for regulating heat such as coatings for passive cooling of buildings and shipping containers.							
DP230100239	**Leveraging Emotion Goals for Emotion Regulation Success**	30,335.00	83,821.00	103,932.00	50,446.00	0.00	0.00	268,534.00
Kalokerinos, Dr Elise K	Understanding how a person wants to feel–their emotion goal–is the first step in helping people manage their emotions, but no research has investigated how to set successful emotion goals. This project aims to undertake the first investigation of what constitutes an effective emotion goal. Using experience sampling and lab methods, this project will generate new knowledge about emotion goals that lays the emotional infrastructure for individuals and communities to flourish. Expected outcomes include a new literature on emotion goals and refined methods to study emotions in everyday life. Benefits include a stronger foundation for theory, enhanced research capacity, and education for Australians on how to regulate emotional turmoil.							
	National Interest Test Statement							
	Australians have faced a series of emotional challenges in recent years that have placed a burden on individuals, workplaces, and communities. This burden makes it a national priority to discover evidence-based solutions to help people effectively manage and regulate emotions in their everyday lives. What a person wants to feel—their emotion goal—is critical to successful emotion regulation. This project aims to uncover how to set effective goals to manage emotional challenges among community members. In doing so, this project will develop new theory and refined methods to help people manage local as well as global emotional turmoil. These outcomes will be translated to relevant stakeholders in the form of academic publications and community-based outreach and education. The new knowledge generated in this project will benefit Australians in managing real-world stressful situations, improving their ability to look after their own well-being and make social connections with others to cope in times of trouble.							
DP230100270	**Cracking the code of snails to elucidate parasite disease transmission**	62,107.50	160,719.00	187,561.50	88,950.00	0.00	0.00	499,338.00
Young, Dr Neil D	In Australia, a disease caused by liver flukes causes major economic losses to livestock production. The role of Australian pond snails as intermediate hosts for this parasite is poorly understood. This project aims to explore the phylogeography, biology and genomics of these snails. It expects to create novel molecular resources for important snail species and verify their roles as key vectors of flatworm parasites. The curation of genomic and transcriptomic data sets, and elucidation of snail–parasite interactions will underpin the development of environmental diagnostic tests and deliver a new generation of intervention strategies to reduce the burden of liver fluke disease through the control of their snail intermediate hosts.							

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	National Interest Test Statement							
	This project will establish the role and importance of aquatic snails in transmitting liver fluke disease to livestock animals in Australia. It will fill the void in our knowledge and understanding of snails that allow parasites to replicate and spread. Nationally, liver fluke disease causes losses of >$130 M per annum, and the discoveries made here aim to find new disease interventions to reduce the economic impact of chronic disease in livestock. This fundamental research will benefit Australia through advanced knowledge and technology creation, the training of next-generation scientists (culture), and discovery of innovative methods to decrease the burden of parasitic disease, resulting in increased agricultural productivity and financial returns (economic). The resources created will underpin on-farm risk assessments, and provide a unique model to explore other diseases. It aims to create IP value for the development of products with benefits, ultimately flowing to end-users including farmers, agriculture and the food industry.							
DP230100276 Donnelly, Prof Paul S	**Heavy Metal Chemistry Goes Nuclear: Radioactive Rhenium and Terbium Agents** This project aims to make fundamental advances in the basic knowledge of the bioinorganic chemistry of radioactive metals that have the potential to be used in the future as radioactive drugs. Technological advances in the production of radioactive isotopes of rhenium and terbium have increased the feasibility of using these radionuclides as radioactive drugs, but their use requires new basic knowledge in their fundamental coordination chemistry. This project will develop new ways to synthesise radioactive rhenium and terbium complexes. The outcomes of this project will be an improved understanding of the coordination chemistry rhenium and terbium which is required to inform their future translation to new radiopharmaceuticals.	70,188.00	141,777.00	144,575.00	72,986.00	0.00	0.00	429,526.00
	National Interest Test Statement							
	Recent scientific and technological advances have dramatically increased the feasibility of using metallic radionuclides for the treatment of cancer. This project will the knowledge gaps in fundamental chemistry that are required to translate these new technological advances to the Advanced Manufacturing of new radiation based drugs. Radionuclides can be used to treat cancer providing they can be delivered selectively to tumour tissue once injected into a patient. This research will develop molecular cages to encapsulate a selection of newly available radionuclides. These cages will be also be attached to targeting molecules to achieve selectivity. Importantly, the new molecular agents will be stable inside the body as leakage compromises targeting and increases side effects. The new technology developed by this project, will be of interest to several Australian biopharmaceutical companies interested in the Advanced Manufacturing of these radioactive agents centralised production and distribution to hospitals in Australia and Internationally.							
DP230100296 Wille, Prof Uta	**How are plants responding to damage by oxidizing air pollutants?** This project aims to obtain detailed understanding of the chemical processes by which the air pollutants ozone and nitrogen dioxide damage plants. Through an interdisciplinary approach involving physical organic chemistry and analytical biochemistry, this project intends to discover important reactions between plant biomolecules and air pollutants, identify biochemical mechanisms for pollution damage in crop model plants and reveal the plant defence mechanism at the molecular level. Expected outcomes include the much-needed scientific foundations to support the development of more pollution-resilient crops in the future, ultimately enabling a breakthrough for the triple challenge of environmental pollution, climate change and food security.	72,000.00	151,000.00	122,500.00	43,500.00	0.00	0.00	389,000.00
	National Interest Test Statement							
	A key Australian government priority is ensuring food security by developing more pollution-resilient plants. This project investigates how plants are damaged by ozone and nitrogen dioxide, two major noxious air pollutants, and uncovers the mechanisms by which plants defend themselves. By studying the interactions between plants and the polluted atmosphere, this project will, for the first time, provide detailed insights into why raising air pollution levels result in decreased crop yields, and identify traits that make plants more pollution resistant. The project will lead to new knowledge and intellectual property with significant commercial benefits for the Australian agricultural sector, which makes up 12% of Australia's GDP. Thanks to established networks through the ARC Hub for Innovative Nitrogen Fertilisers and Inhibitors, this research should inform and lead to new ARC Linkage projects and collaborations with the agricultural industry, allowing the genes involved in combatting pollution damage to be identified and tested for their function to develop more pollution-resistant crops.							

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DP230100380 Johnston, Dr Stuart	**Mathematical models to connect experiments across biological scales** Understanding the function and development of organs is crucial to our understanding of fundamental biology. This project aims to address our inability to connect and understand behaviour between simple and complex biological experiments. This project expects to develop new mathematical theory and models to connect experiments across scales and complexity. Expected outcomes of this project include a new mathematical modelling framework, and advances in understanding in both biology and mathematics. This should provide significant benefits as using mathematical modelling to understand experimental connections will decrease the time- and financial- costs of performing experiments, while increasing efficiency and insight.	91,175.50	184,496.00	147,324.50	54,004.00	0.00	0.00	477,000.00
	National Interest Test Statement It is relatively easy to study individual cells but studying whole organs like the heart or digestive tract is very resource intensive—they are much more than simply the sum of their cells. Being able to predict organ behaviour from simple experiments on cells would greatly reduce research costs and speed up experiments. This project will develop a blueprint for translating the results of experiments from one level of complexity (e.g., cell) to another (e.g., organ) by exploring the connections between simple and complex experiments. Fundamental biological experiments will inform the development of new mathematical models and theory whose predictions will then be tested. This project will advance biological and mathematical knowledge and techniques relevant to a wide range of biological applications; we will deliver new mathematical and software tools to a large academic and industrial network. The research team has experience delivering software being used worldwide in both industry and academia, and experimental standards that have been adopted by an entire field.							
DP230100442 Martin, A/Prof Francesca A	**A longitudinal enquiry into Chinese women graduates' post-study experience** This longitudinal study of female Chinese graduates of Australian universities will be the first to track how international education changes these women's lives long-term. Through in-depth interviews with graduates in China and Australia, it aims to reveal the lasting benefits of an Australian education for our international graduates, providing significant insights for the recovery of Australian international education in a post-COVID world. Further, the project expects to contribute to scholarly, public and government understandings of new Chinese migrants in Australia, provide new knowledge about cultural change in the middle classes of Asia's largest and most powerful nation, and enhance Australia's engagement with its region.	28,670.50	73,534.00	79,363.50	34,500.00	0.00	0.00	216,068.00
	National Interest Test Statement Education is among Australia's most valuable export commodities, contributing $37.5 billion to the economy in 2019-20, but the industry has significantly declined due to the global pandemic. By demonstrating the long-term benefits of an Australian education for our international graduates, this project will deliver important new knowledge to assist the post-COVID recovery of Australian international education. It will provide economic benefit by enabling deeper understanding of the long-term, real-world advantages of an Australian education for Chinese students, thus helping our higher education sector to recalibrate and optimise its appeal in its largest export market. In addition, consistent with the government's concern to enhance social cohesion, the research will contribute to Australia's national interest by providing detailed, up-to-date information available publicly to policy makers and practitioners about the social experiences, attitudes and needs of a fast-growing national population of young, skilled graduate migrants from the People's Republic of China.							

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DP230100618	**Improving water quality modelling by better understanding solute transport**	90,000.00	195,000.00	195,000.00	90,000.00	0.00	0.00	570,000.00
Western, Prof Andrew W	Poor stream water quality is a critical problem in Australia and globally. Stream water quality depends directly on pathways and time taken for water to transport pollutants through catchments. Predicting these pathways is highly challenging and currently requires specialised data. This project aims to better model the movement of water from rainfall to streams, enable greatly improved use of water quality data routinely collected in Australia's catchments and thereby better predict water quality behaviour. Proposed field studies aim to support this development. The outcomes sought are improved planning and management of water quality in our rivers, lakes and estuaries, improved health of these water bodies and improved water supplies.							
	National Interest Test Statement							
	This project aims to improve the modelling of water quality of catchments in Australia. This will be achieved by addressing a long-running challenge - being able to predict the pathways and time taken for water to flow across the surface and beneath the surface of catchments into streams. This is expected to improve our understanding of and ability to predict the movement of pollutants from the land to streams, thereby improving our ability to model water quality in Australian catchments. Better modelling of water quality will support the management of water quality issues impacting our water supplies and environments such as the Great Barrier Reef, and our rivers, lakes, and estuaries nationwide. A range of government agencies lead water quality management strategies across the nation and would be the users of the improved knowledge and predictive capabilities resulting from this project. This would benefit Australians through improved environmental quality and through improved water quality in our water supplies, leading to reduced treatment costs and lower health risks.							
DP230100639	**Cloud-climate interaction over the Great Barrier Reef and Southwest Pacific**	27,000.00	111,000.00	162,000.00	78,000.00	0.00	0.00	378,000.00
Huang, Dr Yi	This project aims to investigate cloud-climate interactions of the Southwest Pacific trade wind region from the regional scale to local forcing over the Great Barrier Reef. The project expects to generate new knowledge in the nature and variability of the trade wind clouds, including their impact on the surface radiative budget, ocean temperatures and coral bleaching events. Potential changes of these clouds due to global warming and ensuing impacts on the environment will be studied. Expected outcomes include better modelling of the Great Barrier Reef environment and improved estimates of low-cloud feedback. This should provide significant benefits in developing warning systems for bleaching events, and regional land and water management.							
	National Interest Test Statement							
	The Great Barrier Reef transcends economic, environmental and scientific measures, having long become one the most recognised symbols of Australia. This project aims to achieve, for the first time, a comprehensive understanding of cloud-climate interactions of the Southwest Pacific trade wind region from the regional scale to local forcing over the Great Barrier Reef. The research will identify the atmospheric processes that contribute to reduced cloud cover over the region and the resulting coral bleaching events, establish the governing mechanisms of the diurnal cycle of trade wind clouds, reveal the potential response of these clouds to climate change and understand their environmental impacts. Expected outcomes include better modelling of the Great Barrier Reef environment and improved estimates of low-cloud feedback. Through community connectivity, this research should provide significant benefits in developing effective warning systems for future bleaching events, improving regional weather and climate predictions, and supporting land and water management for Queensland's coast and rainforest regions.							

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DP230100674	**Transformative simulation techniques for complex polymer networks**	65,000.00	131,500.00	141,000.00	74,500.00	0.00	0.00	412,000.00
Owczarek, Prof Aleksander L	The study of long chain polymers like DNA using computer simulations has uncovered exciting insights over many years. Generally these have been limited to simple topologies, interactions, and environments. This project aims to develop the next generation of simulation techniques to tackle a new frontier of polymer models, including those with complex topologies like stars, knots, and links, which have hitherto been inaccessible. Expected outcomes include new simulation methods which harness modern computational clusters, leading to greater understanding of polymers with complex topologies and in complicated environments. Important elements of biological processes may be discovered, such as how polymer structure affects DNA transcription.							
	National Interest Test Statement							
	Many materials are made of polymers—big molecules made up of repeating small parts. Natural polymers include silk, proteins and DNA; synthetic include nylon, plastics and Teflon. Understanding how different polymers function is key to many studies in biology, medicine and materials science. Polymer function is largely determined by their structure—sometimes the small parts are linked in a straight line, but often it is a complicated knot or web that can only be investigated with sophisticated computer simulations. This project will develop new algorithms harnessing powerful supercomputers to perform high-precision studies of complex polymer networks that could not previously be studied. Our techniques and algorithms will be open access—available to engineers and researchers developing a wide range of polymers such as those affecting how viruses replicate (and thus how their spread could be prevented). Australian industry will be able to use our findings to improve manufacturing techniques or develop new materials (such as those in corrosion-resistant paints and our plastic banknotes) and medical products.							
DP230100747	**Sperm ciliary gating and midpiece formation – a novel player and process**	102,605.00	207,117.00	205,427.50	100,915.50	0.00	0.00	616,065.00
O'Bryan, Prof Moira K	We have identified CCDC112 an essential player in mammalian sperm tail development and male fertility. This project aims to define the role of CCDC112 in 1) the formation of the core to the sperm tail, the axoneme, and 2) the packaging of mitochondria into the midpiece. Within this Discovery Project we will define the mechanism(s) of CCDC112 functions and the consequences of its dysfunction. Insights from this grant will be of significance to fertility across mammals and may ultimately benefit the selection of highly fertile males within the agricultural sector.							
	National Interest Test Statement							
	Male infertility in mammals can be caused by sperm formation problems that result structural or functional defects. These defects sperm's ability to swim through the female reproductive tract and fertilise an egg. This project addresses knowledge gaps in sperm formation, focusing on a protein (CCDC112) known to be essential in male fertility in some species. Using state-of-the-art imaging, at previously unachievable resolution, and cell biology techniques, we will investigate this protein's role in two poorly understood processes: development of the internal structure of the sperm tail; and assembly of mitochondria—cell components that provide energy for movement—in the tail. The project will generate knowledge applicable to breeding of many agricultural species; for example, almost one-fifth of bulls have defective sperm, reducing productivity of cattle herds. Being able to ensure matings with bulls with optimal sperm structure or buy higher-quality frozen sperm for artificial insemination, will improve cattle farmers' profitability.							
DP230100773	**Horizontal ecological networks for understanding biodiversity maintenance**	62,500.00	162,000.00	204,500.00	142,500.00	37,500.00	0.00	609,000.00
Mayfield, Prof Margaret M	The project aims to develop new ecological theory on local diversity maintenance based on an innovative interaction network model, tested on Western Australian wildflower communities. It is novel in its focus on the complexity of species interactions and their importance to diversity maintenance in nature. This project aims to explore links between plant interaction networks and coexistence theory to provide theoretical expectations for how changes to the environment are expected to alter natural plant communities. It aims to fill theory-gap about mechanisms of multi-species coexistence, advance community ecology, and provide the theoretical foundations necessary for translating ecological theory to restoration and conservation in practice.							

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	National Interest Test Statement							
	Maintaining local biodiversity is vital for cultural and economic reasons, but difficult given the complexity of varying threats. Existing diversity models oversimplify the complexity of diverse natural systems, which limits their application to real-world conservation challenges. We will take a networking approach to modelling plant community responses to local environmental changes. Using field ecology studies of a threatened Western Australia plant system, we will test complex systems approaches to understanding the biology of plant community diversity. This project will fill a critical theoretical gap about the biological mechanisms allowing many plant species to live together in nature. Outcomes will include new ecological theory and novel statistical tools useful for translating theory to real-world applications across Australia. Government agencies managing parks and reserves and community groups like Bush Heritage can use the new knowledge and tools to better maintain Australia's iconic ecosystems and biodiversity, futureproofing sectors such as Western Australia's wildflower tourism industry.							
DP230100816	**Domestic Politics, States & the Guiding Principles: Insights from Indonesia**	42,616.00	109,460.50	102,545.00	35,700.50	0.00	0.00	290,322.00
Rosser, Prof Andrew J	States have moved slowly and inconsistently to adopt and implement the United Nations Guiding Principles on Business and Human Rights. We know little about why, or how to ensure states do more. This project aims to shed light on these issues by examining how domestic politics has shaped the state's response to the Guiding Principles in Indonesia. Expected outcomes include an analysis of the Indonesian case, a conceptual framework for explaining state responses to the Guiding Principles, policy-related advice for promoting the Guiding Principles, and enhanced understanding of solutions to global governance gaps. Benefits include these outcomes plus enhanced capacity in Australia and elsewhere to address corporate abuses of human rights.							
	National Interest Test Statement							
	In 2011, the United Nations endorsed the Guiding Principles on Business and Human Rights to combat corporate abuses of human rights, with Australia co-sponsoring the resolution that led to their endorsement. Since then, states have moved slowly and inconsistently to adopt and implement these principles. This project examines the reasons for this, focusing on Indonesia, where corporate activity is a major source of human rights abuses. The first major study of its kind, it aims to enhance our understanding of the domestic political conditions under which the Guiding Principles lead to improved human rights outcomes and the most effective strategies for promoting their adoption and implementation. It benefits Australia by enhancing the capacity of Australian government, civil society, and business actors to promote the Guiding Principles and, in so doing, the capacity of Australian business to establish social licenses to operate in the face of human rights risks. The project incorporates outreach measures to translate findings into policy and practical change.							
DP230100885	**Novel mechanisms by which retinal microglia regulate vascular development**	95,000.00	195,000.00	200,000.00	100,000.00	0.00	0.00	590,000.00
Fletcher, Prof Erica L	This project aims to investigate how immune cells called microglia refine the developing retinal vasculature. New knowledge utilizing state of art imaging techniques is likely to be examine a completely novel mechanism by which vascular development occurs. This information is critical for enhancing our understanding of the role of immune cells in the nervous system and will guide the development of new ways of examining these cells. Expected outcomes include a novel way for assessing microglia in the developing nervous system and new knowledge. In the longer term the information gained in this project may be helpful for understanding scenarios where blood vessels are abnormal, or for using microglia as a target to modify vascular function.							
	National Interest Test Statement							
	Light lands on the retina at the back of the eye where nerve cells (neurons) send signals to the brain, creating the visual images that we perceive. Retinal neurons obtain essential oxygen and nutrients from a network of blood vessels. The factors directing the development of these crucial blood vessels are not known. We will investigate the completely new idea that immune cells of the retina (called microglia) play a critical role in shaping retinal blood vessels. Using novel ways of imaging the retina of mice, we will directly examine how microglia affect blood vessel development. Understanding the interplay between immune cells and the developing retina is likely to be relevant to the development of the entire nervous system and even other organs, potentially transforming neuroscience. The findings could help researchers better model the nervous system for the Human Brain Project and for studies into regenerative medicine or circulatory system disease.							

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DP230100959	**Nowcasting and Interpreting the Australian Economy**	65,469.50	130,815.50	138,084.00	72,738.00	0.00	0.00	407,107.00
Robinson, Dr Tim F	This project aims to investigate methods for nowcasting and interpreting the Australian economy. This is determining the current state of the economy and the factors contributing to it. This project expects to generate new knowledge on how unconventional, new, data sources and innovative methods can be used to in nowcasting and how the Australian economy can be modelled. The expected outcomes include timely new indicators of the state of the economy, and the factors contributing to it. This should provide significant benefits through informing the conduct of Australian macroeconomic policy, as the appropriate policy response depends not only on knowing the current state of the economy but understanding the economic factors underlying it.							
	National Interest Test Statement							
	Australian policy makers need accurate and timely measures of Australian economic activity and its main drivers to set policies on taxes, government spending and interest rates. Yet official data often are months old, and current economic models relying on them do not provide timely measures of the factors driving today's economy. This project will use unconventional, new data sources and modern techniques to create a set of regularly updated, publicly available, high-frequency indicators of the current state of the Australian economy and its determinants. Innovative modelling methods will use these indicators to create a new macroeconomic model of the Australian economy that is intended to become the new benchmark. Project participants from the Australian Treasury and the Australian Bureau of Statistics will facilitate adoption of the project outcomes in Government agencies. This project will produce significant societal and economic benefits by providing Australian macroeconomic policymakers with better, timelier information to assist their decisions and understand the impacts of macroeconomic policies.							
DP230101031	**The impact of copper on protein turnover**	95,000.00	197,000.00	203,950.00	101,950.00	0.00	0.00	597,900.00
Bush, Prof Ashley I	This project aims to elaborate a novel discovery by the research team, that a conserved copper-binding site in a group of conserved conjugating enzymes promotes ubiquitination of a range of essential proteins leading to their rapid degradation, which might be a means of maintaining copper homeostasis. This project will employ a range of integrated physicochemical, biochemical and cell biology approaches to illuminate the molecular nature of this copper action on the enzyme and its partners. Expected outcomes include an analytical understanding of the molecular mechanisms of this process, and enhanced interdisciplinary collaboration between experts. Potential benefits include new strategies to intervene in copper-related disorders of aging.							
	National Interest Test Statement							
	Nutrient copper is an essential ingredient for life and plays a role in diseases like Alzheimer's and cancer. But we know little about how copper acts within cells and why it is so important for life. We recently discovered that copper drives a system that removes damaged proteins within cells. This copper-dependent mechanism is found in humans, other mammals, fish and even flies. Using approaches unique to our laboratory, we will elaborate the precise biochemical way that copper exerts this influence. The findings from this project will be disseminated through the scientific literature, where it will be of importance to biochemistry and biology researchers, particularly those studying these pathways in normal organ development. As defective protein breakdown is implicated in major diseases, the results will also interest medical researchers studying these pathways in cancer and neurodegeneration. The findings will be relevant for future drug development, with potential to benefit the health of Australians, and bring commercial and economic benefits such as improved productivity of livestock and fisheries.							

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DP230101050	**"Painting" the 3D proteome: folding, conformation and interactions**	86,128.00	178,577.00	185,669.00	93,220.00	0.00	0.00	543,594.00
Hatters, Prof Daniel M	The project aims to develop a "residue painting approach", employing novel chemical biology reagents and advanced quantitative proteomics, to monitor changes in protein folding, conformations and interactions in cells, in response to stimuli. Proteins direct almost all functions required to sustain life. The project expects to map the dynamic 3D-structures of thousands of proteins that inform the networks they are in, and of the conformations they adopt. Expected outcomes include the development of novel biotechnology tools for protein structure and function analysis, the illumination of important cell biology pathways underpinning molecular responses to stimuli and stress, and the training of our next generation of scientists.							
	National Interest Test Statement							
	Proteins are the workhorses of biology, assembling together into networks to perform molecular functions. These networks rearrange when a different function is required and when cells respond to different stimuli. These networks are essential to all life functions, so knowing how they are arranged offers great power to tweak them for particular functions and also understand errors that cause disease; this has great potential for improving crop yield, building resistance to disease in animal, plant or microbial organisms and treating disease. This project will develop new tools to provide information on protein network structures, including in live cells with thousands of networks. These tools will be of use to teams researching basic cellular function in fields as diverse as human health (e.g., cancer, Alzheimer's disease), horticulture, agriculture, pathogens and microbiomes. The knowledge may be adopted by industries that manufacture proteins (e.g., pharmaceutical production of vaccines, hormones, protein-based therapies) and in biotechnology (e.g., building resistance to heat stress in corals or crops).							
DP230101111	**Using genetic Allee effects to manage invasive populations**	100,000.00	195,000.00	195,000.00	100,000.00	0.00	0.00	590,000.00
Phillips, Prof Benjamin L	An invasion can be started with only a small number of individuals, and it is very difficult to reliably detect these individuals. This project aims to develop new genetic technology that can send small founder populations extinct without affecting large populations. This technology removes the problem of having to detect small populations; these small populations will go extinct on their own, without the need for management intervention. This technology could be used to prevent establishment and spread of invasive species and agricultural pests. Through a combination of experimentation and modelling, the project develops this technology and assesses its use in applied problems ranging across environment, agriculture, and health.							
	National Interest Test Statement							
	Billions of dollars are spent in Australia each year to manage invasive pests. An invasion usually begins with a small, difficult-to-detect population. This project develops genetic technology designed to cause these small colonising populations to become extinct without additional management intervention. Working with fruit flies in the lab, we aim to show that we can alter the genes of a pest population and so decrease the survival of these small colonising populations. This reduces the need for surveillance and simplifies eradication, reducing costs for farmers and the state and federal agencies responsible for pest control and biosecurity. The tools we develop could be used to manage many pests of national significance, including the spotted wing drosophila (a fly that is a major threat to Australian agriculture). This approach could be used to control organisms from fungi to plants and animals, and could dramatically improve the efficiency and cost-effectiveness of biosecurity actions (e.g. controlling malaria carrying-mosquitoes) and vertebrate pest control (e.g. cane toads).							
DP230101145	**Beyond the resource curse: redistribution and resource-led development**	30,589.50	86,928.00	126,731.50	70,393.00	0.00	0.00	314,642.00
Phelps, Prof Nicholas A	The project aims to improve the sustainability of resource-led development in Australia and worldwide via a novel, multi-scalar framework, co-produced with mining/Indigenous communities that connects local development outcomes with mining global production networks (GPN). It will generate new, community co-authored and policy-engaged knowledge to better attune fiscal, industry and regional policies to tackling the local resource curse. Expected outcomes include co-developed GPN theory advances; new policies for sustainable mining locality development; and more engaged mining/Indigenous communities. Significant welfare savings, social coherence, environment amelioration and cultural transformation benefits are expected.							

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	National Interest Test Statement							
	Mining produces wealth for the country, but the wealth is typically not reinvested into mining towns. They often suffer from a “local resource curse”, facing acute socio-economic challenges including unaffordable housing, lack of services, environmental damage and marginalisation of Indigenous populations. This project investigates three copper mining towns in different countries—Mt Isa, Australia; Calama, Chile; and Chambishi, Zambia—to generate community co-authored, policy-engaged knowledge on how to overcome these challenges. We will combine analyses of data and current policies for local mining industries with data from in-depth interviews with government, industry and community stakeholders, and focus groups with community and Indigenous organisations. Traditional academic outputs, reports and guidelines, public presentations, workshops and a multilingual handbook will be used to inform policy. Best practice evidence-based, community-engaged policy design will empower communities and reduce welfare dependence, social discontent and environmental deterioration, even beyond the mining case studies.							
DP230101148	**All in the family: understanding a new class of bacterial toxins**	108,724.50	222,685.50	227,922.00	113,961.00	0.00	0.00	673,293.00
Parker, Prof Michael W	This project aims to unravel missing molecular details of how a major superfamily of proteins is able to drill holes in cell membranes. 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. 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.							
	National Interest Test Statement							
	This project will provide insights into fundamental biology of bacteria including many with known importance in agriculture and biotechnology. For example, some of these bacteria kill fish and are found in nematodes which can devastate livestock production. This work will focus on bacterial pore-forming proteins, that punch holes in cell walls, which could lead to the development of novel approaches 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, engineering pore-forming proteins into crops to defend against pests has saved billions of dollars annually. This project could identify suitable proteins that could protect against emerging pests and to overcome resistance in existing crops.							
DP230101352	**Identification of causal variants for complex traits**	77,232.50	163,852.00	193,676.50	107,057.00	0.00	0.00	541,818.00
Goddard, Prof Michael E	The aim of this project is to identify causal variants for complex traits in cattle and humans. Although most important traits in agriculture, medicine and evolution are complex traits, very few of the genetic variants affecting these traits are known and this undermines our understanding of how genetic variants affect a trait and practical uses of this knowledge. Huge datasets of individuals with genome sequence and phenotypes and new statistical methods provide the opportunity to close this gap. The outcome will be identification of many genomic variants causing variation in complex traits. This will benefit scientific understanding of complex traits and the ability to predict traits for individuals from their genome sequence.							
	National Interest Test Statement							
	The most important traits in agriculture (e.g., crop yield) and medicine (e.g., susceptibility to disease) are complex traits controlled by many genetic variants and environmental factors. Currently few of these variants are known and this undermines the use of genome sequence data on individuals. This project aims to identify these genetic variants to enable improved prediction of complex traits. The methods pioneered in the project will be able to be used in all species. Farmers, particularly those raising less common breeds, will benefit from faster genetic improvement of cattle for increased meat and dairy production. The project will also increase our understanding of how genes control complex traits leading to new methods of influencing these traits. More accurate prediction of future phenotype in people underlies the new personalised medicine (e.g., targeted cancer treatments). Already pathways are in use to implement this new knowledge in the prediction of phenotype in agriculture (e.g., national genetic evaluation systems) and in people.							

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DP230101493	**Overcoming nonlinearity in short-reach optical communication**	74,490.00	142,480.00	138,480.00	70,490.00	0.00	0.00	425,940.00
Shieh, Prof William	This project aims to investigate the equalization methods for nonlinear optical channels applicable to short-reach optical communications. This project expects to significantly improve the transmission capacity of the cost-effective directly detected transceivers. Expected outcomes of this project include advanced equalization techniques for nonlinear channels and associated signal processing algorithms. These advances will have the potential to provide an enabling technology for surging capacity demand from cloud computing and enhance Australia's standing as a leader in optical communications technology.							
	National Interest Test Statement							
	High-performance communications, involving cloud computing and video streaming from applications such as YouTube and Facebook, transmit huge volumes of data at great speed, leading to extremely high energy consumption. At the receiving device, distortion in the signal must be cleaned up, and the more efficiently this is done, the greater the potential for even higher data transmission rates. This project will investigate faster, more energy-efficient methods to correct distorted signals in high-speed fibre-optic cables. It will enable data-centre operators and telecom equipment vendors to provide customers with more cost effective ultrahigh-capacity services, essential to sustain the exponential growth of communications traffic from media-rich video and live-streaming applications. We will showcase our technologies to top companies in Australia and overseas, boosting the manufacturing capability for state-of-the-art telecommunication equipment. Project outcomes will enhance Australian technical leadership in meeting the surging demand from cloud computing, one of today's most exciting ICT sectors.							
DP230101534	**Next Generation Spatial Data Management for Virtual Spatial Systems**	80,000.00	160,000.00	160,000.00	80,000.00	0.00	0.00	480,000.00
Qi, Dr Jianzhong	This project aims to design novel spatial data retrieval methods for efficient and accurate querying of large datasets with location information. Spatial data is being generated at an unprecedented rate due to the prevalence of mobile devices and ubiquitous connectivity. However, harnessing this data is hampered by outdated and inefficient methods. The project will investigate data retrieval methods that self-optimise for high query efficiency and accuracy, by utilising underlying real-world data patterns. It will enable novel applications for virtual spatial systems with large-scale querying needs, such as spatial digital twins and metaverses, benefiting location-based service providers, urban planners, and emergency management agencies.							
	National Interest Test Statement							
	Spatial data (as used in maps and navigation apps) is being generated at an unprecedented scale from satellites and mobile devices. Increasingly it is used to build virtual spatial systems with real-world applications. For example, a digital version of a city—enhanced with real-time spatial data from sensors and 5G networks—will allow scenario-modelling (e.g., the impact of a flood) to achieve the best outcome (e.g., an emergency response). However, such usage is hampered by old, inefficient data technologies. This project will develop highly efficient spatial data retrieval methods for virtual spatial systems used by organisations and government agencies. The database community will be able to use our results to develop next-generation spatial database systems, which will bring significant business opportunities and enormous cost savings. Our results can inform urban planners and transport and emergency managers, for example, providing real-time spatial data analysis for planning, transport system optimisation, and flood risk management, protecting properties, livelihoods and lives.							
DP230101541	**Control of vascular form and fate by a novel pre-mRNA splicing mechanism**	79,118.00	161,406.50	167,248.50	84,960.00	0.00	0.00	492,733.00
Hogan, Prof Benjamin M	Vertebrate vasculature forms elaborate, branched networks essential for life. As developing vessels permeate tissues and organs, dynamic and spatiotemporally regulated cellular signalling determines the fate, patterning and distribution of new vascular networks. This project follows the recent discovery of a mechanism whereby RNA diversification through alternative splicing controls complex signalling patterns in forming vessels. This project investigates this molecular mechanism in embryo and tissue development. The project will produce fundamental knowledge in RNA diversification, vascular fate, growth and cell signalling. New knowledge generated may lead to new approaches in stem cell biology, tissue engineering and regenerative biology.							

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	National Interest Test Statement							
	In vertebrate animals, the network of blood vessels (vasculature) provide nutrients and oxygen essential for healthy tissue function. Vascular changes are central to the process of healing and ageing. But there are fundamental gaps in our understanding of the cellular and molecular interactions that control how blood vessels form in body tissues. This project will explore how regulation of genes and cell signalling, together control blood vessel formation, growth and function. Understanding the molecular control of blood vessel formation and function in tissues creates opportunity for improvements in tissue engineering, tissue repair and regenerative biology. These innovative approaches will benefit biotechnology, pharmaceutical development and drive further research into vasculature. Longer-term outcomes may help people to keep working and participating in social activities as they age through new tissue repair and future medical applications.							
DP230101749	**Distributed Optimisation without Central Coordination**	60,000.00	122,500.00	127,500.00	65,000.00	0.00	0.00	375,000.00
Tam, Dr Matthew K	This project will develop the mathematical foundations for discovery and analysis of iterative methods for optimisation problems in distributed computing systems. Most methods in distributed optimisation were not designed for distributed computing, rather they were adapted for purpose post-hoc. By building on recent advances in monotone operator splitting, this project expects to develop a mathematical theory for decentralised optimisation algorithms specially designed for distributed systems. The framework is expected to produce a suite of algorithms, each customised to exploit a specific network configuration. The project will provide significant benefits in distributed machine learning applications such as federated learning.							
	National Interest Test Statement							
	Many large, resource-intensive computer applications, such as cryptocurrency systems, scientific simulations, and machine learning platforms, solve the problem of massive job sizes by using distributed computing systems. In these systems, a network of computers divides the work between machines to complete jobs that would be impossible for a single computer to handle alone. Existing algorithms do not make full use of the characteristics of the computer network. This project will develop a rigorous mathematical framework to enable novel solution methods specially designed for distributed computing systems. Project outcomes will measurably improve computational performance and allow even larger problems to be solved. Future applications in healthcare, for example, include detecting the symptoms of stroke or diabetes from wearable devices and other data sources. All data, results and code generated in this study will be made publicly available, helping Australian mathematicians and developers to lead the world in distributed optimisation technologies.							
DP230101757	**Lattice Panel Based Optical Apertures for Optical Wireless Networks**	100,937.50	171,452.50	144,723.00	74,208.00	0.00	0.00	491,321.00
Nirmalathas, Prof Ampalavanapillai	Future work and homes will demand superfast wireless connectivity supported by optical fibre networks providing high speeds into our buildings. The technology gap, however, is a system to deliver this level of connectivity to our wireless mobile devices. Addressing this need, this innovative project proposes a novel architecture of lattice panel apertures based on arrays of phased arrays that can establish and steer multiple optical beams simultaneously. It will investigate these system architectures, demonstrating their feasibility. By transforming broadband wireless into the future of optical mobile networking, the project outcomes will extend to every connected office and home, benefiting Australia's economy and national security.							
	National Interest Test Statement							
	Our society increasingly relies on superfast internet connectivity and, to meet part of the demand, optical fibre networks can now deliver high speeds into buildings. However, within buildings, and over short distances around our work and living environments, current technologies are unable to deliver similar high connectivity wirelessly to mobile devices. Such a gap limits the possibilities of automation, for example in applying smart sensors to deliver advanced applications to users through their wearable devices. This project will demonstrate the feasibility of faster and more secure mobile networking using only optical wireless transmission, a technology that will be compatible with next-generation wireless networks such as 6G mobile networks, and beyond. Outcomes will be open access to maximise knowledge transfer to stakeholders in industry, communications and defence who are delivering the wireless technologies and networking essential for future internet needs. Project outcomes will help improve every connected office and home, benefiting Australia's economy and national security.							

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DP230101787	**AI in agriculture: hybrid machine learning models for nitrogen simulation**	79,619.00	164,759.00	158,650.00	73,510.00	0.00	0.00	476,538.00
Lam, Dr Shu Kee	Agricultural simulation models are used to guide nitrogen management to reduce nitrogen loss and its environmental impact, but they were developed using constrained datasets, which restricts them to site- or regional-specific simulations. This project adopts a novel approach to addressing these problems by applying machine learning-based data analytics. The project will refine the linkages between nitrogen losses and their key drivers, and improve the existing agroecosystem models through data imputation, parameter optimisation and module enhancement. The outcomes of this project will lead to an accurate prediction of nitrogen losses from agriculture, advancement in agroecosystem models and their adaptability to a global context.							
	National Interest Test Statement							
	Quantifying nitrogen losses from agricultural practices is critical to address the challenges of environmental degradation and climate change, and safeguard Australia's food production systems. Agricultural simulation models are well placed to estimate how much, and through which pathways, nitrogen is lost to the environment but current models have many shortcomings. This project will use machine learning-based data analytics to substantially improve the simulation and prediction capacity of these simulation models. This research will help identify the best nitrogen management practices for diverse growing regions in Australia to increase crop productivity, while reducing environmental degradation. This will avoid environmental, economic and societal consequences arising from nitrogen mismanagement (e.g., overuse of nitrogen fertilisers), and will ensure that the rural sector remains profitable and sustainable. The databases and models developed in this project will be made available to researchers, industry and policy makers, and will benefit digital and high-precision agriculture.							
DP230101835	**Close Relations: Irishness in Australian Literature**	54,897.00	109,236.50	102,959.00	48,619.50	0.00	0.00	315,712.00
McDonald, Prof Ronan D	The project aims to transform understanding of Australian literature by combining existing and digital methods to investigate the complex role of Irishness in its production, circulation and reception. It expects to generate new knowledge in Australian, Irish and computational literary studies and to advance a critical and methodological framework of relational literary studies. Expected outcomes include enhanced knowledge of the history of migration and identity formation in Australia, and a new way of integrating human- and computer-led approaches to literary inquiry. The project's substantial benefits should include advancing understanding of Australia's cultural history and promoting public engagement with Australian literature.							
	National Interest Test Statement							
	Irishness is ubiquitous in Australian literature, but rarely discussed. Although many Australian authors, characters, and tropes have strong Irish associations, Irishness is usually folded into Britishness, so there has been little attention to its formative yet fractious role in Australia's national story. Recent computer-enabled modes of enquiry also reveal a previously lost archive of Irish works, including in historical periodicals, while offering new methods for exploring and understanding this important literary phenomenon. As well as enhancing our knowledge of Australian identity and culture this research will offer benefits to Australia including developing innovations in data mining and visualisation to investigate complex textual and cultural documents at scale, and enhancing cross-cultural understanding between Ireland, Australia and the global Irish diaspora. Our use of crowdsourcing to engage the public will promote digital literacy and participation, while the public discussion we will facilitate about cultural difference and belonging in Australia will support community cohesion and wellbeing.							
DP230101907	**Enabling wider use of mechanistic models for biodiversity forecasts**	112,966.00	221,218.50	214,369.50	106,117.00	0.00	0.00	654,671.00
McCarthy, Prof Michael A	Forecasting species distributions is challenging yet necessary. The pattern-based models commonly used are error-prone. Mechanistic models, best equipped for the task, are limited by lack of data. This project aims to enable wider use of mechanistic models by developing new methods for dealing with incomplete trait data and uncertainty. It expects to generate new knowledge about how species' traits define the environments in which they persist. Anticipated outcomes include enhanced capacity to apply mechanistic models to conservation problems, methods for communicating uncertainties and models for tens of species of immediate conservation interest. This will enable more reliable biodiversity forecasts, supporting better decision-making.							

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	National Interest Test Statement							
	Accurate forecasts of how threats such as climate change will affect where, and in what numbers, animals are found are critical to effectively manage Australia's unique biodiversity. The most accurate forecasts can be expected from models that relate species' behaviour and traits (physiology, morphology) to environmental conditions, but for most species such data are limited as field studies are expensive and time-consuming. Building on existing physiological and ecological datasets, we will develop improved methods for generating accurate forecasts when data are incomplete plus tools to measure and communicate the associated uncertainties. Scientists and managers can use our models to better understand how environmental change will affect the distribution of skinks and tree-dwelling marsupials in eastern Australia, which has been recently devastated by drought, bushfires and floods. State and federal agencies can use these more accurate models to make more robust and cost-effective conservation management decisions for a range of iconic Australian species including the koala, now classified as endangered.							
DP230101979	**Can we exploit mRNA modifications to control protein expression?**	78,593.00	160,843.00	120,405.00	38,155.00	0.00	0.00	397,996.00
Ralph, Prof Stuart A	Genes are encoded by DNA but are transcribed into a message called RNA before they can be translated into protein. RNA can be chemically modified at a gene-specific level, and this modification has been central to the success of RNA vaccines against COVID-19. Despite the importance of these modifications in cellular life and in biotechnology, the role of the most abundant RNA modifications is unclear. This project will investigate how we can exploit RNA modifications to modulate protein expression in a tractable single-celled organism with a small genome, Plasmodium. This information is important because understanding gene regulation is fundamental to all life, and the role of RNA modifications is emerging as integral to biotechnology.							
	National Interest Test Statement							
	Our genes contain the code for making proteins—key biological molecules. A molecule called messenger RNA (mRNA) copies the DNA code of our genes to be translated into proteins, so changes to mRNA molecules affect gene expression in cells, and thus the organism. Chemical modification of mRNA is the biotechnological tool underlying the development of the Moderna and Pfizer COVID-19 vaccines. This project will use advanced new genetic technologies to investigate how we can modify mRNA to alter protein expression in a single-celled organism with a small genome. We will openly share our data and bioinformatic software resources to benefit the research community, who will gain a better understanding of gene regulation. The knowledge gained will be applicable to biotechnology and biomedical sectors, building capacity in areas critical areas such as next-generation vaccines and therapies for leukaemia and other cancers and veterinary diseases.							
DP230102105	**Redefining the immune landscape of the human ocular surface**	112,910.50	258,024.50	213,221.50	68,107.50	0.00	0.00	652,264.00
Downie, A/Prof Laura E	At the ocular surface, the cornea and limbus need to mount effective immune responses to maintain corneal transparency for clear vision. The current paradigm is that the human cornea houses the same innate immune cell subsets (dendritic cells and macrophages) as naïve mice in pathogen-free facilities. Our pilot data challenge this premise, with early evidence that innate and adaptive cells (T cells) coexist in normal human corneas. Integrating state-of-the-art techniques, we will advance understanding of immune regulation at the human ocular surface by comprehensively defining immune cell biology and dynamics. We will define the effect of age on immune cells in these tissues, and relationships between the tear proteome and cell behaviours.							
	National Interest Test Statement							
	The cornea at the surface of the eye and its surrounding area (the limbus) produce immune responses if damaged or contacted by an infectious agent. Current understanding of this response is mostly from mouse studies. Our preliminary results suggest that corneas in humans are different from mice and house a distinct type of immune cell – a T cell. This project will be the first to characterise the immune cells of the human cornea and limbus. We have pioneered a high-resolution method to image immune cells in living human eyes to study the form and behaviour of the cells. Our project will redefine fundamental understanding of the eye's immune cell biology, enhancing Australian research in vision science and immunology. We will make the first atlas of immune cells of the human cornea and limbus publicly available and share our new method for visualising the eye's immune cells with researchers, via publications and scientific meetings. We expect strong interest from the ophthalmic imaging industry, with scope to develop new software tools for automated analyses of cell dynamics.							

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DP230102108	**Defining the microenvironmental regulators of spleen function and immunity**	115,366.50	234,471.00	224,987.00	105,882.50	0.00	0.00	680,707.00
Mueller, Prof Scott N	The spleen is an important organ that is present in almost all vertebrates and is a critical site for the induction of systemic immune responses. The current paradigms of spleen biology are mostly derived from rodent studies, but the cellular biology of the spleen in humans remains poorly defined. Using novel tools, advanced transcriptomics and imaging techniques this project aims to reveal the functions of stromal cells in the spleen in humans and to define the fundamental roles of spleen stromal cells in long-lived immunity. The anticipated outcomes are to build Australia's research capacity and to generate new knowledge of significance for our fundamental understanding of the spleen and the role of this tissue in the immune system.							
	National Interest Test Statement							
	The spleen is present in almost all vertebrates, providing critical immunity to bacteria and viruses in the blood. However, exactly how the spleen engenders immune responses and what non-immune cells create the spleen architecture is not well defined. Much of our understanding of the spleen comes from mouse studies and how this organ works in humans is not fully understood. This project will use advanced imaging technology to define the biology of the cells that create the human spleen and to determine how these non-immune spleen cells foster long-lived immune responses. This knowledge will guide future research into the immune system and will reveal new ways of boosting the immunity to infections and chronic diseases like cancer. This project will engage with other researchers to provide training in state-of-the-art imaging technologies not available elsewhere in Australia. It will ultimately contribute to the commercial development of new medical products.							
DP230102121	**How do kangaroo herpesviruses jump to new host species?**	29,951.50	107,582.00	158,837.00	81,206.50	0.00	0.00	377,577.00
Devlin, Prof Joanne M	This project aims to study alphaherpesviruses of kangaroos and other marsupials. These viruses cause outbreaks of severe disease in captive populations of marsupials when they are transmitted from natural hosts to new host species, but these cross-species transmission events are poorly understood. This project aims to study these viruses, and their capacity for cross-species transmission, using new approaches that consider herpesviruses as dynamic, mixed populations of viruses. This project also aims to develop novel, practical, and accessible vaccines to prevent disease. Benefits are expected to arise through prevention of disease in captive marsupial populations, including benefits for conservation efforts and for Australian tourism.							
	National Interest Test Statement							
	This project will study alphaherpesviruses of kangaroos and other marsupials. These viruses cause outbreaks of disease in captive populations of marsupials in zoos and wildlife parks when the viruses are transmitted to new species, however these viruses are poorly understood. This project is expected to provide foundational knowledge of how these viruses are able to cross into new species. This project is also expected to develop novel vaccines for use in captive animals to prevent disease outbreaks. Benefits to conservation efforts are anticipated through the use of vaccines to protect the health of animals involved in captive breeding programs. Benefits to Australian tourism are anticipated though the use of vaccines to protect the health of exhibited animals in zoos and wildlife parks. There is a clear translation pathway for these vaccines through existing systems that support the production and use of autogenous (custom) veterinary vaccines. This represents a feasible and attractive alternative to commercial vaccine development, thus supporting the health of this small but important group of animals.							

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DP230102244	**Investigating novel pathways in ferroptosis**	64,247.50	138,245.00	146,997.50	73,000.00	0.00	0.00	422,490.00
McColl, A/Prof Gawain	This project aims to develop new tools to investigate iron-mediated cell death and uncover new pathways involved in ageing. Accumulation of iron leads to frailty in late life, a process that appears common to all animals. Iron becomes reactive and inappropriately triggers a cell death process called ferroptosis leading to dysfunction. To understand these processes and to identify means to intervene, this project aims to use genetic approaches to identify new cell pathways that regulate ferroptosis. This project also aims to develop new tools to study this process. Outcomes of this project may include the identification of potential strategies to alter late life frailty with an expected benefit to life sciences and biotechnology industries.							
	National Interest Test Statement							
	In 2017, there were 3.8 million Australians aged 65 and over (comprising 15% of the total population) with both the proportion and number of older Australians expected to continue increasing. This project will generate an understanding of the role of a newly identified form of iron-dependent cell death, known as ferroptosis, in ageing in a whole organism. This information will contribute to developing a complete understanding of biological ageing. The knowledge gained may, in the longer term, identify new strategies to alter ageing rate and reduce late-life frailty in a targeted manner. To achieve this aim, we will develop new tools and technologies for studying iron-dependent cell death and ageing. Outcomes of our research will be shared with a network of researchers in the biology of ageing, as well as clinician researchers investigating diseases of old age such as cancer and Alzheimer's and Parkinson's diseases. Thus, in the long term, this fundamental biological research could contribute to future improvements in the health and fitness of the growing number of older Australians.							
DP230102422	**How do cytokine receptors transmit signals?**	98,368.00	197,607.00	167,354.50	68,115.50	0.00	0.00	531,445.00
Griffin, A/Prof Michael D	This project aims to determine the mechanisms of signal transmission by cytokine receptors using state-of-the-art microscopy techniques. Cytokines are small proteins that act as messengers between cells and play fundamental roles in biology. Cytokines bind to receptors on the surface of cells, producing a response within the cells. Yet, how the message is transmitted across the cell membrane is not well understood. Expected outcomes of this project include discovery of mechanisms general to cytokine signalling and new approaches to investigate cytokine biology. This new knowledge will benefit efforts to understand and modulate cytokine signalling in animals and humans, with future impacts in the agriculture, veterinary, and health sectors.							
	National Interest Test Statement							
	Cytokines are small proteins that act as messengers between cells and play fundamental roles in biology, including in immunity and inflammation. Cytokines bind to receptors on the cell surface, producing a response within the cells. Yet, how these messages are transmitted across the cell membrane is not well understood. This project will unravel the biochemical mechanisms of cytokine signalling using biochemical approaches to dissect cytokine biology and similar receptor systems. The results will have far-reaching scientific impact and contributions to health, agricultural productivity and veterinary science. For example, it will inform future treatment of many conditions such as fibrosis, cancer, mastitis in dairy cows and dermatitis in pet cats and dogs. The project will strengthen our linkages with scientific and industry researchers, and it will place Australia at the forefront of cytokine biology research. Australian biotechnology and pharmaceutical sectors will benefit directly, including through spin-out commercialisation in this area.							
DP230102453	**Improving the mental health of young adults in Australia's universities**	63,641.00	137,323.00	146,373.00	72,691.00	0.00	0.00	420,028.00
Baik, Prof Chi	This project aims to contribute to national efforts to address high rates of depression and anxiety among 18-25 year-olds by investigating alterable factors that impact student mental health in Australia's universities. With one in two young adults now engaged in post-secondary education, the research expects to generate critical new knowledge about educational conditions, practices and experiences that support (or thwart) the wellbeing-needs of students with diverse backgrounds. This knowledge will be translated into actionable, evidence-based recommendations for policy and innovation. Improving university student wellbeing should benefit the health, educational and employment trajectories of young adults in both the short-and longer-term.							

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	National Interest Test Statement							
	With higher education participation at unprecedented levels, universities have significant potential to contribute to national efforts to support the mental wellbeing of young adults. They are currently hindered, however, by a lack of systematic evidence about tertiary students' mental health and incomplete understanding of alterable factors that foster (or frustrate) diverse young adults' wellbeing-needs in higher education. By developing a sustainable Australian Student Wellbeing Research Hub, this project will provide universities and policymakers with the robust data and advanced knowledge they need to ensure student wellbeing initiatives are evidence-based and beneficial. Key findings will be accessible through a searchable website and publications designed to build the capacity of institutions and the higher education sector to adopt and evaluate cost-effective student wellbeing initiatives. In the long run, this increase in capacity should improve young adults' health, educational, and employment trajectories, resulting in significant socio-economic benefits for individuals, families, and the nation.							
DP230102497 Lee, Prof Peter V	**A digital twin framework for human mobility measurement in the home setting** Mobility is essential to maintain quality of life and healthy ageing, yet we do not have the capability to perform accurate long-term mobility assessments of a person in their home or community. This project will overcome this engineering challenge by developing a user-friendly 'digital twin' that combines wearable sensors, 3D mapping and artificial intelligence to predict and visualise real-time human joint motion and mobility in any location. This digital twin framework will benefit next-generation healthcare for older Australians, including telemedicine and remote rehabilitation for isolated communities, performance monitoring of elite athletes and military personnel, and the gaming and film/animation industries.	34,988.00	164,988.00	230,000.00	100,000.00	0.00	0.00	529,976.00
	National Interest Test Statement							
	This project aims to develop an advanced digital twin to monitor and visualise the mobility of an individual in their own home over extended periods. It will combine 3D mapping of the home, wearable technology and artificial intelligence to generate user-friendly human joint motion and motor task assessment with unprecedented accuracy. Maintaining mobility is an essential part of healthy ageing, yet the long-term mobility pattern of older persons living in their home is poorly understood. This project will provide a deep understanding of how older Australians move and interact with their living environment. The digital twin framework has the potential to impact the multi-billion-dollar aged-care sector and facilitate low-cost telemedicine and rehabilitation for remote communities. The framework has applications in sports and elite athlete training and injury prevention, human performance monitoring of military personnel, and improved infrastructure design for long-term living in naval application and spaceflight.							
DP230102527 Jeffrey, Prof Craig J	**Hunger for Change: Student Food Insecurity and Youth Agency in Australia** Rising food prices threaten to exacerbate an already pressing problem of food insecurity among students in Australia universities. This project will examine the causes, consequences, and nature of food insecurity among students in Australia employing interviews, focus groups and participant observation. It will contribute to scholarly debates on food security and youth agency through highlighting the imaginative ways in which young people are developing responses to food insecurity. The project will offer the Australian government, State governments and universities opportunities to build upon student-led solutions to food insecurity, enhance capacity for research on food and youth issues, and heighten public understanding of the issue.	66,500.00	171,000.00	181,500.00	100,500.00	23,500.00	0.00	543,000.00
	National Interest Test Statement							
	The project focuses on the problem of food insecurity which affects 40% of university students in Australia but has not yet been the subject of intensive research. There is an urgent need to rectify this situation, especially given current concern over rising prices and an impending global food crisis. This project will provide vital new data on students' own experience of food insecurity, including how it relates to other forms of social deprivation. It will also identify and seek to encourage student-led solutions to food insecurity. Through the development of a toolkit for government and universities, the project will offer key stakeholders crucial information and practicable ideas that could form the basis for universities' institutional response to food insecurity, for example through the development of new university food policies in Australia. Via the production of an animated film, recipe book, and global network, the research will create opportunities for wider publics in Australia and overseas to understand the vulnerability of students and, especially, how young people can address food crises.							

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DP230102550	**Photoacoustic cellular manipulation: building from the bottom up**	87,500.00	147,500.00	127,500.00	67,500.00	0.00	0.00	430,000.00
Collins, Dr David J	In this project we propose an approach for creating complex 3D prints. Whereas current approaches are limited to defining the external geometry, this technology will permit the organization of the internal structure as well, with the potential to do so at the scale of individual cells. Achieving this has important applications in bioprinting human tissues and additive manufacturing. This is based on the manipulation of particles and cells using holographic acoustic fields controlled by patterned light. This is compared to current acoustic patterning approaches are mostly limited to static simple geometric arrangements and lack the flexibility to produce arbitrary, rapidly changing fields that enable the fabrication of complex structures.							
	National Interest Test Statement							
	The printing of human organs and tissues is of great importance to the health outcomes of many Australians. While this nascent technology is still advancing, it is currently limited by the ability to manipulate and build complex biological structures at the cellular level. This project proposes the development of a new technique, combining light patterning and ultrasound, to finely control single cells and permit the fabrication of complex structures, including human tissues. This project will provide researchers a new tool to engineer complex structures that are tailor made from the level of a single cell to the macroscopic geometry. By engineering tissues and from the 'bottom up', researchers can further understand the structural nuances of diseases. Improved tissue models have wide applications in drug discovery, minimizing the need for animal testing, and therapeutics in the form of improved tissue implants. This research will benefit the Australian health industry, with further commercialization potential in the development and sale of equipment that permits cell-scale additive manufacturing.							
DP230102585	**Destratification and mixing by boundary turbulence in oceans and rivers**	140,000.00	230,000.00	180,000.00	90,000.00	0.00	0.00	640,000.00
Philip, Dr Jimmy	Periods of high temperature heat the surfaces of the oceans and lowland rivers, thereby increasing stratification and inhibiting mixing. This undermines the processes that normally distribute heat and CO2 and can lead to processes like rapid destratification in rivers that can result in mass fish-kills. This project aims to reveal the mixing and destratification mechanisms driven by turbulence from wind and sudden temperature change in oceanic and riverine systems through controlled laboratory experiments, targeted field measurements and theoretical modelling. Outcomes will include physical understanding, predictive models, and practical tools for waterway management, with the potential for better management of our riverine systems.							
	National Interest Test Statement							
	Periods of high temperature heat water bodies so the top layer is much warmer and less dense than the water below. This 'stratification' reduces mixing between the layers, blocking normal distribution of heat, oxygen and carbon dioxide. In Australian lowland rivers, hot summers caused by global warming are causing extreme stratification and, when it suddenly breaks down, mass fish kills. Understanding the physical mechanisms of destratification (turbulence and sudden temperature change) is key for water management in rivers and lakes, but our knowledge is currently limited. This project will use novel laboratory experiments, field data and modelling to create models of stratification dynamics, which will also apply to ocean processes and weather prediction. The models will help river managers predict stratification and destratification events so they can take actions (e.g. environmental flows) at critical times to avoid mass fish deaths and maintain the rivers for water supply and other uses. We plan to work with the Murray-Darling Basin Authority to apply the research to create management solutions.							

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DP230102614	**Brain states and their roles in evasive behaviour**	132,500.00	232,500.00	202,500.00	197,500.00	95,000.00	0.00	860,000.00
Scott, Prof Ethan K	Using cutting-edge custom microscopy, neuroinformatics, and optogenetics in the larval zebrafish model, this project aims to describe the neurons, circuits, and networks that govern brain states. These brain states, by altering sensory-response relationships, allow animals to tune their behaviour to their circumstances, and the small transparent brains of zebrafish offer the possibility to observe activity across all neurons in the brain while these processes occur in real time. Benefits would include knowledge gained about this fundamental property of the brain, further refinement of technologies in microscopy and biophyisics, and the training of Australia's next generation of optical physicists, neuroscientists, and mathematicians.							
	National Interest Test Statement							
	Animals, including humans, tune their behaviour to their environment. To respond appropriately to stimuli received by the senses, the same nerve cells and their connections function quite differently in different circumstances (e.g. at rest vs under threat). While tools exist to investigate the function of a whole brain or a single neuron, to date neuroscientists have not been able to study these different brain states. We will use advanced genetic tools in zebrafish that allow us to observe neurons firing in real time as the fish sense stimuli. We will develop new methods in optical physics to observe and model how a large neural network can quickly change its functional properties to suit its context. This fundamental biological research into how sensory information influences brain states will have wide application. In the long term, it may lead to a better understanding of conditions like autism that affect how people sense the environment. It will also aid engineers designing algorithms to receive information from artificial sensors used in robotics and artificial intelligence.							
DP230102652	**Characterising a novel stress-sensing signalling factor**	141,626.00	250,506.00	222,734.00	113,854.00	0.00	0.00	728,720.00
Parker, Dr Benjamin L	Aim: To understand how phosphorylation regulates signalling pathways to allow metabolic adaptations in response to energetic stress. Significance: A fundamental understanding of the activation of signalling pathways via phosphorylation is vital for our knowledge of homeostasis and the mechanisms controlling cell survival. Expected outcomes: To generate new systems biology and physiology data to understand how the stress response is regulated and characterise new stress-sensing pathways. Benefits: A greater understanding of the molecular mechanisms controlling metabolism in response to stress has extremely broad applications to improve metabolic efficiency in fields ranging from exercise- and life-sciences to agriculture.							
	National Interest Test Statement							
	Understanding how cells respond to stress (e.g. how muscle cells respond to exercise) is a fundamental research question in biology. Cellular stress activates enzymes known as kinases, but we do not know exactly how they function to preserve stressed cells from death. This project will develop new approaches to understand that process by studying the effects of kinases on cells experiencing exercise stress. We will also investigate a newly identified and uncharacterised protein that responds to exercise stress to see how it regulates fibre size, function and exercise capacity of skeletal muscle cells during ageing, injury and regeneration. Preliminary data suggest it has a role in boosting muscle strength. Understanding these mechanisms will inform research into how muscles adapt to exercise, recover from injury and decline with age. This is highly relevant to Australia's ageing population as maintaining muscle mass is key to healthy ageing. It could also lead to better livestock production and athletic performance. We will share our results at national and international conferences and in leading journals.							
DP230102657	**A Process-Based Framework for Open Innovation with Social Media Data**	45,129.00	92,293.50	98,903.00	51,738.50	0.00	0.00	288,064.00
Liu, Dr Libo	This project aims to improve the capacity of Australian businesses to derive value from social media data for innovation in an efficient manner, which is central to improving Australia's global competitiveness. This will be achieved by developing an open innovation process-based framework for social media, which utilises advanced analytics to unlock the value of social media data and provides the analytics tools required at each stage of the innovation process. The resulting outputs will allow local businesses to transform social media data into actionable insights for each of the three stages of the open innovation process through machine learning and social network analysis algorithms.							

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	National Interest Test Statement							
	Many Australian manufacturing and service businesses use social media, but few systematically use social media data to drive open innovation (innovation informed by people and knowledge outside the business); current analytical tools are not designed for that. Our project fills this critical gap by developing the first holistic, actionable, cost-efficient open access tool Australian businesses can use for open innovation. We will create advanced machine learning and social network analysis algorithms to identify innovative ideas for idea generation, lead-users for idea development and opinion leaders for idea commercialisation using easily accessible social media data. A local winery and a clothing manufacturer will pilot our tool to create new (or innovate old) products (e.g., herb-infused wine or sustainable clothing) and build a community of talent for innovation (e.g., engaging lead-users in product design); thus, reduce costs, risks and timescales of innovation and create new (or increase existing) revenue streams. Consumers will benefit from novel products/services that meet their needs and preferences.							
DP230102663	**Microcosm Experiments for Improved Species Distribution Models**	97,689.50	159,988.50	105,445.00	43,146.00	0.00	0.00	406,269.00
McCarthy, Prof Michael A	This project aims to use a spatially-explicit experimental system based on protists (microscopic organisms) to evaluate the predictive performance of dynamic distribution models, which are a newly-emerging class of species distribution models. Species distribution models are a fundamental part of ecological science, and underpin a range of applications related to managing threatened and invasive species. The project is expected to provide insights into when these models are likely to work better than more traditional correlative models in non-lab environments. The experiments will inform further development of dynamic distribution models, and help determine whether dynamic distribution models can be usefully applied to species management.							
	National Interest Test Statement							
	Species distribution models—mathematical models that predict the occurrence of species across landscapes—are a fundamental part of ecology used in settings from land-use planning to management of threatened and pest species. Traditional models correlate species occurrence or abundance at a location to local environmental variables. In contrast, new dynamic distribution models predict occurrence from models of population dynamics that are driven by environmental conditions. It is difficult to evaluate the behaviour of the two types of model with field data, which limits further refinement. This project uses an experimental system that provides a means to evaluate how accurately and reliably the models predict species abundance and distribution, and will help define the predictive limits of each method. Improved insight into these models will help users such as environmental government agencies and nongovernment organisations to manage the Australian environment and conserve biodiversity. Our links to and collaborations with such organisations will facilitate the application of our research findings.							
DP230102668	**Data-led bioengineering to uncover hidden chemical wealth in bacteria**	110,927.00	228,438.50	234,331.50	116,820.00	0.00	0.00	690,517.00
Stinear, Prof Tim S	The soil bacteria Nocardia are an untapped source of industrially prized chemical compounds called natural products. This project aims to develop innovative bioprospecting genomics technologies built from the disciplines of microbiology, biochemistry and computational statistics to discover hundreds of new natural products in Nocardia. This project will unlock the diversity of potent new enzymes and molecules with high economic value that could include insecticides to protect crops, bioactives to fight diseases, or new enzymes for food and biofuel production. This research unlocks enormous hidden chemical potential in soil bacteria, to build sustainable national economic growth through innovative, high-value industrial chemical development.							
	National Interest Test Statement							
	Soil microbes are a rich source of molecules called natural products (NPs) that are our most potent, industrially prized chemicals. For example, NPs are the basis of drugs to treat cancers and infectious diseases and manage organ transplants, and insecticides to protect crops. This project will develop fundamental knowledge of microbes and their natural products and create new technologies to speed their discovery. Our focus is an under-explored genus of soil bacteria that is rich in untapped NPs, including ones with potential to counteract antibiotic-resistant superbugs. We will use highly innovative modelling to link the NPs with the genetic basis for their biosynthesis, providing opportunity for future, low-cost commercial-scale production. The data and genetic blueprints will be available in open access to other researchers, and the computational tools developed will empower scientists to unlock the potential of their own data. Thus, this project could have far-reaching economic, commercial and social impacts across Australia by discovering high-value chemicals in bacteria found in Australian soils.							

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(Columns 1 and 2)	(Column 3)	2022-23 (Column 4)	2023-24 (Column 5)	2024-25 (Column 6)	2025-26* (Column 7)	2026-27* (Column 8)	2027-28* (Column 9)	(Column 10)
DP230102752	**Photoinduced Palladium Catalysis for Next Generation C-H Bond Activation**	94,916.50	189,833.00	194,833.00	99,916.50	0.00	0.00	579,499.00
Polyzos, Dr Anastasios	This project aims to discover new methods for the conversion of carbon-hydrogen bonds in organic molecules as a general strategy in chemical synthesis. A key conceptual advance in this project is the unification of transition metal catalysis and visible light as a powerful tool to activate these traditionally unreactive, yet abundant chemical bonds in alkanes. With application in fields that range from fine chemical production to drug discovery, the overarching aim of this research is to establish new carbon-hydrogen bond activation reactions and to demonstrate that this strategy can be translated to the invention of new pharmaceuticals, agrochemicals and advanced synthetic materials that will have societal impact.							
	National Interest Test Statement							
	Alkanes are simple organic molecules found mainly in oil and natural gas. This project will develop new ways to build chemicals from alkanes using visible light to catalyse reactions. Although alkanes are important raw materials of the chemical industry, they are relatively unreactive, limiting our ability to create new molecules from them to use in, for example, new fertilisers, pesticides and drugs. The new catalysis methods we develop will make it possible to create materials that are beyond the reach of current technologies. They can be applied to drug discovery and invention of advanced materials that do not yet exist for medicine, textiles, engineering and packaging. We will share these new processes with the Australian science and technology community, including CSIRO and local companies with established manufacturing capacity, who will gain a competitive advantage in producing high-value chemical products from simple hydrocarbon feedstock. This project will strengthen Australia's chemical sector and enhance Australia's supply chain resilience for key chemicals and pharmaceuticals.							
DP230102753	**Butyrophilin ligand sensing by the immune system**	71,530.50	140,794.50	116,923.00	47,659.00	0.00	0.00	376,907.00
Uldrich, Dr Adam P	T cells are an important part of the immune system, surveying our body and preventing many diseases. A subset of T cells, gamma delta T cells, are a crucial component of the immune system. A key problem is that the mechanism(s) controlling gamma delta T cell behaviour are poorly understood. This proposal aims to decode how these cells are triggered into action by using innovative tools to investigate the molecular basis underpinning their function. This project expects to create fundamental new knowledge regarding how gamma-delta T cells are regulated, which will ultimately allow us to harness these cells to improve health.							
	National Interest Test Statement							
	T cells are part of the immune system that surveys our body to eliminate pathogens and cancers. For this purpose, T cells use receptors designated as either alpha-beta or gamma-delta. While alpha-beta T cells are well studied, the mechanisms controlling gamma-delta T cell behaviour are poorly understood. This project aims to discover how gamma-delta T cells are triggered into action using sophisticated cell sorting and antibody markers to investigate the molecular basis underpinning their function. It builds on our data identifying a novel sensing mechanism that differs markedly from that used by alpha-beta T cells. This project will fill a major gap in our understanding of T cell immunology leading to future treatments for diseases such as infection and cancer. The work will secure new patents and industry partnerships that will enable adoption of the discoveries by industry to both improve human health and enhance Australia's economy.							
DP230102775	**Small Scalable Natural Language Models using Explicit Memory**	80,000.00	160,000.00	160,000.00	80,000.00	0.00	0.00	480,000.00
Drummond, Prof Tom	Deep neural networks have had spectacular success in natural language processing, seeing wide-spread deployment as part of automatic assistant devices in homes and cars, and across many valuable industries including finance, medicine and law. Fueling this success is the use of ever larger models, with exponentially increasing training resources, accompanying hardware and energy demands. This project aims to develop more compact models, based on the incorporation of an explicit searchable memory, which will dramatically reduce model size, hardware requirements and energy usage. This will make modern natural language processing more accessible, while also providing greater flexibility, allowing for more adaptable and portable technologies.							

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	National Interest Test Statement Artificial intelligence technologies are widely used in automatic assistant devices in homes, cars and many industries. AI uses natural language models—statistical representations of a language such as English—for analysing text, machine translation and captioning images. The best models use vast computer resources to run large complex artificial neural networks. We will create and share with other researchers and engineers an innovative model with much lower processing requirements and many operational advantages. Rather than training a model to memorise a whole dataset, our new, fast retrieval method will access a large external memory (like Wikipedia) as needed, making it quicker to update and customise, including addressing key problems such as misinformation spread and cultural bias. Voice-controlled virtual assistants will be capable of more sophisticated interactions than answering simple questions, and AI used in decision-making will be able to explain outcomes (e.g., denial of banking credit). Users will also benefit from more powerful AI mobile phone apps (e.g., faster and better translations).							
DP230102850 McKay, Prof Matthew R	**Engineering Methods for Resolving Complex Mutational Networks in Proteins** This project aims to develop a novel computational framework for resolving complex mutational networks that underpin how proteins function and evolve over time. It seeks to develop statistical inference methods that are robust, efficient, and widely applicable. The project will promote international collaboration and spawn multidisciplinary research by introducing parameter estimation and optimisation techniques that stem from signal processing, mobile wireless communications, and random matrix theory. The project's outputs can be used to understand diverse protein systems and have the potential to be applied to wide-ranging applications from protein engineering to brain signal analysis to vaccine design.	73,000.00	145,000.00	139,500.00	67,500.00	0.00	0.00	425,000.00
	National Interest Test Statement Proteins, encoded by DNA, represent the basic building blocks of life. But studying how genetic mutations affect the properties and actions of interacting proteins is notoriously difficult. This project is unique in addressing this fundamental biological problem with techniques from data science and engineering. We will produce efficient and robust algorithms and software tools that can be applied to analyse diverse and complex datasets, such as interacting systems of proteins, beyond the reach of existing technologies. This could aid researchers identifying the pathways used by bacterial proteins to acquire antibiotic resistance or the networks of cancer mutations that drive the disease. We will share our data and create easy-to-use software packages to help biological researchers benefit from our advances. This engineering “toolbox” will have broad application to translatable bioengineering technologies that will contribute significant social and economic benefits to Australia. Potential long-term applications include protein engineering, brain signal analysis and drug and vaccine design.							
DP230102908 Wirth, Prof Anthony I	**Fast effective clustering technologies for highly dynamic massive networks** Clustering is a fundamental data mining and analysis task. In an interconnected evolving world, friendships and information flows are modelled as large dynamic networks. Structural clustering and correlation clustering are important and well-studied approaches for static networks; for evolving networks, where links appear and disappear over time, we lack efficient techniques. Anticipated outcomes are new practical clustering algorithms for dynamic networks – with performance guarantees of efficiency and clustering quality – and prototype software, guiding us to pick a good clustering. Expected benefits include better understanding of spread in evolving social networks, accelerating the software testing cycle, and improved topic detection.	67,500.00	142,500.00	150,000.00	75,000.00	0.00	0.00	435,000.00
	National Interest Test Statement Massive volumes of data are continuously created and shared, such as from tweets or sensors. Grouping related items into clusters is essential for efficient and effective data mining and analysis. This grouping is critical, but current approaches struggle with the great volumes of rapidly changing data and lack reliable ways to know when clusters no longer make sense. This project aims to develop new algorithms that provide a new, richer approach to clustering in massive highly dynamic data networks. Paired with new visualisation techniques, they will enable faster, more reliable discovery of knowledge from data sources and thus improved interpretation of the social, information and traffic networks our society depends on. This project aims to produce an accessible easy-to-use prototype system to enable improved data-based insights for applications in marketing, software engineering and health that will deliver efficiencies and cost savings to industries that rely on real time data. Our tools will be shared with the academic, public-sector and industrial research communities and end-users in conferences, seminars and live demonstrations.							

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DP230102942	**Obstacles to Contract Enforcement in Indonesia**	53,781.00	142,704.00	142,460.00	53,537.00	0.00	0.00	392,482.00
Lindsey, Prof Timothy C	The Australia-Indonesia Comprehensive Economic Partnership (IA-CEPA) came into force in 2020 but foreign investment in Indonesia has consistently failed to meet targets, largely due to concerns about the lack of reliable and just judicial contract enforcement. This project aims to investigate why predictable and fair contract enforcement in Indonesia is so inaccessible, particularly for foreign investors, and, through doctrinal and empirical research, explain the causes of this situation. In partnership with Indonesian courts and lawyers, it also aims to support the development of legal and policy reform proposals that can help resolve Indonesia's commercial contract enforcement problems and encourage Australian investment there.							
	National Interest Test Statement							
	Indonesia is the world's fourth largest country, third largest democracy and largest Muslim nation and is predicted to have one of the world's five largest economies by 2050. It is of significant economic and strategic importance to Australia. In spite of the recently implemented Indonesia-Australia Comprehensive Economic Partnership (IA-CEPA), many Australian businesses avoid investing there because they do not trust the Indonesian legal system to protect their investments through reliable and just judicial contract enforcement. Although there is strong anecdotal evidence that contract enforcement is generally weak in Indonesia, there is a lack of detailed research to confirm this, let alone explain its causes and identify ways to improve the situation. This project aims to remedy these deficiencies through empirical research and, in partnership with Indonesian courts and lawyers, develop pragmatic legal and policy solutions to Indonesia's contract enforcement problems to support IA-CEPA. Doing so will allow Australian business to invest with much greater confidence in Indonesia's fast-growing economy.							
DP230103058	**Unravelling the brain circuits linking emotions and heart rate variability.**	200,482.50	335,564.00	272,901.50	137,820.00	0.00	0.00	946,768.00
Allen, Prof Andrew M	We are all familiar with the rapid breathing and heart pounding that occurs when we are frightened. Is the feeling of panic because we sense our heart pounding, or does our heart pound because we panic? This age-old question has resisted attempts to understand its neurobiological basis. This project aims to address this lack of knowledge using novel cutting-edge neuroscience methods that enable mapping of connected brain pathways and the ability to change the activity of specific brain cells with millisecond time resolution. The project will identify, and functionally characterise, the link between the heart and emotions, to gain new insights into the interaction between the autonomic nervous system and disordered emotional regulation.							
	National Interest Test Statement							
	Emotions such as anxiety are closely linked to breathing and heart rate, but for over 100 years we have asked: does anxiety raise heart rate or does a raised heart rate cause anxiety? This project conducts experiments designed to understand the link between higher brain neural pathways that regulate emotions and brainstem neural circuits that regulate heart function. We will map previously undescribed neural pathways between the brain and brain stem in rats. We will alter the activity of specific pathways, using innovative methods, to gain insight into their function during rest and under stress. To answer the question above, we will test whether interrupting the heart rate response to anxiety changes emotional perception. This basic research will improve our understanding of the anxiety disorders that affect many Australians and of the interaction between some mental health disorders, such as depression, and cardiovascular disease. Our results will provide a foundation for clinical studies testing the effect of changing breathing patterns to help moderate extreme emotional responses to triggering stimuli.							
DP230103117	**Human Leukocyte Antigen-A and -B regulation of Natural Killer cell function**	120,060.50	263,304.50	284,432.50	141,188.50	0.00	0.00	808,986.00
Brooks, Prof Andrew G	The aim of this project is to determine how genetic variation in the genes encoding cell surface receptors expressed by innate lymphocytes and the molecules they recognise diversifies their capacity to sense and respond to infection. This knowledge is critical for understanding why there are intrinsic differences between individuals with respect to their capacity to respond to different types of infection and will ultimately inform our capacity to better deploy personalised medicines.							

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	National Interest Test Statement							
	Precision medicine—personalised to an individual's genes, lifestyle and environment—has the potential to offer huge health and economic benefits to Australia arising from earlier identification of disease and ensuring that the initial treatment is the most appropriate. While the immune system responds to a wide range of diseases, we need to understand why the response differs so much between people. In the humans, one type of cell that plays a vital role in the immune response —the Natural Killer (NK) cell—shows unusually high genetic variation. This study investigates how this genetic variability determines how NK cells recognise and respond to unhealthy cells. As well as generating new knowledge of basic immune mechanisms, it will help define why the immune function differs between people, contributing to precision medicine for conditions such as cancer, motor neuron disease and transplantation. Our results will be shared with prominent researchers in a wide range of fields and will enhance ongoing partnerships with the biotechnology and pharmaceutical sectors.							
DP230103229 Young, A/Prof Morag J	**About time; a new biology for the mineralocorticoid receptor** Temporal control of cell function aligns biological pathways with environmental cues and is critical for optimal heath in mammals. This project will shed light on how a hormone receptor, the MR, modulates time keeping of biological clock time in cells. We will bring together cutting edge genetic modals and bioinformatic approaches with a unique set of research models to define the interaction between the MR and the circadian clock and its role in the normal biology of the heart. New data will significantly enhance our understanding of the biology of MR and cortisol for the circadian time keeping function in peripheral tissues, and gain a clearer understand how our heart cells adapt to environmental circadian disruptors such as shift work.	58,500.00	152,297.00	158,039.00	64,242.00	0.00	0.00	433,078.00
	National Interest Test Statement							
	This project is about how circadian rhythms and a hormone receptor (MR) coordinate to control cell and tissue function. Circadian rhythms are internal processes that regulates the sleep–wake cycle and repeats roughly every 24 hours and provide organization to biological processes. We recently discovered that the MR receptor regulates circadian rhythm function but do not know how. We will deliver new data showing how MR activity is controlled over time and the ensuing impact on tissue function. We will also define how the MR regulates the circadian clock in the process of adapting to environmental disruptors. Random work hours and poor sleep are increasing globally, profoundly affecting worker health, particularly in shift workers who live with disrupted circadian rhythms. Understanding the underlying biological processes determining tolerance or vulnerability to circadian disturbances is key to helping employers optimise work practices to maintain a healthy and effective workforce. This work will be shared with effected industries such as health, emergency services and mining sectors to assist in improving safety outcomes.							
	The University of Melbourne	4,624,845.50	9,545,201.50	9,418,723.00	4,712,114.00	251,374.50	37,627.50	28,589,886.00
	Victoria	11,022,440.00	22,617,079.50	22,240,399.00	11,099,198.00	491,066.00	37,627.50	67,507,810.00

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Western Australia								
Curtin University								
DP230100301	**Expanding the Foundation of Planetary Science**	96,000.00	202,000.00	212,000.00	106,000.00	0.00	0.00	616,000.00
Sansom, Dr Eleanor	Our understanding of the Solar System is based on a foundation of meteorite analyses. Knowing their orbital origin provides a critical spatial context, but we have this data for <0.1% of samples. This project aims to address this issue. There are 66 meteorite falls across Australia with orbits determined by the Desert Fireball Network that await recovery - more than the current global dataset. This project expects to generate new knowledge by applying an innovative search methodology using drones and machine learning. Expected outcomes include dramatically increasing the number of orbital meteorites. This should provide significant benefits. By linking meteorites to their parent asteroids every rock becomes a small sample-return mission.							
	National Interest Test Statement							
	Meteorites are the key to understanding the formation of our Solar System. Where they come from however, is mostly unknown. The Desert Fireball Network in Australia observes meteorite falls, and determines their orbital origins in the Solar System. Their recovery is an affordable alternative to $ billion dollar sample return missions. We have developed a search methodology that combines drone technology and cutting edge machine learning (ML) to recover DFN meteorites. It has the potential to double the global collection of these orbital meteorites. The innovation has applications far beyond planetary science. It is a complete remote-site workflow, designed to be easy train in the field, with drone observations linked to full logistical support, integrated into a system built for a rough field environment, with rapid ML analysis, and user interface allowing operators to evaluate candidates while still on site. Translation to industry and defence applications has already begun. Collaboration with Australian Army, WA Police and Fugro is underway to develop a tool for battlefield clearance and search & rescue.							
DP230100390	**Modelling, Design and Development of a Novel Wave-Energy Converter**	77,500.00	162,500.00	170,000.00	85,000.00	0.00	0.00	495,000.00
Do, Prof Duc K	Australia has an abundant source of wave-energy commercially untapped due to technical limitations of current wave-energy devices. This project aims to develop a novel wave-energy converter (WEC) that integrates energy capture and electricity generation through a single mechanism. This novel WEC can overcome or significantly reduce the drawbacks of existing WECs, is compact and light-weight (about 30 times less), ensures survivability, and has low-cost installation and maintenance. The project expects to deliver novel theoretical results in fluid-structure interaction, control systems and electrical conversion for WECs and other applications. The WEC will be demonstrated via a tested proof-of-concept physical model.							
	National Interest Test Statement							
	Australia possesses a vast wave-energy resource around its shores that is as yet untapped. The new wave-energy converter (WEC) to be developed in this project will enable Australia to exploit this energy resource. It also stands to make wave energy competitive in a global commercial market. The immediate applications of this project will make the utilization of (offshore) wave-energy resources possible in Australia, and hence will directly benefit the national electricity sector. Effective wave-energy conversion can then contribute to the replacement of existing fossil-fuel power stations and therefore to the achievement of Australia's target greenhouse-gas reductions. The new device can also create an increasingly valuable global export market for Australian renewable-energy technology. In addition to these directly targeted benefits, the fundamental findings will find applications throughout engineered systems in which existing motions can be utilized (for energy capture) or mitigated, such as the vibration of cars/trucks, bridges, and offshore platforms, thereby developing new products.							

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DP230100429	**Solid-State Battery Interface Design (SS-BID)**	82,500.00	162,500.00	160,000.00	80,000.00	0.00	0.00	485,000.00
Paskevicius, A/Prof Mark	This research project aims to use the world's best performing solid-state ion conductors to develop next generation solid-state batteries. Boron-rich electrolytes will be paired with lithium metal anodes to construct batteries that are more energy dense, safer, have wider operational temperature windows, and aim to be lower cost than existing Li-ion batteries. The current roadblock for these batteries lies in the poorly performing interfaces between anode, electrolyte and cathode. This research aims to develop new strategies to overcome these barriers and perform world-class measurement techniques to understand and optimise solid-state batteries to provide a commercially viable energy storage solution.							
	National Interest Test Statement							
	Despite Australia's great wealth of renewable sources for energy production, the transition to a green energy economy has been hindered by a lack of efficient and safe energy storage. Lithium-ion batteries are expensive, have limited operating temperatures, can pose safety risks, and have limited lifetimes. This research aims to develop new types of batteries that are smaller, higher voltage, cheaper and safer, providing significant improvements in storing energy. The research will be shared with Australian energy providers and emerging battery industries, building on existing links through the Future Battery Industries CRC, to promote adoption. Installing this technology in solar and wind farms across Australia will be a cheaper and more reliable option for the Renewable Energy Industry and aligns with Australia's pledge to reduce carbon emissions by 43% by 2030 and to net zero by 2050. The outcomes should thus include significant economic and environmental benefits and consolidate Australia as an international leader in energy storage development.							
DP230100685	**Efficient and selective water electrolysis for clean energy and environment**	95,659.50	182,543.50	116,319.00	29,435.00	0.00	0.00	423,957.00
Shao, Prof Dr Zongping	This project aims to develop an anion exchange membrane electrolysis cell for efficient co-generation of hydrogen and hydrogen peroxide from the splitting of water by coupling the hydrogen evolution reaction with a selective, two-electron water oxidation reaction catalysed by cost-effective, perovskite materials. This project expects to generate new knowledge in understanding the selective water electrolysis and in developing efficient energy conversion technologies. This project is expected to improve the utilisation of renewable energy and promote development of manufacturing and chemical industries in Australia. This should provide significant benefits to achieve energy safety and environmental sustainability for Australia.							
	National Interest Test Statement							
	This project will deliver a new technology that enables the conversion of renewable solar energy into hydrogen as a green fuel, and the production of a by-product, peroxide, which is important for wastewater treatment. The key concept lies in the development of an innovative electrocatalyst that enables efficient and selective production of peroxide instead of the formation of oxygen, which has little economic value. This approach reduces the energy input and increases the value of the products. The adoption of this innovative method can reduce atmospheric CO2 emissions and accelerate the transformation of Australia from fossil fuel use to sustainable hydrogen, setting a path to build Australia's hydrogen industry, thus providing new jobs. Peroxide can be used for wastewater treatment to provide cleaner water with substantial resulting societal benefits. The success of this project may offer more efficient options for production of useful chemicals, which will benefit Australia's manufacturing and chemical industries and lift Australia to a better position in the international market of energy export.							
DP230102079	**Development of a novel best approximation theory with applications**	63,500.00	128,500.00	131,500.00	66,500.00	0.00	0.00	390,000.00
Wu, Prof Yong Hong	The aim of this project is to develop an innovative best approximation theory for complex fractional boundary value problems with discontinuities and with no compactness, and then apply the theory to study two classes of complex partial differential equation boundary value problems with industrial applications. The work will lead to the development of a new theory and a suite of innovative analytical and computational methods for solving a wide range of nonlinear problems with singularities and non-local properties. The expected outcomes of the project will significantly advance our methods for the modelling and control of many industrial systems and processes.							

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	National Interest Test Statement							
	Optimal control of fluid flow is essential for the maximum efficiency of many engineering systems and industrial processes. This project will develop innovative mathematical and computational techniques to achieve accurate modelling and optimal control of complex fluid flows. The newly developed computational tools will have a wide range of applications from the control of fluid flow in underground oil reservoirs, to the flow of solutions in heap leaching for copper/gold extraction, and the control of fluid flow through microchannels in biomedical engineering and manufacturing. The project will deliver economic value through more efficient production and enhanced skill development for various industries. Research results from the project will be disseminated through industry training and skill development, and translation of the research will be facilitated through links with researchers and industries in relevant fields.							
DP230103085 Danisik, Dr Martin	**Novel tools for dating explosive volcanic eruptions in the critical window** This project will develop novel dating methods necessary for precise reconstruction of the eruption histories of super-volcanoes in the Asia-Pacific region over the last million years. The project outcomes will provide better models for predicting super-eruptions, thereby informing global climate change research, urban planning, and transport and telecommunications infrastructure engineering. Results will also improve existing volcanic risk models used by insurers to quantify volcanic risks and calculate expected losses from volcanic eruptions, and greatly improve our ability to use eruption deposits as time markers for important events in human evolution.	63,500.00	127,500.00	110,500.00	46,500.00	0.00	0.00	348,000.00
	National Interest Test Statement							
	The Asia-Pacific region is important to Australia for economic and strategic reasons. Many of Australia's immediate neighbouring economies are built on tectonically active plate boundaries that are at risk from the devastating impact of (super)volcanic eruptions such as recently evidenced in Tonga (2022 Hunga) and Indonesia (2019 Bali). Improvements in the design of natural hazard models is a social imperative, and one of the key parameters in assessing volcanic hazards is understanding the absolute age and frequency of past eruptions. This project will provide the new geochronology tools necessary to reconstruct the temporal framework of volcanic eruptions in Asia-Pacific countries over the last 1 million years. This will, in turn, allow Australia and its neighbours to develop better preparedness and emergency response measures, reducing the social and economic impact of these devastating events. Finally, this project will showcase the impressive suite of analytical facilities at an Australian institution and cement Australia's position at the forefront of geochronology and Earth science research worldwide.							
	Curtin University	478,659.50	965,543.50	900,319.00	413,435.00	0.00	0.00	2,757,957.00
The University of Western Australia								
DP230100051 Stewart, A/Prof Scott G	**Counting the Electrons: Nickel Catalysed Electrochemical C-H Activation** Modern chemical synthetic methods using organometallic catalysts are highly prized in chemical industry and provide a multibillion dollar driver for world economies. However, traditional catalysis is expensive because of the reliance on rare earth metals often conjunction with toxic additives or reagents. The aim of this work is to develop new inexpensive transition metal catalysts based on earth abundant nickel and harness the power of electrons through electrochemistry to dramatically improve the reactivity of these catalysts. This project will seek to improve the way both complex and commonly used chemicals constructed through an atom economical process with potentially renewably produced electrons.	105,500.00	206,000.00	189,000.00	88,500.00	0.00	0.00	589,000.00
	National Interest Test Statement							
	The ability to produce advanced materials, drugs and agricultural chemicals is important for the national economy. However, the preparation of these chemicals currently requires the use of expensive materials to speed up chemical reactions - catalysts - that are not manufactured in Australia and must be imported. This project aims to develop alternative catalysts based on nickel, which is an abundant Australian resource, in a process that can be driven by solar power. These new, low-cost and readily available catalysts can contribute to the growth and innovation of the Australian manufacturing industry by improving the supply chain for critical chemicals. This project will add value to our natural resources through the production of advanced materials, drugs, agricultural chemicals and new manufacturing processes. Australian manufacturers will be able to directly use these chemicals to create new potentially life-saving drugs and crop-protecting chemicals and bypass supply chain limitations.							

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DP230100248 Johns, Prof Michael L	**Monitoring Desalination Membrane Fouling using Sodium Magnetic Resonance** Seawater desalination using membrane modules is critical technology for potable water access, however it faces significant challenges due to fouling. Sodium magnetic resonance techniques will be developed to non-invasively detect and image salt accumulation in these opaque membrane modules due to fouling. These data will first be used to improve our understanding of the unexplored interplay between fouling and detrimental salt accumulation in the modules (known as cake-enhanced concentration polarisation) and thus validate 3D simulations of this phenomenon. The ability to unambiguously detect salt accumulation in membrane modules will then be extrapolated to a non-invasive monitoring tool for membrane fouling in desalination facilities.	72,500.00	157,500.00	152,500.00	67,500.00	0.00	0.00	450,000.00
	National Interest Test Statement Desalination is a method used to produce clean water supplies from sea water and is especially useful in Australia as it does not depend on rainfall. In order to purify the sea water, it is filtered through membranes, which can clog easily (called fouling) resulting in increased costs and less efficient production of fresh water. Early detection of fouling is essential to allow the membrane surface to be cleaned before the fouling becomes impossible to remove. However, current measurements are unable to detect this early fouling. This project aims to develop novel detection methods of the start of membrane fouling. Early detection will have economic and environmental benefits for Australia, saving money currently spent on filter cleaning and replacement, resulting in more reliable supplies of fresh water for a growing population. Australian industry and government agencies that make use of desalination will be able to easily adopt this technology to make the resultant clean water both cheaper and more reliable.							
DP230100262 Johns, Prof Michael L	**A New Spin on Liquid Hydrogen: Controlled Cold Energy** While hydrogen is set to play a leading role in global decarbonisation, significant challenges remain regarding methods for its reliable storage and transportation. Hydrogen liquefaction has emerged as a promising approach in this regard due to its high energy density and hydrogen purity, but is currently prohibitively expensive. In this project we will exploit the peculiar spin physics of hydrogen to alleviate liquefactions costs through the provision of controllable refrigeration (so-called 'cold energy') following regasification. In particular we will measure, optimise and exploit the highly endothermic catalysed conversion of para- to ortho- hydrogen, which can provide up to 525 kJ/kg of cooling at convenient temperatures.	100,000.00	205,000.00	202,500.00	97,500.00	0.00	0.00	605,000.00
	National Interest Test Statement Australia is very favourably placed to generate much of its energy needs from renewable sources such as wind and solar. However in order to ensure a continuous supply of energy from these sources, we need to develop cost-effective methods to store the energy generated. One option is to convert this energy into hydrogen, and then liquefy it for storage and transport. However, this process consumes a lot of additional energy and is expensive. The outcomes of this project will reduce the cost of converting hydrogen to a liquid by designing equipment to efficiently recover most of the additional energy used in this process, and then use this energy directly for refrigeration and air conditioning. This will have economic and environmental benefits for Australia as energy companies will be able to integrate this new technology into future liquid hydrogen facilities and hence provide cheaper storage of renewable energy. We will work with energy companies towards adoption of this cost effective energy storage solution.							

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DP230100522	**Rethinking collaborative federalism in Australian schooling policy**	45,000.00	92,500.00	72,650.00	25,150.00	0.00	0.00	235,300.00
Savage, A/Prof Glenn C	The governance of schooling in the Australian federation is in flux and undergoing significant contestation, with serious questions being asked about whether national policy arrangements are fit for purpose and decision-making processes are achieving the policy aspirations of collaborative federalism. This project aims to examine how Australian governments engage in collaborative schooling reform by focussing on processes associated with the formulation of the new post-2023 National School Reform Agreement. The research will engage in 'real time' policy analysis, engaging with policy stakeholders to examine collaborative processes centred on the new agreement, and to consider how to improve future national decision-making processes.							
	National Interest Test Statement							
	It is crucial for Australian governments to work together to produce effective policies to guide our nation's schools, yet there is limited research on the ingredients of successful collaboration in education. This research will examine how collaboration between Australian education departments and agencies can be improved to generate better outcomes in key areas such as curriculum, teaching and assessment. The project will work directly with policymakers to examine decision-making processes linked to the new National School Reform Agreement, which is a crucial policy for shaping reforms until 2028. The project will produce practical knowledge and advice for policymakers and bring them together to co-develop reforms linked to the agreement. The research has clear benefits for Australia, as improving schooling policies is key to our social and economic prosperity in a rapidly changing global environment. Research findings will be used to inform debates about the future of schooling through media outputs and public events, and will also be of significant interest and use to policymakers in other federations.							
DP230100568	**Roads to the Future: Infrastructure and the New Development in Africa**	37,386.00	149,242.00	215,992.50	152,263.00	48,126.50	0.00	603,010.00
Vokes, A/Prof Richard P	This project aims to conduct a comparative analysis of new road schemes in East Africa and the Western Indian Ocean (a region which sits at the intersection of several major global transport and development corridors), in order to understand their economic, socio-political, cultural and public health effects. As global road-building accelerates at an unprecedented rate, especially in the developing world, there is an urgent need for new models for understanding roads' potential economic benefits, as well as their risks, including their environmental risks. This project is benefitting citizens, NGOs, donors and governments, by generating new knowledge about how we have in the past, do at present, and should in the future, engage with roads.							
	National Interest Test Statement							
	This research is focusing on major new road-building projects in East Africa and the Western Indian Ocean, a key region of economic and strategic importance to Australia. It is looking at these road projects' economic, environmental, social, health and governance impacts, and in so doing is creating benefits for communities living adjacent to them. Currently there is no way of knowing if these projects are achieving their claimed economic benefits, what environmental, health and social impacts they are having, or how they are reshaping regional geo-politics. This research will place Australia at the forefront of sustainable international development at a time when China and Russia are investing billions in development finance, and the G7 is launching A$900 billion of new investment in sustainable infrastructure in developing economies. It will provide Australian policymakers and businesses with a blueprint for developing partnerships with Indo-Pacific countries, and for forecasting impacts of new road projects at home, especially in remote communities.							

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DP230100810	**Pyruvate provision for mitochondrial respiration in plants**	78,166.50	157,333.00	156,833.00	77,666.50	0.00	0.00	469,999.00
Millar, Prof Andrew H	This project aims to generate new knowledge about pyruvate provision for respiration in plants as it is a major pathway of carbon loss from plants. It will address specific gaps in knowledge about how pyruvate is provided to mitochondria for respiration, how channelling of pyruvate is achieved between components in this pathway and it will seek to engineering a new pyruvate supply pathway to change respiratory processes in plants. It will develop techniques for analysis of metabolic processes in plants and genetic proof for assumptions of how plant respiration works. Benefits will be training of early career researchers, enhanced international reputation of Australian plant science and new approaches to engineer respiratory rate in plants.							
	National Interest Test Statement							
	Agricultural crop plants absorb carbon. However, half the carbon that crop plants absorb through photosynthesis (making energy from sunlight) is subsequently lost back to the atmosphere as a waste product of plant growth processes (respiration). This CO2 release raises carbon emissions from agriculture and negatively affects the environment. This project will develop new approaches to decrease CO2 release by plants by pinpointing genes and biochemical strategies to slow unnecessary respiration. Plant breeding companies will be able to utilise this research to release new crop varieties that are more efficient and less environmentally damaging. Decreasing plant carbon emissions will have economic and environmental benefits for Australia as we will be able to produce more crops for export while lowering the carbon emissions from those crops.							
DP230100949	**Brain-skull interface: discovering the missing piece of head biomechanics**	97,500.00	200,000.00	185,000.00	82,500.00	0.00	0.00	565,000.00
Wittek, Prof Adam	Overall objective of this project is to measure, mathematically describe and implement in software mechanical properties of brain-skull interface – a critical component of current large and sophisticated computational models of the brain and the last missing piece of brain biomechanics knowledge. This will allow increased reliability of comprehensive biomechanical models used to simulate realistic injury and surgery scenarios. The problem is significant and urgent. Every year in Australia, there are over 22,000 cases of traumatic brain injury, some of which could be prevented by better passive and active countermeasures; and over 12,000 neurosurgical procedures that surgical simulation could make more accurate and therefore safer.							
	National Interest Test Statement							
	Every year in Australia over 22,000 people suffer a traumatic brain injury, and over 12,000 neurosurgical operations are performed. This project integrates knowledge of brain biomechanics with computer modelling techniques to create software to design safety devices to prevent traumatic brain injury (TBI), as well as surgical simulation to improve surgery accuracy and safety. Currently, gaps in knowledge of brain function and limitations of current computational techniques limit our ability to improve design of safety devices and create accurate surgical simulations. Our research will uncover this missing knowledge and develop software for advanced computer simulations to run on off-the-shelf personal computers. Software produced as a result of this research will be made available to the engineering and medical communities, to enable adoption of the outcomes. Australia will benefit economically through a reduced incidence of disabling brain injuries, and reduced costs from caring for people with brain injury.							
DP230101190	**Carboxylate exudation and phosphorus acquisition in eucalypts**	83,155.00	191,379.00	176,889.00	68,665.00	0.00	0.00	520,088.00
Lambers, Em/Prof Johannes (Hans) T	Eucalypts are thought to rely on mycorrhizas to acquire phosphorus (P). Using leaf manganese concentrations in the field to proxy rhizosphere carboxylates, followed by plant growth in low P-solutions, it was shown that some, but not all eucalypts that grow on P-impoverished soils release carboxylates from their roots. This trait is a strategy of Proteaceae to access soil P, but assumed not to be used by eucalypts. This game-changing discovery challenges the current dogma that eucalypts invariably rely on mycorrhizas to acquire P. This project will explore the significance of this newly-described trait for functioning of eucalypts more broadly and produce results that are important for conservation, restoration and forestry activities.							

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	National Interest Test Statement							
	Native Australian eucalypts are thought to depend on fungi living close to their roots to acquire phosphorus, an essential nutrient that frequently limits plant growth. However recent research has shown that this is not always the case, because some eucalypts instead release organic acids which convert unavailable soil phosphorus into a form that is available to roots. This project will explore how widespread the release of these organic acids is among Australian eucalypts. This will allow conservationists and tree growers to decide which species to grow based on known soil and climate conditions. This will also result in economic and environmental benefit for Australia as we will be able to breed for eucalypts that are better able to access soil phosphorus and reduce the dependence on phosphorus fertilisers. Adoption of these results will be through communication with conservationists, eucalypt growers and breeders.							
DP230101268 Giudici, Prof Michael R	**Symmetry: Groups, Graphs, Number Fields and Loops** Exploiting symmetry can greatly simplify complex mathematical problems. This project aims to apply the powerful Classification of Finite Simple Groups to advance our understanding of the internal structure of number fields, highly symmetric graphs, and algebraic structures associated with Latin squares. The project expects to generate new constructions and classifications utilising group theory. Expected outcomes include resolutions of major open problems in each area as well as innovative methods for studying algebraic and combinatorial structures based on group actions. Expected benefits include enhanced international collaboration, and highly trained mathematicians to strengthen Australia's research standing in fundamental science.	59,500.00	121,500.00	124,500.00	62,500.00	0.00	0.00	368,000.00
	National Interest Test Statement							
	Cutting-edge mathematics research is essential so that Australia can respond to challenges in robust communications, cryptography and cyber-security. Highly symmetric mathematical structures and systems are very common in these applications. This project will develop the mathematical theory of symmetry and symmetric structures to advance our understanding of these areas. We expect to generate new mathematical methods and theory, allowing us to resolve decades-old questions. This strengthened theory of symmetry will be communicated to the wider international mathematical community to maximise the range of resulting translatable applications in the mathematical and physical sciences such as the encoding schemes that allow us to receive high-quality images from space, or send secure communications with our mobile phones. The project supports world-leading research in group theory, and fosters Australian intellectual property and international competitiveness. It will train early career researchers in advanced science, technology, engineering, and mathematics, and so strengthen Australia's STEM workforce.							
DP230101545 Chooi, Dr Yit-Heng	**Engineering Fungal Nonribosomal Peptide Synthetases for Novel Alkaloids** This project aims to use protein-domain shuffling aided by structural biology to decode and engineer a class of modular megaenzymes, called nonribosomal peptide synthetases (NRPSs), in fungi. These are responsible for the biosynthesis of peptide-derived bioactive molecules, such as the antibiotic penicillin and the immunosuppressant cyclosporin. Expected outcomes of this project include a fungal NRPS engineering platform for generating new molecules with desirable biological activities that can be readily scaled up for sustainable bioproduction. This will provide significant benefits to Australia through the development of cutting-edge biotechnologies as well as the discovery of new pharmaceuticals, veterinary products and agrichemicals.	88,150.00	176,150.00	165,500.00	77,500.00	0.00	0.00	507,300.00
	National Interest Test Statement							
	Fungi have an extraordinary ability to produce molecules that are useful to humans, such as penicillin. However, fungi make these molecules for their own survival, so the molecules often require alterations to make them suitable for human use (i.e. life-saving drugs or pesticides). In order to do so, we need to learn more about the enzymes that fungi use to make these molecules. This project aims to decode these enzymes, to allow us to engineer them to make new molecules designed for our needs. The outcome will be a new ability to generate high-value molecules, such as pharmaceuticals, veterinary medicines and pesticides, that will have economic and commercial benefits for the Australian pharmaceutical and agricultural industries. Translation of this research would be achieved through engagement with these industries.							

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DP230101629 Kuzenko, Prof Sergei M	**Conformal Field Theories with Higher Spin Symmetry and Duality Invariance** This project aims to develop novel methods to study conformal field theories with higher spin symmetry and duality invarianvce that are important in variety of applications ranging from cosmology to phenomenology of elementary particles. The project expects to advance our knowledge in one of the most challenging areas of modern theoretical physics - Quantum Gravity and physics beyond the Standard Model of particle physics. Its expected outcomes will be new conceptual results of major significance for modern theoretical and mathematical physics, thus placing Australia at the forefront of this research. Benefits will include a rich intellectual environment for training Australian PhD students by internationally recognised experts.	74,000.00	149,000.00	153,500.00	78,500.00	0.00	0.00	455,000.00
	National Interest Test Statement Quantum mechanics is the study of nature at the scale of atoms and subatomic particles. This understanding can be used to develop exciting new quantum technologies – such as unbreakable data encryption to prevent hacking, and advanced sensors that would make MRI technology used in medical scanning more accurate. This project will deepen our understanding of quantum technology for the development of new uses in the future. It will bring together an internationally recognised team with a proven track record in pushing the boundaries of research in quantum physics, which will be critical to an integrated approach by Australia in maintaining our leading role in the quantum revolution into the future. The research will have economic and commercial benefits for Australia as the intellectual property developed through this work will be held in Australia. This research will be translated and adopted through relationships with industry partners in relevant fields, such as cybersecurity and medical imaging.							
DP230101849 O'Loughlin, Prof Conleth D	**Reducing geotechnical design conservatism to secure floating wind energy** The next frontier for offshore wind energy is moving further out to sea to avail of stronger and more consistent wind speeds. In these water depths, wind turbines are installed on floaters tethered to anchors in the seabed. Geotechnical design of anchors is inherently conservative, having been shaped by technical and economic considerations of oil and gas facilities. The offshore wind energy industry cannot afford to adopt such conservatism if floating wind is to become commercially viable. This project will, through numerical developments, geotechnical centrifuge modelling and field testing, develop the science that will lead to a reliability-based geotechnical design approach to make floating offshore wind energy economic and viable.	101,450.00	228,350.00	195,900.00	69,000.00	0.00	0.00	594,700.00
	National Interest Test Statement Offshore wind will play a major role in energy generation into the future, with plans in place for enough floating wind projects on Australia’s coastlines to power over 6 million homes. This scale of renewable energy development will require thousands of anchors to keep the floating wind turbines in position. However, anchoring costs are currently a barrier to Australia’s offshore wind energy ambitions. Research outcomes from this project will allow for a design approach that identifies and adopts improvements in seabed strength, allowing for smaller and therefore less expensive anchors. These outcomes will be made publicly available as a web-based application design tool that can be directly adopted in engineering practice. This research will result in economic, environmental and societal benefits for Australia by reducing costs of generating affordable clean energy, creating sustainable jobs, and training the next generation of engineers for this industry.							

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DP230102786	**New Silent Anchors for Floating Offshore Wind Turbines in Calcareous Sand**	85,000.00	160,000.00	145,500.00	70,500.00	0.00	0.00	461,000.00
Hu, Prof Yuxia	Reliable wind energy sites are in deeper waters and require offshore floating structures to harness the wind energy. Such floating structures require a reliable anchoring system that is secure and environmentally friendly. Calcareous sands, rich in carbonate content, pose unique challenges with their behaviour difficult to predict. In this project, a novel silent anchoring system is investigated that can be installed with minimum noise and vibration compared to more traditional counterparts. Through the state of the art development in numerical modelling and centrifuge modelling, this project will advance Australian Science and Practice in designing floating wind turbines in carbonate rich soils offshore and help energy transition.							
	National Interest Test Statement							
	Floating wind turbines and floating wave energy devices can help us generate more renewable energy offshore. But for this to happen, we need to attach these devices to solid foundations that are friendly to marine life. The project aims to develop this kind of foundation in the challenging seabed soils off the Australian coast. It will lead to new design guidelines for engineers developing offshore renewable energy devices with foundations that are suited to Australian seabed conditions and similar conditions around the world. The resulting improvement in the design of these foundations will place Australia in a leading global position in the development of floating offshore renewable energy devices and support our transition to renewable energy. The research team works closely with the offshore industry in Australia and around the world, and these long-standing ties can help ensure that the research is translated into widely adopted new technologies.							
DP230103081	**Micro-electromechanical technology for harnessing terahertz waves**	104,012.00	192,352.00	172,852.00	84,512.00	0.00	0.00	553,728.00
Martyniuk, A/Prof Mariusz	This project proposes novel low-cost miniature devices for spectral, spatial and temporal manipulation of terahertz waves realised using a unified platform based on a single material and fabrication technology sufficiently generic to span the entire very broad terahertz band. It inherently overcomes the most hindering issue of current terahertz instruments relating to the limited span of the spectrum each tool can cover and the high costs associated with increasing this span; removing the need for making spectral band compromises in the design of future tools. The intended outcome is a platform for terahertz spectroscopic imaging, target recognition, detection of chemical composition of objects, and future high-bandwidth communications.							
	National Interest Test Statement							
	Imaging technologies are key to many aspects of our lives, from medical images to diagnose and treat disease to satellite images to monitor melting ice caps. Imaging at different wavelengths of light can reveal new information, extending the applications of these technologies. Traditional imaging components such as lenses and mirrors work only across a limited range of wavelengths. Creating imaging systems that use long wavelengths, in the 'terahertz' range, requires novel materials and production methods. In this project, we will develop low-cost, miniature devices, using existing semiconductor manufacturing methods, that can be mass-produced, to manipulate terahertz waves. This will allow exciting new uses of terahertz light waves in drug detection, medical imaging and pharmacology. This technology will also be used for remote and real-time sensing and monitoring in key Australian industries, e.g., agriculture and mining, and in border security, aerospace and defence. These developments will form the basis of new products and markets.							
DP230103095	**Why is (re)development hot?: Measuring cumulative heat in Australian cities**	108,470.50	218,571.50	137,036.00	26,935.00	0.00	0.00	491,013.00
Boruff, A/Prof Bryan J	Incremental (re)development of Australia's residential areas occurs piecemeal, with varied planning oversight, and results in potentially harmful cumulative warming. This project aims to causally identify the warming effect of residential (re)development and investigate the impact of planning policies that control changes in the built form associated with increased heat exposure. Using large geospatial datasets and a quasi-experimental research design, warming in Australia's suburbs over the past decade at the micro (street canyon)- and neighbourhood-scales, will be attributed to (re)development types and 'fissures' in policy to inform climate resilient planning.							

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	National Interest Test Statement							
	Extreme heat kills more Australians than any other natural hazard (36,000 between 2006-2017), affects mental and physical health, and reduces economic productivity (by 35%). More than 7 in 10 Australians live in cities, where the worst heatwaves occur because there is less vegetation cover and more hard surfaces. Our cities are growing, with current enthusiasm for increased density over 'urban sprawl', which can magnify heat exposure even further. Yet, there is little understanding of how this increased warming accumulates across our streets and suburbs as they (re)develop and densify. This project will measure the warming effect of different types of (re)development and suggest climate-resilient planning policies that mitigate increased heat exposure. These outcomes will provide social and health benefits for Australia, as our results will give planners the evidence they need to make our dense cities more liveable. Adoption of our results will occur through direct interaction with the Australian planning community and through advocacy more broadly with Government stakeholders, and the media.							
DP230103107	**Synthetic biology tools for just-in-time control of biosynthetic pathways**	76,466.50	152,933.00	152,933.00	76,466.50	0.00	0.00	458,799.00
Fritz, Dr Georg	Synthetic biology enables sustainable synthesis of precious chemicals, ranging from drugs to biomaterials. Using microbes, high production levels are usually attained by overexpressing the genes that make the desired product, but this simple approach often fails for antibiotics and other compounds that are toxic to microbes. Using synthetic biology this project builds genetic circuits enabling smart, just-in-time activation of target genes, which is pervasive in natural pathways. Using these circuits we will boost 1) the production of a valuable antibiotic and 2) calcite precipitation in self-healing concrete. This approach enables the biosynthesis of many other chemicals, leading to cleaner and greener bio-factories.							
	National Interest Test Statement							
	In recent years, there has been a rapid expansion in government-funded bio-foundries, which are accelerating the adoption of synthetic biology. These global efforts are underpinned by the benefits synthetic biology has to offer, such as cheaper and safer bioproduction of chemicals from sustainable sources, plus the opportunity to produce highly complex and valuable molecules. The synthetic biology approach we propose here will improve the productivity of novel bioproduction pipelines, allowing us to cheaply manufacture antimicrobials that help to combat the rising superbug crisis as well as smart biomaterials, such as self-healing concrete, supporting safer and more durable building construction. This will not only advance Australia's manufacturing capacity but also provide direly needed drugs to improve human and animal health, with potential benefits to the health and food sector.							
	The University of Western Australia	1,316,256.50	2,757,810.50	2,599,085.50	1,205,658.00	48,126.50	0.00	7,926,937.00
	Western Australia	1,794,916.00	3,723,354.00	3,499,404.50	1,619,093.00	48,126.50	0.00	10,684,894.00
		35,974,916.50	**74,279,418.50**	**72,692,349.50**	**36,037,178.00**	**2,029,805.00**	**380,474.50**	**221,394,142.00**

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