Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
Australian Capital Territory								
The Australian National University								
DP210100088 Huber, Prof Thomas	This highly interdisciplinary project aims to establish new tools to analyse the structure and motions of proteins that are otherwise difficult to study. A combination of advanced biochemistry, modern magnetic spectroscopy methods, and high-performance computing techniques will be applied to study proteins at physiological concentrations and in complex environments. New techniques will be developed and tested on proteins of high biochemical or biomedical importance, and the approach will be applied to established drug targets. **National Interest Test Statement** Proteins are the essential building blocks of life. Among their many important functions, proteins are critical for signaling to molecules, scaffolding cell structure, and acting as the functional components in molecular machines. Embedded in membranes or floating in solution, proteins have a defined structure and motion which dictates their function. We aim to develop new tools to study large and complex protein systems within their native environment. Our approach uses innovative biochemistry and modern magnetic spectroscopy methods coupled with high-performance computing. These tools provide both the structural information and the motion of important disease-related proteins to define function. The knowledge gained from this project will provide new design criteria for pharmaceuticals and related therapies. It will enhance Australia's capacity to respond to existing and emergent invasive diseases, improving health and welfare outcomes into the future.	76,500.00	154,500.00	155,000.00	77,000.00	0.00	0.00	463,000.00
DP210100401 Canudas Romo, A/Prof Vladimir	This project aims to improve methodological tools for calculating life expectancy for populations with mental or physical disorders in Australia as well as to determine gains and losses in terms of excess mortality. To achieve this goal innovative measures, which solve methodological previous shortcoming regarding different age at diagnosis will be applied. The expected outcomes of the project include precise figures of excess mortality related to mental and physical disorders. Significant benefits for future public policy-making will be gained by analysing excess mortality among individuals diagnosed mental or physical disorders, and cross-country comparisons using national linkage data. **National Interest Test Statement** Mental or physical disorders shorten people's life spans. Yet, previous attempts at assessing life expectancy of people with disorders have failed at addressing the fact that diseases occur at different ages. This project resolves this methodological shortcoming and develops precision metrics, which will be used to determine trends of mental health or physical disorders that affect Australians. By analysing national linkage data, we will identify gaps in longevity between those diagnosed and the general population. The outcomes of this project will inform people with disorders, healthcare providers and decision-makers regarding exact life expectancies and, thereby, generate information on diseases, which ought to be addressed more comprehensively. Thus, supporting all levels of the health system to improve quality of life for those suffering from health disorders. The findings from this project will provide critical insights into the recent gains and losses in Australian life expectancy of populations diagnosed disorders; which will help in establishing priorities for coming public health efforts.	92,500.00	175,500.00	168,000.00	106,304.50	21,304.50	0.00	563,609.00
DP210100454 Hicks, Dr Jamie	This project aims to develop a range of complexes based around earth abundant metals that are capable of activating nitrogen (N2) at ambient pressure and temperature. The project expects to generate new knowledge in the area of organometallic chemistry, specifically with regards to molecular metal-metal bonding and subsequent reactivity towards the activation of nitrogen. The activation of atmospheric nitrogen is performed on a multi-million tonne scale each year and is key to a number of industrial processes. As such, investigations into new and improved catalysts for this process would potentially bring huge financial benefits to industry, as well as benefiting the environment by reducing energy demand and associated climate change.	60,000.00	120,000.00	110,000.00	50,000.00	0.00	0.00	340,000.00

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	The reaction between nitrogen (N2) and hydrogen (H2) to synthesise ammonia (NH3) is performed on a massive scale globally as ammonia is a primary feedstock in a number of industrial processes. Most important amongst these is the synthesis of fertiliser (95% of consumption), without which the global population would require 4 times the current cultivatable land. However, due to the relatively low activity of the current catalyst, the current process to synthesise ammonia (Haber-Bosch) requires extremely high pressures (>20 MPa) and temperatures (450°C). As a result, the synthesis of ammonia consumes 1-2% of the worlds annual energy supply and produces approximately 300 million tonnes of atmospheric carbon dioxide each year. Developing a catalyst that can perform this reaction under much lower pressures and temperatures would result in huge benefits to both industry and the environment. Some benefits include lower production cost of ammonia (and consequently fertiliser) whilst also considerably reducing the global atmospheric CO2 emissions, a major contributor to climate change.							
DP210100471 Peakall, Prof Rod	This project aims to determine the changes in key floral volatile compounds underpinning pollination transitions, identify their molecular basis, and understand the ecological processes favouring reversals away from extreme specialisation. By focusing on pollination of sexually deceptive Australian orchids, this project would be the first to determine the molecular, chemical and behavioural basis of evolutionary reversals to more generalised strategies in a group of plants facing high risk of pollinator extinction. The expected outcome, a mechanistic understanding of how pollination transitions occur, would be internationally ground-breaking, and provide crucial insights to protect this diverse but highly threatened group of plants.	67,125.00	147,250.00	146,500.00	66,375.00	0.00	0.00	427,250.00
	National Interest Test Statement							
	Australian orchids are widely known and loved by the public as a national treasure. They are also renowned worldwide for their unique flowers and extraordinary pollination strategies, and have featured in high-profile international documentaries. Yet because of their specialised pollination requirements they are extremely vulnerable to climatic extremes, the effects of habitat fragmentation and degradation, and increasing fire frequency and severity, with many species already listed as nationally endangered. This study will: 1. Improve Australian orchid conservation outcomes by obtaining critical knowledge on their pollination strategies and their evolutionary flexibility in the face of environmental change, 2. Enable science-community engagement through revealing the evolutionary origins of some of our best-known plants 3. Build a national database of biological, chemical and genomic data as a key resource for ongoing theoretical and conservation studies of Australian orchids, 4. Discover new scent compounds and their associated genes with the potential for future commercial use in perfumes and flavours.							
DP210100820 Keogh, Prof J. Scott	This project aims to address fundamental questions about the diversification of Australian species and to have practical and impactful outcomes. It will leverage previous ARC funded research on the phylogenomics of Australian reptiles and amphibians and apply sophisticated analytical tools for quantifying and evaluating biological diversity in multiple dimensions and in a phylogenetic context. The expected outcomes include a publicly accessible comprehensive database that will be integrated with the Atlas of Living Australia and rigorous testing of a series of hypotheses concerning how old and recent Australian groups evolved in response to biotic invasions and climate change.	89,427.00	162,635.50	146,415.50	73,207.00	0.00	0.00	471,685.00
	National Interest Test Statement							
	This project will play a significant role in advancing understanding of part of Australia’s unique biodiversity in the light of evolution. Our study will consolidate diverse genetic, distributional, ecological and morphological data sets for all of Australia’s frogs and squamate reptiles. The project will deliver improved understanding by applying sophisticated analytical tools for quantifying and evaluating biological diversity. Outcomes will include a continental-scale assessment of form vs function across Australia’s diverse landscapes and rigorous testing of a series of hypotheses concerning how old and young Australian groups evolved in response to climate change. Our project will deliver a comprehensive publicly accessible database which will be integrated with the Atlas of Living Australia. Our project benefits Australia by directly addressing the governmental research priority on environmental change and our results and approach can be applied to any other system in Australia or world-wide.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101121 Dowding, Prof Keith M	The project aims to uncover the determinants of successful careers of elected and non-elected political elites. The project expects to generate new knowledge about elite career paths (politicians, political staff, media, interest group personnel and bureaucrats), examine the impact of political elites on the quality of government, and whether this has changed over time. The project should provide significant benefits to academics via theoretical development of processes driving careers progression and establishing Australia as a benchmark case facilitating future international collaboration. It hopes to enhance the capacity of citizens and policy makers to assess the overall effectiveness of governance and the regulation of political life.	64,639.00	133,827.50	110,601.00	41,412.50	0.00	0.00	350,480.00
	National Interest Test Statement Australians' trust in the government is at an all-time low and citizens are concerned about the representativeness of those who lead the country. This project tackles this national concern by analysing the career paths of political elites in Australia and how they impact on how we are governed. By tracing the characteristics and relationships of those 'at the top', this project will help the Australian community to understand more clearly why some representatives make it to the top, and others do not. The Government has taken steps to make it clearer to the public how political careers operate by establishing a Commonwealth Integrity Commission (CIC). This project furthers this important national priority by providing the evidence base needed for honest debate about the representativeness of those we elect. It can show us how to make career success in politics a clearer and fairer process that the community can trust and to improve the overall quality of government.							
DP210101141 Jatrana, A/Prof Santosh	Current evidence suggests that humanitarian migrants settle less successfully than other immigrants both economically and socially. This project aims to examine the causal mechanisms and pathways to economic, sociocultural and political settlement outcomes of humanitarian migrants to Australia. This project expects to generate new knowledge in the area of humanitarian migrants' settlement by using nationally representative data and cutting-edge longitudinal techniques.Expected outcomes include enhanced research capacity in causal methods, interdisciplinary and institutional collaborations, and evidence-based social policy for humanitarian migrants, significantly benefitting humanitarian migrants directly and society more broadly.	60,000.00	124,000.00	124,000.00	60,000.00	0.00	0.00	368,000.00
	National Interest Test Statement Australia spends $ 207 million/ year on humanitarian migrants' settlement services. However, humanitarian migrants settle less successfully than other immigrants. The project will improve understanding of the factors that aid or hinder the successful settlement of humanitarian migrants in Australia by analysing longitudinal and nationally representative data set. In doing so, it will provide empirically robust evidence to critical policy question "what is the best intervention?" to improve settlement outcome of humanitarian migrants. Understanding factors shaping positive settlement outcomes is an essential first step to improve humanitarian migrants' settlement services and policies. Such knowledge is critical for the economic and social contribution of humanitarian migrants and their civic participation to society. Given the enormous costs to settlement services, these outcomes will save millions of dollars from the national budget. This project will offer an empirically grounded, evidence-based policy response to reduce settlement disadvantage faced by humanitarian migrants.							
DP210101152 Noble, Dr Daniel W	This project aims to investigate how maternal contributions to offspring developmental environments affect metabolism, learning, growth, and survival of offspring. This project expects to provide mechanistic and evolutionary insights into how changes in metabolic function, brought about by changes in the developmental environment, contribute to variation in learning and life-history. Expected outcomes include an in-depth understanding of how changes in maternal investment and hormones impact offspring developing in different thermal environments and how such changes are mediated by compromised physiological function – providing significant benefits in understanding population persistence in Australia's rapidly changing climate.	65,354.50	136,554.00	137,625.50	66,426.00	0.00	0.00	405,960.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement The project is expected to have a number of environmental, economic, and social benefits to the Australian community. Environmental benefits include an increased understanding of how organisms and populations can respond and adapt to Australia's rapidly changing climate, where severe drought and changes in temperature will impact on resource availability and early developmental conditions (targetting the ARC's Environmental Change Research Priority). Given that biological science research contributes substantially to the Australian economy, amounting to about 5% GDP or $65 billion dollars, this proposed project will yield social and economic benefits by promoting fundamental research that solidifies Australia's reputation as a world leader in evolutionary ecology and providing knowledge that can be used in plant and animal breeding programs, which may help bolster populations of endangered species and improve economic returns. This project will also forge research ties with leading national and international researchers providing superb opportunities for training students and postdoctoral researchers.							
DP210101186 Lemay-Hebert, Dr Nicolas S	This project investigates the impacts of security mapping and the use of specific color-codes by United Nations peacekeeping operations when assessing risks. It will for the first time trace the origins of United Nations security mapping practices and compare key case studies: Afghanistan (green zone), Somalia (white zone), South Sudan and Kenya (blue zones) and Haiti (red and yellow zones). Expected outcomes include better understanding of how policy-makers assess risks on the ground, how security maps are drafted and modified across time, as well as an understanding of the meanings given to specific color-codes. The findings expect to benefit Australian and other policy makers seeking to design better security interventions.	49,143.50	133,759.50	123,955.00	39,339.00	0.00	0.00	346,197.00
	National Interest Test Statement Australia is renowned as an active contributor of personnel to peacekeeping missions, especially in our region. But the UN security maps determining how those operations are mounted seem to be produced by factors outside of strict efficiency, efficacy and safety considerations. It is in Australia's interest to improve the safety of its peacekeeping personnel. This project seeks to understand how the UN and other agencies translate risk assessment into operational maps, which then determine the deployment of personnel and resources. More effective peacekeeping fosters rules-based order, which is pivotal to Australia's regional security and the future prosperity of economies in the region. Through close partnerships with the Australian Government and other agencies, this project will deliver a set of recommendations on managing risk in peacekeeping operations. The uptake of these recommendations will lead to improved safety of peacekeepers and the local populations they aim to protect, efficiency and efficacy of peacekeeping.							
DP210101201 Stuchbery, Prof Andrew E	This Project aims to elucidate the nature of nuclear vibrations. Evidence is mounting that nuclear excitations long identified as vibrations cannot truly be so. This shakes the foundations of nuclear theory. Coulomb excitation and transfer reaction experiments are to be developed to probe the structure of these quantum states. Expected outcomes include clarification of their true nature and a deeper understanding of why nuclei differ from other many-body quantum systems that do vibrate. Anticipated benefits include enduring methodologies to facilitate international research engagement, and rigorous hands-on training in nuclear methods, to help meet Australia's need for nuclear-qualified personnel in health, mining, industry and security.	114,500.00	226,500.00	225,000.00	113,000.00	0.00	0.00	679,000.00
	National Interest Test Statement The aim of this project is to advance the fundamental understanding of atomic nuclei by developing new experimental capabilities at Australia's Heavy Ion Accelerator Facility. The Project thus aims to enhance international scientific exchanges by attracting top scientists to a world-class Australian facility, and promote opportunities for Australians to lead experiments at the top overseas accelerator laboratories. It will serve society by enabling rigorous hands-on training in state-of-the-art nuclear techniques. Nuclear-based technologies are broad ranging and central to diverse public agencies and private industries. Highly skilled personnel are needed for applications in medicine, environmental monitoring, industry, and to support Australia's leading role in nuclear safety, security and non-proliferation. Two current high-technology national projects that require nuclear expertise are Australia's first proton cancer-therapy centre under construction, and the developing Australian space industry, which requires radiation-proof instrumentation.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101292 Kivshar, Prof Yuri S	This project aims to address a big challenge in nanophotonics by developing revolutionary methods for efficient chiral sensing of molecules without the need for spectrometry, frequency scanning, or moving mechanical parts, and to enhance chiroptical signals a hundredfold with the help of metasurface structures. Resonant metasurfaces are arrays of engineered dielectric nanoparticles with extraordinary characteristics, and they would allow to overcome current limitations of chiral sensing analytical tools. Detecting chiral molecules in low concentrations is crucially important to many fields of biology, chemistry, and pharmacy, as well as to the food and cosmetics industries, constituting a market of tens of billions of dollars.	116,026.00	236,982.00	220,673.50	99,717.50	0.00	0.00	673,399.00
	National Interest Test Statement The emerging field of metaphotonics addresses important problems at the frontier of modern physics, and it is one of the hottest areas of research in optics. This project aims to employ the fundamental concepts of resonant metaphotonics to achieve novel functionalities of metasurfaces with the world-first demonstrations of disruptive sensing applications including chiral sensing. Detecting chiral molecules in low concentrations is crucially important to many fields of biology, chemistry, and pharmacy, as well as to the food and cosmetics industries. The project will develop nanophotonic methods capable of efficient chiral sensing of molecules without the need for spectrometry, frequency scanning, or moving mechanical parts, and to enhance chiroptical signals from novel types of resonant nanostructures. This project will provide an innovative research environment for students and postdoctoral fellows, creating unique opportunities to foster skilled people for academic research and upcoming industries in Australia.							
DP210101312 Kingston, Dr Andrew M	This project aims to achieve safer, faster, and cheaper 3D X-ray imaging through a technique known as ghost imaging. X-ray imaging provides valuable information about internal structures, however, X-rays are carcinogenic and exposure (or dose) should be limited. Ghost imaging is an unconventional technique developed with visible light that has many potential benefits over conventional imaging. This research group are world leaders in ghost imaging and expect to develop software and hardware techniques to realise its potential and extend it to ghost tomography. The focus of this project is on reducing cancer risk in medical imaging, and allowing real-time quality control for 3D printing in safety-critical industries such as aerospace.	54,500.00	134,500.00	130,000.00	50,000.00	0.00	0.00	369,000.00
	National Interest Test Statement The key outcome of this project is anticipated to be a "ghost tomography" method for reducing the X-ray dose required for 3D imaging. This method would enable inspection of the internal structure of a medical patient, scientific sample, or industrial part, to become cheaper, faster, and less dangerous. In addition to reducing the cancer risk of medical CT scans, this approach could revolutionise medical imaging by making X-ray screening for early signs of disease safer, cheaper, and more accessible. This would improve early detection of diseases in Australia's ageing population. In Australian industry, additive manufacturing (3D printing) is a rapidly developing technology. The ability to digitise a spare parts inventory makes commercial sense in the automotive and aerospace sectors. However, quality control of the individual custom-printed replacement parts is a significant impediment to its widespread adoption. Rapid, cheap ghost tomography is anticipated to be a viable method for quality control in these safety-critical industries.							
DP210101517 McAllister, Prof Ian	Declining public support is one of the greatest challenges to democracy. In 2019, Australia recorded the lowest level of trust in politics on record. This project aims to understand the reasons for declining political trust and satisfaction with democracy in Australia. The project hopes to field the 2022-25 Australian Election Study to address these issues by surveying a representative sample of voters following the 2022 and 2025 Australian federal elections, in addition to continuing a longitudinal survey started in 2016. The project wants to add to an unbroken series of publicly available data on Australian political behaviour since 1987, while also producing new insights into how individual opinions change over time.	16,304.50	113,304.50	113,304.50	40,804.50	92,000.00	67,500.00	443,218.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Democracy requires the unconditional support of the public to survive and prosper. Understanding the reasons for the recent decline in public support for democracy is therefore crucial to maintaining the future health of Australian democracy. The project aims to identify the drivers of trust (and distrust). It seeks to provide independent, robust evidence to help inform policy makers and politicians about possible reform measures which could halt the decline. It also aims to provide an important educational asset for voters, by providing up-to-date information about how the political system functions and modifying voter expectations about what the system can deliver in practice. Finally, the project seeks to enrich civic education among school and university students by providing them a better understanding of the role of public opinion in the political process in general, and on how we vote and why.							
DP210101569 O'Neill, Prof Hugh S	This project aims to measure the high-temperature geochemical properties of the precious metals, which include gold, silver and the platinum group elements. The measurements are needed to quantify the partitioning of the precious metals between silicate melts and metal or sulfide, which would enable their distinctive geochemical properties to be applied to the testing of current hypotheses on how Earth formed, the composition of Earth's mantle through time, the relationship of Earth to the Moon, and the evolution of magmatic systems to form copper-gold deposits. The measurements have become feasible due to newly developed experimental and analytical methods, which avoid the problems that have bedevilled previous attempts.	55,994.50	120,889.00	132,989.00	68,094.50	0.00	0.00	377,967.00
	National Interest Test Statement							
	The precious metals share distinctive geochemical properties, understanding which will have multiple applications. For Australia's economy, these include modelling how ores form, predicting which magma systems are prospective for gold and/or copper, and which are barren, and extracting precious metals as a by-product of smelting ores, particularly nickel ores where the value of unrecovered platinum group elements in Australian tailing dams alone exceeds $1.5 billion. Improved knowledge of precious metal partitioning relations can test hypotheses on how Earth and other rocky planets accreted, the relationship between Earth and the Moon, and the extent and timing of of mixing of late meteoritic additions into Earth's mantle. These latter questions are central to understanding our planet and its place in the solar system, and addressing them will maintain Australia's high international standing in the Earth sciences. The experimental research to be undertaken provides excellent training for students because of the wide range of skills involved.							
DP210101585 Malins, Dr Lara R	Peptides and proteins are increasingly important therapies for the treatment of disease. Nevertheless, the synthesis and optimisation of these high-value compounds still relies primarily on technologies developed decades ago. There is a desperate need for modern strategies to unlock the full potential of peptides and proteins for diverse applications in drug discovery. This interdisciplinary research aims to develop new tools for the construction and modification of peptides and proteins by harnessing the energy in a unique class of strained molecules. A focus on peptide-based inhibitors of the proteasome, a critical target for modern cancer treatments, should provide future health and economic benefits for the Australian community.	50,000.00	120,000.00	140,000.00	70,000.00	0.00	0.00	380,000.00
	National Interest Test Statement							
	This project aims to create modern tools for the development of new medicines. The fundamental knowledge gained has potential to contribute to the health and well-being of Australians, directly addressing one of our nation's critical Science and Research Priorities. Outcomes of the proposed research include new chemical reagents, novel tools for drug discovery, and promising therapeutic molecules with future applications in the treatment of cancer. These technologies have vast potential for translation into the growing Australian biotechnology and pharmaceutical sectors, thus fueling economic growth through innovation. The cutting-edge and multi-disciplinary research will also provide world-class training for Australia's next generation of scientists. This critical investment in our future will elevate Australia's standing as a global leader in the chemical and biological sciences.							
DP210101643 Breunig, Prof Robert V	This project aims to produce evidence that can be used to address problem gambling in Australia. Problem gambling is a major issue, costing Australians over $4.7 billion per year. Better understanding of problem gambling and better policy coming from our project have the potential to significantly improve the lives of Australians--their labour market performance, their mental health and the quality of their relationships. This project will generate new knowledge by using a novel approach where problem gamblers are considered in the context of their families. Using quantitative data over more than 10 years, this project seeks to produce new evidence about how problem gamblers affect their families and how families help or harm gamblers.	33,965.50	65,532.00	73,692.00	42,125.50	0.00	0.00	215,315.00

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement Problem gambling costs Australia at least $4.7 billion per year. Our focus on problem gamblers and their families will provide new information that can be used to design programs to assist problem gamblers and affected individuals around them. We study the role that families play in helping problem gamblers and in the coping mechanisms that families use to care for each other in the presence of a problem gambler. We look at the negative effects that problem gamblers cause for those around them--particularly children and partners. Better data on problem gambling and the effect that it has on families will bring economic, social and cultural benefits to Australia. Problem gambling has major economic impacts through lost productivity of problem gamblers and harm to families. Problem gambling can lead to mental health problems, financial stress and relationship breakdown all of which harm the social and cultural fabric of society. This novel research will generate ideas for new policy based on a better understanding of the real impacts of problem gambling.							
DP210101727 Putt, Dr Judy	The project aims to result in improved knowledge and community acknowledgement of sexual violence against children in Papua New Guinea (PNG), and an approach that could be adapted and adopted in other low income, fragile contexts. It is a very significant project because sexual violence against children is a widespread and escalating social problem, with a very limited capacity to respond to reported incidents. Working closely with two specialist services to trial and assess a low-cost approach, the project is expected to result in longer-term support for child survivors and their families, and reduce further victimisation and offending. The potential benefits are multiple and far ranging, in PNG and in the Pacific region more broadly.	88,306.00	157,241.00	145,911.00	76,976.00	0.00	0.00	468,434.00
	National Interest Test Statement The proposed research will have significant and ground-breaking social benefits to Australia and the Pacific region. Very little investigation has been undertaken in Papua New Guinea (PNG) on sexual violence against children. Focusing on preventing and reducing the harms of child sexual abuse is known to provide direct and indirect benefits to survivors, their families and communities, future generations and wider society. The project results will be of considerable relevance and interest to service providers in multi-cultural Australia, and to key stakeholders in PNG and other low-income countries in the Pacific region. The Pacific Step-Up is one of Australia's highest foreign policy priorities, and PNG receives the biggest share of foreign aid. The project has the potential to inform future policy priorities and program development in aid for the region, and demonstrate leadership on a social problem that is a major concern to all societies and governments in the region.							
DP210101757 Whitney, Prof Spencer	A solution for improving crop yield is to enhance the carbon dioxide fixation properties of the enzyme Rubisco whose inefficient activity often limits plant growth. This project makes use of new synthetic biology capabilities to artificially evolve Rubisco in the laboratory and select for new versions with improved performance. These beneficial changes will be introduced into crop Rubisco using targeted gene editing approaches and the improvements in photosynthesis, growth and yield evaluated. This information will aid complimentary biotechnological efforts seeking to supercharge photosynthesis and help deliver the second Green Revolution needed to meet the improvement required in future agriculture productivity and resource use.	92,067.50	188,195.00	188,646.50	92,519.00	0.00	0.00	561,428.00
	National Interest Test Statement There will be economic benefits for Australian agricultural food production if crops such as wheat and canola could be made to produce more product, more economically and with less impact on the environment. This project proposes fundamental research towards achieving these benefits - improving crop production with reduced need for water and nitrogen. The research uses new technologies that enable us to escape the confines of natural evolution and identify unique, naturally inaccessible, solutions for improving the performance of the photosynthetic protein Rubisco, the carbon dioxide fixation enzyme whose inept activity often limits crop growth. Artificially evolving an improved Rubisco is vital towards supercharging crop photosynthesis to help boost yield and resource use. Of additional importance, this project will continue to foster research training excellence in a first-class research environment and advance our international standing in the field of Synthetic Biology and its application in “smart plant” Ag-biotech applications to meet the growing Australian and global food demands.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101798 Ireland, Prof Trevor R	This year sees the highly anticipated return of the Hayabusa2 spacecraft to Woomera carrying samples of the asteroid Ryugu. This is only the fifth extraterrestrial sample return mission in history. The research team has been invited to participate in the preliminary examination which will take place in Japan in early 2021. The investigators have developed unique analytical skills that allow measurement of small amounts of rock for oxygen isotope compositions at unprecedented precision. This project aims to characterise a suite of carbonaceous chondrites, which appear to be the best match to Ryugu, and therefore will provide the exemplar data to understand the provenance of Ryugu, and place it in the context of solar system materials.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
	National Interest Test Statement International Space Programs are the fundamental conduit for any country, including Australia, to develop the infrastructure necessary for exploiting space related resources. Through participation in the upcoming Japanese Hayabusa 2 space mission, this project will draw on Australia's unique analytical capabilities to examine preliminary samples returned from the mission. The project will develop protocols for analysing samples from space and unravelling each sample's solar system history. Expected outcomes include boosting visibility of Australia's capability in extraterrestrial materials analysis and asteroid characterisation in the region, and building relational links between the new Australian Space Agency and a high level international space research project for future productive collaboration. Longer term, this fundamental research will benefit Australia economically by helping to guide our space industry in future exploration of asteroids for commercial purposes.							
DP210101938 Petersen, Prof Ian R	This project aims to develop new methods for the design of robust coherent controllers for emerging applications to quantum systems and networks. Using robust controllers which are themselves quantum systems, tools from the theory of optimal risk sensitive control aim to enable technological systems to be designed with high levels of performance in the face of unavoidable uncertainties due to imperfect fabrication and interactions with the environment. The research aims to yield systematic control engineering methods to combat the effects of quantum decoherence which is critical in order to make quantum technologies such as quantum computing truly practical. Applications include computing, secure communications, sensing and simulations	83,349.50	166,699.00	166,699.00	83,349.50	0.00	0.00	500,097.00
	National Interest Test Statement Quantum technologies have the potential to lead to a whole new technological infrastructure. Already major companies such as IBM, Google and Microsoft are making major investments in quantum computing and quantum measurement technologies are achieving stunning scientific advances such as the detection of gravitational waves. Australia is strongly positioned to be part of this quantum revolution with our strengths in quantum physics, but quantum technology is now moving to a phase where its progress requires advances in engineering and in particular control engineering. This project will help produce those advances, concentrating on new types of control systems in which both the system being controlled and controller are quantum in nature and which have the robustness necessary to operate in demanding quantum environments. The research will advance Australia's capabilities in quantum control engineering and provide research training to Research Associates and Postgraduate Students, improving our ability to apply emerging quantum technologies in areas like manufacturing, medicine, the environment, and defence.							
DP210102020 Sellars, A/Prof Matthew J	This project aims to develop the technology to connect superconducting quantum computers to the future quantum internet: an optical interconnect. Superconducting qubits are a leading quantum computing system, but their practical use is limited by their microwave operation frequency, as global quantum networks will operate at optical frequencies. This project aims to solve this problem by converting the microwave photons that carry superconducting quantum information to optical photons. To achieve high efficiency the project will investigate magnetically ordered rare-earth crystals, which uniquely possess the strong optical and microwave coupling required, to build a converter that could greatly enhance the capabilities of quantum computers.	92,500.00	177,500.00	165,000.00	80,000.00	0.00	0.00	515,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement Australia has been a research world leader in the rapidly growing field of quantum information technology for over a decade. Currently, there is a concerted national effort to translate this strong research position into an internationally competitive high-technology industry. Such an industry would contribute not only to Australia's economy, generating high-quality jobs, but also support the country's cybersecurity efforts. This project aims to address a key outstanding issue in the field, the inability to interface quantum computers to quantum communication networks. As with conventional computing, the full potential of quantum computers will only be realised when they are networked. This project will greatly add value to Australia's investment in quantum information by developing knowledge and techniques to enable superconducting quantum computers to be interconnected via optical communication systems. Given the number of commercial players developing superconducting quantum computers, there will be a substantial market for such a device to base the growth of an Australian startup quantum enterprise.							
DP210102243 Batchelor, Prof Murray T	This project aims to calculate and understand the physical properties of free parafermions. Parafermions have attracted interest in topological schemes for quantum computation because they are computationally more powerful than Majorana fermions. The core of this project is a fundamental model of free parafermions, which has been shown to exhibit unexplained puzzling properties. The project outcomes include an in-depth understanding of this model by taking the non-Hermitian features into account, establishing a connection with open quantum systems. Non-Hermitian systems are also of increasing relevance in physics, especially in quantum optics. The project also aims to contribute to training researchers in the mathematical sciences.	52,500.00	105,000.00	102,500.00	50,000.00	0.00	0.00	310,000.00
	National Interest Test Statement Quantum computers will enable unprecedented advances in information processing across many domains of national interest such as drug development, cybersecurity, financial modelling, and climate change science. Among the approaches in the quest to design and build quantum computers of ever-greater power by global giants such as Intel, IBM, Google and Microsoft, a particularly powerful approach is the possibility to employ parafermions. This project will develop the mathematical theory of the unexplained physical properties of parafermions. Expected outcomes include revealing the fundamental aspects of quantum physics that will be relevant to new applications of quantum devices in the above-mentioned domains. A further outcome will be training the next generation of highly skilled workers to drive Australia's growing quantum industry. These outcomes will contribute to Australia's longer-term participation in and economic benefit from the quantum and computational industries.							
DP210102267 Moritz, Prof Craig C	This project aims to resolve the factors that lead to the mixing of species' gene pools, with a focus on whether climate change will increase such mixing, possibly leading to extinction by genetic swamping. The significance is that the project would improve our understanding of speciation and species' vulnerability to rapid climate change through genetic mixing; a largely overlooked process. Key outcomes would be to generate new knowledge of a fundamental evolutionary process and extend the toolbox of biodiversity managers facing rapid environmental change. The project would benefit Australia by highlighting our unique biodiversity and scientific capability, and by training early career researchers in advanced evolutionary biology.	101,000.00	190,500.00	151,000.00	61,500.00	0.00	0.00	504,000.00
	National Interest Test Statement Australia is the only biologically megadiverse OECD nation. Our unique and diverse fauna, combined with high level expertise in evolutionary biology enable us to contribute significantly to global science. The project would (i) highlight the strength of evolutionary biology in Australia, (ii) build further capacity by training young scientists in advanced concepts and methods, (iii) improve our knowledge of tropical diversity in Australia, and (iv) by considering the role of genetic exchange between species under changing climates, extend our understanding of the consequences of rapid climate change for Australia's globally unique biodiversity. The project aligns clearly with the National Research Priority – Environmental Change. The project builds on substantial prior investments from the Australian Research Council and other sources, which have produced foundational data, insights, and materials. This foundation now enables us to advance our knowledge of the important, but largely overlooked, process of climate-driven genetic mixing of species.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102273 McKay, Prof Brendan D	This project aims to investigate graph isomorphism, a fundamental problem in graph theory, using deep learning techniques. Solutions to graph isomorphism are in demand by researchers in many fields of science, such as biology, chemistry, computer science, and quantum computing. The project expects to advance knowledge about graph isomorphism and state-of-the-art methodologies for its applications. The expected outcomes include new theoretical insights on combinatorial structures of graphs, efficient heuristic techniques for (maximum) subgraph isomorphism, and structured representation learning. The project should provide significant benefits to research in a wide range of science fields, as well as many real-world applications.	68,221.00	134,537.00	135,362.50	69,046.50	0.00	0.00	407,167.00
	National Interest Test Statement Graph isomorphism is a fundamental concept for exploiting the structure of graphs which we will explore through development of new heuristic techniques and theories. The research in this project will keep Australia in its position at the forefront of this field and has the potential to significantly benefit many research areas, including computer science, biology, chemistry, social science and quantum computing. More generally, it can contribute to any areas that have data or complex objects being modelled as graphs. Economically and commercially, it can enhance efficiency and quality of graph data analysis, lowering business costs and strengthening Australian industries and government agents to be more competitive on a global scale. The research will also benefit environmental planning in urban analytics and city sciences, global warming graph analysis, etc. Socially and culturally, it could provide solutions for necessary components of many research projects across science, e.g., social network analysis, cyber security analysis, anomaly detection and sociocultural analysis.							
DP210102385 Preiss, Prof Thomas	This project aims to investigate a new layer of genomic control mediated not by DNA but instead by chemical modifications found on the cell's working copies of genetic information called messenger RNA. The investigations will use cutting-edge RNA sequencing technology and the fruit fly model organism to uncover the scope and mechanisms by which such modifications enact their roles at the molecular level and within the body plan of an animal. Expected outcomes include novel molecular tools and models that will assist in understanding and manipulating the function of genomes. Such knowledge should provide benefits in developing innovative biotechnology applications of use in human health, agriculture and managing the environment.	124,370.00	249,440.00	248,640.00	123,570.00	0.00	0.00	746,020.00
	National Interest Test Statement All living cells selectively retrieve information from their genome in response to a changing environment. The genome is earmarked chemically to express this information into gene products. However, a much more diverse range of chemical marks also exists for these gene products. But their broader role for cells and organisms is still largely unknown. This project will leverage new technologies to scope out the function of this novel layer of gene control in the very tractable fruit fly model. Outcomes will assist in understanding and manipulating the function of genomes in other species, including Australia’s wildlife, species of economic importance in Australia’s agriculture, and pathogens, thereby potentially benefitting the whole of Australia’s society. Some new insights to be generated will enable the development of intellectual property and drive technological innovations with strong potential for economic impact at the national level. Environmental benefits might stretch to areas such as bioremediation and mitigation against the effect of climate change on Australia’s diverse ecosystems.							
DP210102513 Sterelny, Prof Kim	The aim of this project is to investigate the evolution of social norms, and their causal role in social life and its breakdown. It expects to generate new knowledge in this area through the application of new formal techniques to existing hypotheses; especially causal analysis, evolutionary game theory, and phylogenetic cross-cultural testing for empirically plausibility. Expected outcomes include theory development, improved research infrastructure and training in collaboration with international partners, and theoretical recommendations for policy intervention. This should allow greater insight and control over the levers of peaceful social life, both in traditional societies, and in large, open, multi-cultural nations like Australia.	40,738.00	81,588.50	80,207.00	39,356.50	0.00	0.00	241,890.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Producing and maintaining healthy and peaceful societies in large, multi-cultural nations like Australia, requires knowledge of the full range of social systems, and recognition that many of the most pressing problems for humanity are failures of cooperation. This project seeks to understand the challenges resulting from the social norms and behaviours that influence and disrupt the way we operate as a society. Working in collaboration with a range of leading international scholars, this research will generate new knowledge of the fundamental role cooperation plays in human social life. It will provide key material to build the skills and capabilities of policy makers and practitioners alike, and pave the way for the development of more sophisticated and effective interventions in public policy. Having greater insight into how and why we function the way we do as a society will ensure that Australia has the cutting-edge expertise crucial to supporting our future economic prosperity, security and cohesion as a nation.							
DP210102607 Mahony, Prof Robert E	This project aims to enable autonomous robotic systems to operate more robustly and more reliably in the complex, cluttered and dynamic environments found in real-world applications. Applying the latest understanding of symmetry in non-linear systems and control provides tools that can be used to develop new design methodologies for spatial awareness algorithms. The outcomes of this project should increase Australia's capacity in high-tech systems and deliver world best open source code for spatial awareness problems to enable the next generation of automation in Australia.	83,978.00	170,706.00	177,884.00	91,156.00	0.00	0.00	523,724.00
	National Interest Test Statement							
	Society is on the cusp of a revolution in robotics in which autonomous robotic systems will play a transformative role in labour-intensive industries such as construction, agriculture, logistics, and transport, and impact everyone's daily lives through consumer devices such as autonomous toys, vacuum cleaners, and lawnmowers. The spatial awareness algorithms developed in this project will drive improved performance in robustness, safety and reliability of real-world robots operating in complex, cluttered and dynamic environments that challenge and break existing algorithms. Coupled with the human capacity developed through direct alumni from the project team and the education program proposed, the project will contribute to accelerating the rate of automation in essential Australian industry sectors such as agriculture and transport. Applications of the technology will improve autonomous harvesting and autonomous driving, for example, and will contribute to an estimated additional $AU1 trillion in value of the Australian economy flowing from advanced automation by 2030.							
DP210102739 Wright, Dr Duncan J	The project aims to provide a high-resolution archaeological record of ritual mobility by examining a Torres Strait Islander initiation pathway. The project is expected to generate new knowledge about human movement and improve public understanding of Indigenous peoples connection with country. Anticipated outcomes of the multi-disciplinary and community-led research include the first detailed record of ancient ritual mobility in northern Australia and development of a web-based system to transfer archival information between cultural institutions and remote communities. This should provide significant benefits and assist Meriam people to engage with their cultural heritage and expand public knowledge about Indigenous forms of mobility.	43,100.50	110,559.00	112,684.00	60,876.50	15,651.00	0.00	342,871.00
	National Interest Test Statement							
	The Australian Government’s Torres Strait and Northern Peninsula Area Regional Plan (2009-2029) has prioritised building healthy and resilient First Nation communities. To improve community well-being, the Plan recognises the need to conserve and revive Torres Strait Islander and Aboriginal traditions and to provide communities with autonomy over the process by which heritage is protected and promoted. But there is a problem. Many traditions and cultural behaviours are connected to ancestral sites that are no longer visited while sacred objects, archival photographs and stories about ancestral heroes were taken in the past and are held in overseas institutions. This project seeks to reconnect Torres Strait people with their ritual sites through archaeological investigations, and to repatriate cultural heritage that belong to the region in the form of a digital archive. By doing this, the project directly benefits the people of the Torres Strait to maintain their traditional culture and history, and to share these with the wider Australian community.							
DP210102784 Tran, A/Prof Chung	This project aims to develop a new methodology to study trends in inequality in Australia. It expects to advance the body of knowledge by measuring inequality in living standards over the whole lifetime and by identifying the role of the Australian fiscal system in redistributing lifetime resources across households and generations. This new approach would help clarify the potential bias embedded in commonly used inequality indicators based on current-year income. Its findings expect to provide new insights into how the gains from economic growth have been shared among Australians. It should also offer policy options for designing a better tax and transfer system that would sustain economic prosperity and fairness in Australia.	36,000.00	69,500.00	73,500.00	40,000.00	0.00	0.00	219,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	The tax and transfer (fiscal) system is one of core components of Australia's national infrastructure and a policy tool to enable economic prosperity and social fairness as well as to protect national interests and the wellbeing of Australians in the face of negative events. This research will develop a new methodology to measure the growing inequality in Australia, using a lifetime approach. The new knowledge acquired by this research will provide a more accurate understanding of the evolution of the trend towards inequality and the role of fiscal policy and taxation in Australia. It will contribute to enhancing the efficiency and fairness of Australia's tax and transfer system—the most critical national infrastructure. It will equip the Australian government with a better policy tool to effectively respond to rising dispersion in living standards due to changing national and global conditions. Overall, the research is expected to offer a more efficient and fairer design of the Australian tax system to sustain economic prosperity and social fairness for Australians in the twenty-first century.							
DP210102801 Gedeon, Prof Tamás (Tom) D	We aim to investigate computer vision training data and test data, using automatically generated data sets for facial expression recognition and object re-identification. This project expects to quantify and understand the domain gap, the distribution difference between training and test data sets. Expected outcomes of this project are insights on measuring the domain gap, the ability to estimate model performance without accessing expensive test labels and improvements to system generalisation. This should provide significant benefits for computer vision applications that currently require expensive labelling, and commercial and economic benefits across sectors such as transportation, security and manufacturing.	83,083.50	165,543.00	170,252.00	87,792.50	0.00	0.00	506,671.00
	National Interest Test Statement							
	Computer vision is a field of research aimed at developing technologies to help computers 'see' and understand the content of digital images such as photos and videos. With this research, computer vision researchers will be able to better understand their systems and explore new environments with greater efficiency and precision. The expected outcomes of this research include (1) quantitative insights on measuring the domain gap between datasets, (2) the ability to estimate model performance without accessing test labels, and (3) improvements to system generalisation using optimally generated training data. The project is expected to bring commercial and economic benefits across sectors in Australia such as transportation, security and manufacturing. It will enable access to a wide range of applications where large-scale real-world annotations are expensive to obtain, including autonomous driving, defect detection and visual analysis in smoke conditions.							
DP210102806 Glushenkov, Dr Alexey M	The project aims to develop dual-ion electrochemical systems. In contrast to conventional single-ion rechargeable cells, the charge storage process in the cathodes of these devices is facilitated by a second, negative ion. Dual-ion systems represent robust alternatives to current lithium-ion batteries and lithium-ion capacitors, addressing their sustainability and energy density limitations. The project's outcomes are in the form of new sustainable energy storage technologies with attrative energy and power densities for a wide range of applications. This should provide a significant benefit to society, the economy and the environment in enabling an easier transition to clean energy and ensuring energy security in Australia.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
	National Interest Test Statement							
	Electrochemical energy storage plays a major role in Australia's economy and society. Batteries and related storage devices are the key components of critical applications – power grid security and stabilisation, home energy storage and electrification of transport. The outcomes of this project will have a strong impact on many critical uses that currently depend on lithium-ion batteries and lithium-ion capacitors. The reliance on cobalt, nickel and lithium, mineral resources available in insufficient quantities but widely used in lithium-ion batteries, represents a significant risk for Australia. This project will lead to new, sustainable electrochemical systems that use abundant natural feedstock and have energy storage performances rivaling or exceeding those of current technologies. The project's results are expected to enable efficient decision making in future energy policy. Its benefits include the prospects of cheaper domestic energy for the households as well as decreasing pollution and carbon emissions. These economic, environmental and social benefits are in the national interest of Australia.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103002 Liang, Prof Weifa	This project aims to develop a suite of novel algorithms and enabling technologies for service provisioning of the Internet of Things (IoT) applications in mobile edge computing (MEC). This project will develop performance-guaranteed algorithms and core technologies for IoT service provisioning through effective cost modelling. The project expects to lay theoretical foundations, discover key principles and generate new knowledge for IoT service provisioning in MEC. The expected outcome of the project is a suite of solutions to the myriad of IoT services in MEC including e-Health and autonomous vehicles. This project should also develop key fundamental technologies to improve Australia's standing in the international research community.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement The Internet of Things (IoT) that connects smart objects to the Internet is the next frontier in the digital revolution. With the number of IoT devices connecting to the Internet estimated to reach 25 billion by 2021, limitations for delay-sensitive IoT applications, for example improved critical medical health monitoring, must be overcome. Mobile edge computing technology promises real-time, high-bandwidth, and low-latency access to network resources, and fills the storage and performance gap between centralised clouds and IoT devices. This project will develop novel algorithms and core enabling technologies for efficient service provisioning of IoT applications in mobile edge computing environments. Project outcomes will provide the foundation for innovative markets including e-Health, disaster monitoring, autonomous vehicles in smart cities, and precision agriculture. The fundamental research of mobile edge computing for IoT applications will also enable Australia to maintain a position of world leadership in the Information and Communications Technology field.							
DP210103186 Farquhar, Prof Graham D	This project aims to better understand plant transpiration. It is significant from both a basic and a practical perspective. It intends to solve a conundrum of the biophysics of the evaporative sites within leaves. That is, in dry air, the relative humidity of intercellular air spaces suggests much lower liquid water potentials than those typically measured. At a practical level, the failure to sustain transpiration in dry conditions leads to desiccation and tissue death, and plants differ in this vulnerability. The aim is to apply a novel nanoparticle technique to measure the water potential distribution within the leaf, identify hydraulic resilience attributes, and develop a modern theory of optimal transpiration under varying conditions.	79,500.00	160,000.00	161,000.00	80,500.00	0.00	0.00	481,000.00
	National Interest Test Statement Rapidly growing plants, including trees, use a great deal of water, and this can be useful if managed for high crop yields by farmers and horticulturists, but can be at the expense of urban water supplies, particularly during regrowth after bushfires, and of environmental flows in our rivers. As the supply of water diminishes in a dry season, different plant functional types react differently, and there is also genetic variation within single crop species. These contrasts will be characterised so that plant breeders will be informed about how to match genotypes to appropriate growth climates, and to better understand vegetation responses to climate change and extreme weather events. Results will contribute toward an improved capacity for sustainable food production and climate change mitigation.							
DP210103877 Williamson, Prof Robert C	The project aims to develop a systematic theory of ethical machine learning. Machine learning is a powerful and pervasive technology that is already having a huge impact on Australia. When applied to data about people there are a range of ethical harms that can arise (fairness, and privacy are two of them). The project aims to develop a rigorously grounded foundation for managing such ethical harms. For example it will allow the quantification of the inevitable trade-offs between fairness and utility. The benefits of the project should include better ways of managing these trade-offs, a competitive advantage for Australian firms developing the technology, and will ensure that the country retains a social license to use the technology.	77,906.00	166,737.50	176,445.50	162,804.00	75,190.00	0.00	659,083.00
	National Interest Test Statement Machine learning is a general purpose technology that is already having an enormous impact on Australia. It stands to have greater impact still in the future. It is widely used in every industry sector, from health care to defence; from financial service to transport. The Commonwealth government has already commissioned an AI ethics framework, but there remain fundamental unanswered questions regarding how best to incorporate ethical concerns into machine learning. Doing so is essential to maintain the social license to operate the technology of machine learning which offers enormous economic and social benefits. The specific national benefits will include: lifting Australia's international reputation in the most contentious aspect of the hottest technology of the present time; providing government and business with the best possible tools to manage the ethical concerns arising from the use of machine learning; providing a competitive advantage to Australian commercial developers of machine learning algorithms and aid their wider deployment.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	The Australian National University	2,422,599.50	5,019,480.00	4,933,487.50	2,473,252.50	204,145.50	67,500.00	15,120,465.00
University of Canberra								
DP210100157 Park, A/Prof Sora	This project aims to investigate how trust and mistrust in news changes audiences' behaviours as they increasingly access news through digital platforms. Observing the global crisis of trust, the project will undertake a longitudinal analysis of trust and mistrust in news, a four-country experiment that links trust and audience responses, and an in-depth qualitative study that provides specific contexts of these choices. The research will directly benefit policy makers, as it addresses questions of how to better secure trustworthy news content in an age of increasing dominance of digital platforms that algorithmically sort the range of news available to the Australian public.	52,801.00	120,920.50	135,619.50	67,500.00	0.00	0.00	376,841.00
	National Interest Test Statement Mistrust in news in the digital environment is an area of significant public concern in Australia. The Senate Select Committee Inquiry into the Future of Public Interest Journalism and the ACCC Digital Platform Inquiry both addressed the decline in journalism jobs, and the implications of power imbalances between traditional news media and digital platforms for the future of news as a public good. Through a four-country comparative analysis, experimental methods, and an in-depth qualitative investigation, this project analyses sources of trust and mistrust in news and how they influence behaviour. It addresses the growing crisis of trust of core social, political and civic institutions, and the sustainability of high-quality news as a vital component of democratic participation. This major international comparison will generate the much needed empirical evidence to inform policy institutions in addressing the urgent issue of providing of quality news for informed citizenship and democracy.							
DP210102436 Dryzek, Prof John S	The project aims to explain responses to extremist attacks intended to sow division, and why some democracies prove fragile, succumbing to polarisation or exclusion of key groups, while others prove resilient by sustaining integrative, tolerant discourse. The project develops new knowledge through an innovative synthesis of cultural sociology and deliberative democracy to analyse nine cases of responses in the public realm to attacks. Expected outcomes include a new account of the democratic public sphere, and identification of how meaningful, civil communication whose health is vital to democracy, especially in a multicultural society, can be maintained. Benefits include identification of measures to counter extremist political disruption.	77,712.00	174,561.50	178,192.50	81,343.00	0.00	0.00	511,809.00
	National Interest Test Statement The health of the public sphere is vital to Australian democracy, as it is to any democracy. Our results will be applicable to improve communication in a multicultural society by identifying successful strategies that politicians, community leaders, journalists, and institutional designers can deploy to promote democratic resilience, in Australia and internationally, in the face of threats from far right and Islamic extremists. Understanding how to counter polarisation and intolerance is essential for maintaining Australia's status and international reputation as a successful multicultural society. Our results will contribute to the Australian government's Countering Violent Extremism program. End-users of the research will include government departments concerned with social cohesion in the face of extremist threats, notably Home Affairs, as well as journalists, community leaders, and organisations seeking to foster integrative and tolerant discourse. The project will also help cement Australia's place as a leader in the research and practice of deliberative democracy and multiculturalism.							
	University of Canberra	130,513.00	295,482.00	313,812.00	148,843.00	0.00	0.00	888,650.00
	Australian Capital Territory	2,553,112.50	5,314,962.00	5,247,299.50	2,622,095.50	204,145.50	67,500.00	16,009,115.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
New South Wales								
Australian Catholic University								
DP210100402 Craven, Prof Rhonda G	This project aims to test the effectiveness of a new preschool oral language, literacy, numeracy and wellbeing intervention for Indigenous and non-Indigenous Australian students using powerful interdisciplinary approaches. The project generates new knowledge about enabling preschool children to have a deadly start to literacy, numeracy and wellbeing, capitalising on research-derived interventions. Expected outcomes include salient intervention and measures and advances in preschool education that enable a deadly start. The benefits encompass identifying effective intervention and drivers that support a deadly start to literacy and numeracy, and having adaptive motivation, new theory and developmentally appropriate measures.	108,491.00	298,485.00	277,334.50	87,340.50	0.00	0.00	771,651.00
	National Interest Test Statement Literacy, numeracy and adaptive motivations such as feeling good about one's self and abilities, predicate quality of life and human potential and are essential for getting the best start in and the most out of life. However, little is known about how best to optimise these critical drivers of success for Indigenous and non-Indigenous preschoolers. This research tests the effectiveness of an intervention to enable preschoolers, to have a Deadly Start to literacy, numeracy and wellbeing. The project is expected to yield significant practical and conceptual advances in developmentally appropriate oral language, literacy, numeracy and wellbeing interventions for Indigenous and non-Indigenous preschoolers; robust evidence for education policies and strategies, and enhanced interdisciplinary research collaboration. This is expected to provide evidence-derived intervention, advance policy and practice, reduce socio-economic costs of literacy and numeracy failure, benefit economic productivity and growth, and add materially to strengthening the socio-economic fabric of Indigenous and non-Indigenous communities.							
DP210100772 Riseman, Prof Noah J	This project aims to explore how the Australian military and its members have dealt with sex and sexuality. Through uncovering policy, health and disciplinary files, as well as medical literature, civilian police, newspaper and court records, the project intends to analyse how the Australian military evolved its approach to members' sexual and intimate relations, and the consequences military life had for individuals' sexual and romantic partnerships. By illuminating the relationships between the Australian military, sexual cultures, the law, health and public policy, the findings should benefit the Australian Defence Force's ongoing process of culture change and inform policy formulation around veterans' health and welfare.	29,474.50	67,933.00	102,743.00	64,284.50	0.00	0.00	264,435.00
	National Interest Test Statement This project aims to uncover the history of sexual cultures in the Australian armed forces, and how military authorities have (and have not) regulated service members' sexual behaviour and relationships. The Australian Defence Force continues to confront a culture where embedded attitudes towards sex, sexuality and gender influence members' behaviour and performance. Producing new knowledge about the long history of sex cultures within the military, and about strategies that have shaped sexual and intimate relationships, will have social and cultural benefits in developing effective policies that support culture change. The project also aims to analyse the relationships between veterans' sexual and mental health, the influence of military medicine on sexual health, and what is revealed about sexual cultures by active and returned service members' interactions with the law (especially prosecutions for sexual assault and intimate partner violence). Such research will potentially benefit the formulation of policies and programs to support service members' and veterans' healthcare provision and social inclusion.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101275 Musgrove, A/Prof Nell	This project aims to create the first history of survivor-activism that challenged and exposed failings in Australian child welfare systems. It intends to reveal how Care Leavers (people institutionalised as children—500,000+ Australians in the 20th century alone) advocated for government inquiries and reforms, and how stigma ascribed to them impacted their disparate experiences of citizenship. Expected outcomes include an innovative survivor-led participatory research model for ethical research with marginalised groups, and an interactive website presenting new narratives of out-of-home care. The project seeks to benefit Care Leavers by highlighting their resilience, and in the process inform service provisions to support their wellbeing.	61,558.00	117,611.50	110,983.50	54,930.00	0.00	0.00	345,083.00
	National Interest Test Statement Since the late 20th century, Care Leavers (people institutionalised as children, of whom there were more than 500,000 in Australia during the 20th century alone) have used survivor-activism to successfully campaign for a series of government inquiries, and to make important challenges to past and present child welfare practices. Yet they continue to face adversity in accessing education, social welfare and health services. This project's history of Care Leaver activism and advocacy will be written by and with the people who have been the grassroots of this significant social movement. It seeks to explain how Care Leavers' social, physical and mental health needs have been shaped by their experiences in out-of-home care, which will in turn support the development of better models of health care and services that improve outcomes and reduce disparities for this disadvantaged and vulnerable group. This will benefit not only the Care Leavers of today, but also the more than 50,000 Australian children and young people currently in out-of-home care who will face similar challenges in the future.							
DP210102840 Scott, Dr John W	This project aims to understand how cells sense changes in metabolic activity, to ensure energy demands are matched with nutrient supply. Our proposal will fill critical gaps in our understanding of the molecular mechanisms underlying metabolic sensing. This will generate new knowledge with far reaching potential for Australian industries that rely on the propagation and utilization of living organisms, including agriculture, biotechnology and brewing, as well as knowledge relevant to sporting performance and the metabolic dimensions of ageing. This project will support advanced training of early career researchers and PhD students, which will expand Australian research capabilities and contribute to a producing a highly skilled workforce.	75,316.50	160,524.50	160,667.50	75,459.50	0.00	0.00	471,968.00
	National Interest Test Statement The survival and function of all organisms depends on their capacity to sense and regulate metabolic activity, to ensure energy demands are matched with nutrient availability. Our research has exposed critical gaps concerning the molecular mechanisms underlying metabolic-sensing, and we now propose a conceptually innovative project to advance our understanding of how cells sense and respond to a continually changing nutritional landscape. By further advancing our understanding of these fundamental mechanisms, our research outcomes have the potential to underpin future innovations in Australian industries reliant on the propagation and utilization of organisms including agriculture, biotechnology, viniculture and brewing. The project will also generate high impact publications in top ranking journals that will reinforce Australia's position as a global leader in metabolism research, incentivising collaboration and maintaining the current position enjoyed by Australian higher education sector as destination centers of research for both domestic and international students.							
	Australian Catholic University	274,840.00	644,554.00	651,728.50	282,014.50	0.00	0.00	1,853,137.00

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
Macquarie University								
DP210100399 Hermkens, Dr Anna-Karina	Australia's neighbour, the Autonomous Region of Bougainville in PNG, is about to become the world's newest nation. The proposed reopening of a highly divisive copper mine to finance its independence raises pressing economic and political issues for Australia. Both in Bougainville and its diaspora in Australia, people are passionate about Bougainville's future. But what kind of development do they aspire to and why? This collaborative, interdisciplinary and multi-sited project aims to examine the neglected roles of religion and gender in shaping people's 'faith' in development. The expected outcomes will improve understanding of Bougainvillean notions of development, facilitating better frameworks for development practices and outcomes.	34,085.50	70,671.00	78,479.50	79,703.00	72,517.50	34,708.50	370,165.00
	National Interest Test Statement This cutting edge interdisciplinary project will provide important information about the security and economic well-being of the Australian community, PNG and the Asia-Pacific region. The decade-long war resulting from the closure of the Rio Tinto copper mine in Bougainville in 1989, caused dramatic economic and political instability in the region. The recent plan to reopen the mine, informed by Bougainville's economic underdevelopment in spite of Australian aid, is again creating unrest. This project's transformative indigenised framework will explore how the economic situation could escalate into instability in Bougainville, and the region. Australia has been vocal about improving economic development and political stability, responding to the growing influence of China in the region. The project will benefit Australia by facilitating informed decision-making for generating peaceful and sustainable outcomes. It is vital that these insights are brought to bear as Australian foreign policy evolves to address ever more complex dynamics in the pursuit of our economic stability.							
DP210101019 Stevenson, Prof Richard J	Many experiences, like food, wine and sex, are pleasurable. These experiences are also desired, but less so when sated. The aim of this proposal is to understand how satiation regulates desire. We propose two memory-based models, and test them using several new experimental approaches. This is significant, not only because poorly regulated desire is linked to many social and economic ills (e.g., over-eating), but also because it is a key part of human motivation that is poorly understood. The expected outcome is a new theoretical model of how memory processes interact with bodily signals to generate both sated states and desire. The benefits include a new understanding of how desire is regulated and how and why this might break down.	24,160.00	51,677.50	45,600.50	18,083.00	0.00	0.00	139,521.00
	National Interest Test Statement After people have eaten a meal they often encounter opportunities to eat more. For example, an advert might remind them of biscuits in the kitchen. Such situations are probably common and if one succumbs and eats, this incrementally tips one towards weight-gain. We recently discovered something new about this type of situation. When people look at food after a meal, the pleasure they expect to get from eating it - their desire - is much less, than the actual pleasure reported if it is eaten. It seems being full can produce useful reductions in desire that lead us to underestimate how much we will enjoy something. This presumably serves to stop us eating more. The aim of this project is to explore this effect, examine if it does serve to stop us eating more, determine how it works and see if it applies to other situations - thirst, sex and drugs. This research will help us understand how desire is regulated, giving us new and better ideas of how to fix it when it fails. And fail it does, with many social ills (e.g., obesity, drug abuse, crime, gambling) being a consequence of poorly regulated desire.							
DP210101094 De Marco, Prof Orsola	Our aim is to explain increasingly observed numbers of astronomical outbursts and explosions emitting electromagnetic radiation and gravitational waves. The underlying cause of these phenomena is the interaction and merging of stellar pairs, but a viable model does not yet exist. Our current calculations ignore the effects of dust that forms in the expanding and cooling gaseous layers. Without dust we cannot accurately model the outburst dynamics nor the light emitted by these events. We will capitalise on a decade of simulation code development paired with a team of world experts of dusty winds. The inclusion of dust in our modelling code will also benefit studies of dusty plasmas, from stellar winds to planet formation.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement Astronomy attracts Australians, young and old, by providing context for our lives and inspiring us to ask questions that transcend our existence. Our research to understand colliding and interacting stars, carries significant national benefit. The novel methods from this project apply fluid motion modelling to a new field, serving as a pioneer for researchers and industry to replicate in other fields, with commercial and non-commercial applications in science and industry. The innovative strategy and fluid modelling outcomes of this project will advance fluid dynamic applications in climate and geological sciences, as well as modelling fluid flows in the human body. We will train researchers in modelling fluid motion and inspire students to appreciate how science can be applied to understand the natural world. Through the innovative inclusion of dust in the code used to model three-dimensional stellar mergers and interactions, this project will lead to benefits well beyond astronomy. Thus, this project will have broad educational, social, and potentially commercial benefits to the Australian community.							
DP210101117 Bayeh, Dr Jumana	This project aims to shed new light on diaspora voices in debates about the formation and narration of nations to argue for a more inclusive view of the nation and to challenge the dominance of canonical literature in these debates. Arab writing is closely tied to its diaspora, making it particularly significant for probing how fiction registers the transformative effects of migration on our grasp of the nation. Spanning four diaspora sites and a century of writing, potential outcomes include a diaspora-focused approach to reassess the nation from a transnational perspective, a new awareness of the value of diaspora writers' engagement with the nation, and the vital repositioning of Arab-Australian writing in this field of world literature.	19,082.00	36,634.50	37,375.00	19,822.50	0.00	0.00	112,914.00
	National Interest Test Statement This project takes a renewed look at the nation and its borders from a transnational perspective. The work of Arab diaspora writers, which includes those residing in Australia, provides an ideal case study for examining the ways our national identity is being questioned, expanded and repositioned. The importance of Arab diaspora literature cannot be overestimated because it raises issues that are fundamental to our most pressing national debates. One of the more urgent debates concerns our substantial refugee and migrant communities, many of whom come from the Arab and Muslim world. Border security, boat people, refugees and other displaced persons dominate our national agenda, prompting a need to develop a new conception of Australian identity. This project argues that such a reappraisal is being undertaken by diaspora literature. Literary works open spaces of critical reflection to challenge how we perceive the world, and model new modes of national belonging. As such, fiction has the potential to provide nuanced awareness and critical re-imaginings of our national self-understanding.							
DP210101247 Thompson, Prof William F	The aim of this project is to investigate how music-supported exercise, called physical musicality (PM), can promote wellbeing, quality of life, and cognitive-motor function in older adults, beyond the benefits of exercise or music listening alone. To achieve this aim, we will (a) conduct randomised control trials on PM programs; (b) isolate the ingredients and mechanisms underlying the benefits of PM; and (c) design culturally appropriate programs that optimise wellbeing and cognitive-motor function for older adults. Our research will reveal simple, non-medical steps that all adults of advancing age can take to maintain their wellbeing and cognitive functions so they can lead productive and successful lives into older age.	41,828.00	100,773.50	115,061.00	107,411.00	51,295.50	0.00	416,369.00
	National Interest Test Statement By 2057, 22% of the Australian population will be over age 65 years. This project seeks to understand how older adults can optimise cognitive-motor function and quality of life, reducing the burden of longevity for individuals, families, government services, and the economy. The project has a vision of Australia as a global leader in research on optimal ageing, with implications for quality of life, society, policy, and services. The research will contribute to a better understanding of the ageing process, and the non-medical activities that can contribute to optimal cognitive-motor function and wellbeing. The research will lead to the delivery of culturally appropriate programs and tools that serve individual, behavioural and sociocultural outcomes. It will empower older adults and equip stakeholders with the knowledge to make decisions about engaging in activities that promote cognitive-motor function, wellbeing and social engagement. Our research challenges the view that ageing is burdensome, replacing that view with a perspective that celebrates the opportunities and benefits of an ageing population.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101268 Jacob, Prof Dorrit E	This project brings together expertise and cutting-edge methodology from different disciplines to identify the controls on the compositions of the shells and skeletons of marine organisms. The compositions of these materials are essential tools to reconstruct environmental conditions before modern climate records began. However, recent insights into how they form profoundly complicate and affect their interpretations. The results will enable us to develop new, realistic models for the behaviour of chemical elements in these materials. This will significantly improve paleoclimate interpretations and provide critical benefit for protecting Australia's marine resources in the future. **National Interest Test Statement** Shells and skeletons of marine animals are important archives of past environmental change, reaching back thousands of years. The reliability of data derived from them for use in robust models of our climate future relies on understanding how they are formed by the animals. This project creates synergies that combine innovative nano-analytical and aquaculture methods using Australia's cutting-edge research facilities. It will strengthen the country's world-leading position in this research area and expand Australia's research potential and competitiveness. This interdisciplinary project will ready the next generation of young scientists and industry professionals by equipping them with new cutting-edge nano-analytical skillsets required for Australia's economy. It will significantly enhance our understanding of, and capability to probe into, past and future climate and environmental change, and secure our marine resources for changing environments in the future.	55,000.00	135,000.00	155,000.00	75,000.00	0.00	0.00	420,000.00
DP210101279 Terno, A/Prof Daniel R	This project aims to verify if black holes can actually exist in our Universe. It is still unknown if any of the candidate objects possess the key black hole feature -- a trapped region from which no signal can escape. By focusing on conditions for existence of trapped regions, this project expects to describe their neighborhoods and observable properties. This information is critical for interpretation of the data from the next generation of gravitational wave detectors and radio telescopes, and for determining the true nature of astrophysical black hole candidates. Further benefits include simplification of calculations of the observable properties of compact objects and resolution of a long-standing black hole information loss paradox. **National Interest Test Statement** Understanding of black hole physics is a global research priority. The development of large-scale international facilities is now accelerating. Our project will complement the current Australian involvement (which is predominantly technical and observational) and provide a high-quality low-cost theoretical contribution that will establish an Australian presence in ultra-compact objects. The project will train the next generation of research leaders in the development of new computational tools. This will contribute to the Australian workforce in an emerging key area of information science and computer modelling, where a critical skill shortage has been identified. The outcomes of this project can be applied to a wide range of research and engineering problems in many industries, including aerodynamics and aerospace analysis, fluid flows and heat transfer, engine and combustion analysis, weather simulation, and natural science and environmental engineering. This project will therefore have broad economic and educational benefits to the Australian community as well as social benefits through public engagement.	70,000.00	142,500.00	108,750.00	36,250.00	0.00	0.00	357,500.00
DP210101324 Alroy, A/Prof John	Wild mammals have experienced major population losses and extinctions in recent centuries, but their communities had already suffered from widespread losses during the Pleistocene. Existing literature has focused on documenting individual extinctions or continental-scale patterns. This project aims to show how biodiversity loss played out at the local scale around the world. It will use palaeontological and zooarchaeological data to show how losses varied in space, how population sizes changed, and how species attributes such as rarity and body size related to loss. The world of mammals has become more homogeneous as biodiversity has declined. The challenge is to show how that happened across space and time.	65,000.00	130,000.00	130,500.00	65,500.00	0.00	0.00	391,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Australia's native mammals have suffered greatly from biodiversity loss. Current stressors include introduction of invasive species, habitat destruction, and climate change. These have played out over the last two centuries. However, a mass extinction of most of Australia's large mammal species occurred shortly after the arrival of humans more than 40,000 years ago. Similar losses occurred later in Eurasia, the Americas, and many islands. To understand these losses, it is imperative to put Australia's history in a global context. This new project will show how losses in local communities reflect extinctions across Australia and in other parts of the world. It will investigate whether continental-scale losses were greater than local losses, whether local communities became homogenised, whether rare species suffered more, and how the balance of populations changed. These factors may have been more or less intense in Australia than other areas. The research project will raise national and international consciousness about a unique Australian biological catastrophe.							
DP210101957 Ittner, Prof Lars M	This project aims to develop a novel method for markedly accelerating production of genetically modified mice, which are a key 'tool' for studying biological processes and diseases. The work plans to take CRISPR, the latest gene-editing technique, to the next level by developing a novel CRISPR-based method to generate different mouse strains with distinct variations of the same gene sequences, at a fraction of the present cost and time. This project should overcome a major barrier to studying gene function with unprecedented detail, thereby opening new avenues for future research into biological processes. Thus, the outcomes from this project should impact on the entire field of biomedical research, and advance Australia's biotech industry.	111,773.00	226,686.00	229,897.50	114,984.50	0.00	0.00	683,341.00
	National Interest Test Statement							
	Generating animal models for biological and biomedical research remains a costly and time-intensive endeavour, limiting access to well-funded laboratories. Yet it is a critical tool in developing and testing new drugs and therapies. This project will break this barrier by developing a novel technology to generate multiple genetically modified mouse models rapidly and for a fraction of the present cost. The technology will open new opportunities to the wider research community and assist with more-efficient spending of research funding. Importantly, this new technology will be applicable to all areas of biomedical sciences. Consequently, it should significantly accelerate Australian biomedical research and industrial biotech and pharma R&D, as well as being of considerable interest internationally. Accelerating future research across biomedical fields by cutting time and costs for generating critical animal models will ultimately benefit end users economically and by improving health outcomes through access to new drugs. The new technology also has commercial potential as novel transgenic service platform.							
DP210102196 O'Neill, A/Prof Craig J	This project aims to understand the role of Earth's redox state on the geodynamic evolution of continental cratonic roots. Cratonic roots form strong, buoyant rafts upon which Australia's oldest crust and mineral deposits survived. Cratons preserve a record of planetary-scale chemical shifts, including the rise of surface oxygen, but it is unclear how these redox shifts themselves affected lithospheric processes. This project integrates new developments in geochemistry, geophysics, and geodynamics, to map the geochemical state and structure of cratonic roots, aiding mineral exploration, and also shedding light on the processes that modify, mineralise, and sometimes destroy cratonic roots.	55,000.00	132,500.00	132,500.00	55,000.00	0.00	0.00	375,000.00
	National Interest Test Statement							
	The style of mineralisation seen on continents depends on the oxidation state of the fluids responsible. Earth's surface has become more oxidised over time, transitioning from an oxygen-free atmosphere, to an oxygen-rich one, but it is very unclear how the interior and mantle - a primary factor in world-class deposits - evolved. This project will map the geochemical and redox structure in the deep continental cratonic roots, using geochemistry and seismic tomography, and model cratonic roots dynamics to understand the minerals systems they host. Cratonic roots themselves are a source region for major lithospheric-scale mineral systems, and mapping their detailed chemical structure is of marked importance to the geoscience and mineral exploration communities.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102442 Jackson, Prof Stuart D	We will create a new composite glass providing strong fluorescence which fully exploits the high transmission of glass in the mid-infrared. When combined with emerging rare earth ion transitions and precise excitation processes, this project will help solve an important problem in optics; that the overall efficiency and power produced from deep mid-infrared light sources is not sufficient for all industries. The primary outcome will be a series of robust fibre-based gain modules suitable for high power and very short optical pulses in the mid-infrared. These light sources will beneficially impact medicine, defence, sensing and manufacturing providing excellent opportunities for increasing Australian productivity and global competitiveness.	85,000.00	173,500.00	177,000.00	88,500.00	0.00	0.00	524,000.00
	National Interest Test Statement The mid-infrared is a region of the spectrum that is progressively being heavily exploited for widespread application. Thermal imaging cameras, dental and skin resurfacing lasers and narcotic detectors at airports are all mainstream examples involving the mid-infrared, but the potential of the mid-infrared is much larger. The creation and modification of materials using highly refined mid-infrared sources will greatly expand advanced manufacturing, opening up significant opportunities in pharmaceutics, medicine, and defence. The Project will train students and staff creating a highly skilled workforce that will enhance Australia's capacity in many high technology industries. The outcomes of the project will augment Australia's knowledge base and contribute to nearly all of the Science and Research Priorities.							
DP210102789 Wang, Dr Xin	Most people in the world today speak more than one language. Thus, they need to decide, unconsciously, which language to use at any given time. This project aims to understand how healthy adult bilinguals resolve competition from their unintended language to communicate successfully in the intended language. In both bilingual language comprehension and production, the project will characterise the role of an under-explored linguistic dimension, lexical tone, in cross-language processing. Expected outcomes include enhanced understanding of bilingual communication and theories of bilingual language use, and practical implications for optimal language learning for bilinguals and intervention for clinical populations who speaks two languages.	28,850.00	68,489.50	74,189.00	34,549.50	0.00	0.00	206,078.00
	National Interest Test Statement This project will benefit Australia as it becomes an increasingly multilingual and multicultural society. Over 50% of Australians will speak a language other than English by 2025, and 300 separately identified languages are spoken in Australian homes. Among them, the most common ones are Mandarin, Arabic, Cantonese and Vietnamese. Thus, 3 out of the top 4 languages use tone pitches to disambiguate word meanings. Despite this increasing multilingualism, linguistically and culturally diverse populations remain under-studied in Australia, in particular, from the linguistic and cognitive perspective. This project will respond to this acute need to advance understanding of tonal bilingualism/multilingualism and its linguistic and cognitive implications in order to improve educational, clinical, economic and social outcomes for Australia's multilingual society. This project will serve the foundation to develop pedagogical innovation in second language learning and build applied interventions for clinical purposes to serve an increasingly multilingual society.							
DP210103349 Whiting, A/Prof Martin J	This project aims to investigate the mechanisms underlying the formation of complex social systems in vertebrates. Our understanding of these mechanisms is strongly biased towards a few model systems. We have identified a novel Australian model system with a wide range of sociality for this purpose. This project expects to generate new knowledge on how the social environment interacts with the brain during social organisation. Expected outcomes include the refinement of social theory and capacity building via international collaboration and postgraduate training. This work will provide significant benefits by increasing our understanding of how the brain and social environment interact to moderate aggression and enhance social associations.	82,518.50	141,046.50	87,769.50	29,241.50	0.00	0.00	340,576.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Our study deals with a question of great national and international interest: how the social environment interacts with the brain to influences an organism's behaviour and learning ability during development. The potential benefits to society are an increased understanding of how animals form social bonds and also, how they moderate aggressive interactions. This information could be beneficial for managing animal and human health. For example, current evidence suggests the role of neuropeptides (protein-like molecules in the brain that communicate with neurons) in determining social behaviour is remarkably similar in humans and animals, although the vast majority of studies are of mammals. Furthermore, neuropeptides have profound effects on human social cognition, and play a role in treating social anxiety and cognitive/social disorders such as autism. Our study will help us understand the bigger picture with respect to how aggression and social bonding is mediated and ultimately, the consequences of parental care for social and cognitive development.							
DP210103469 Morsch, Dr Marco	Cell-mediated tissue clearance following brain injury is a universal mechanism. However, our understanding of the cells that perform these tasks is very limited. Our project will characterise this inflammatory response at a single-cell level using the zebrafish spinal cord as a versatile experimental model. The project is expected to strongly contribute to the molecular understanding of the mechanisms underlying debris removal and will advance innovative technologies that facilitate intellectual progress in neuroscience. It will produce new insights into the process of neuronal degeneration, promote Australia's growing reputation as a global leader in neuroscience, and provide high quality training for early career researchers.	65,000.00	133,000.00	143,000.00	75,000.00	0.00	0.00	416,000.00
	National Interest Test Statement							
	The outcomes of the proposed research are critical for understanding how cell and tissue clearance is regulated in the central nervous system. This project provides a platform for future diagnosis and treatments of neurological disorders (incl. Alzheimer's disease, Parkinson's disease and ALS) that result from dysfunctional clearing mechanisms. Neurological and mental disorders amount to 17% of the total burden of disease in Australia and represent a significant financial and social responsibility. The project promises to contribute to Australia's national interest by aligning well with the Science and Research Priority "Improved prediction, identification, tracking, prevention and management of emerging local and regional health threats" and will therefore have significant social and economic benefits. Furthermore, this project will significantly promote Australia's growing reputation as a global leader in neuroscience, and provide high quality training for early career researchers, in a strong multidisciplinary research environment.							
	Macquarie University	802,297.00	1,672,478.50	1,645,122.00	864,045.00	123,813.00	34,708.50	5,142,464.00
Southern Cross University								
DP210100096 Maher, A/Prof Damien T	Methane is an extremely potent greenhouse gas. Recent evidence suggests that tree-mediated fluxes may be a significant, but overlooked source of methane to the atmosphere. This project aims to quantify the magnitude and drivers of tree-mediated methane fluxes from Australia's dominant forest types. Innovatively, we will be using a novel combination of empirical field based measurements, gas tracer experiments, microbial analysis and modelling methods. Expected outcomes are a mechanistic understanding of tree-mediated methane fluxes, helping to constrain regional, national and global methane budgets. The results of this study will help inform publicly funded greenhouse gas abatement strategies, ensuring a maximal return on investment.	57,600.00	132,625.00	124,825.00	49,800.00	0.00	0.00	364,850.00
	National Interest Test Statement							
	Australia has invested heavily in reducing greenhouse gas emissions, with a cornerstone of these efforts being the Emissions Reduction Fund, and more recently the Climate Solutions Fund. Many of the funded projects under these schemes are associated with reforestation/afforestation projects, and are based on carbon sequestration in biomass and soils. However, the potential for methane release as a part of these projects has not been considered, which is important considering methane is a potent greenhouse gas (~ 34 times more potent than carbon dioxide). Tree-mediated methane fluxes have recently been highlighted as a potentially important source of methane to the atmosphere, but there is very limited information on Australian forests. This project aims to quantify this overlooked component of Australia's methane budget providing the detailed information required to ensure that publicly funded greenhouse gas abatement projects provide the highest return on investment.							
	Southern Cross University	57,600.00	132,625.00	124,825.00	49,800.00	0.00	0.00	364,850.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
The University of New South Wales								
DP210100094 Boyer, Prof Cyrille A	This project aims to apply state-of-the-art living polymerisation techniques to 3D printing to efficiently produce customised polymer materials that are tailored at the molecular level. By combining computational modeling and experimental approach, fast and oxygen tolerant photoliving radical polymerisation will be developed and applied to 3D printing. These new systems will produce highly structured polymer materials with remarkable mechanical properties. The effect of nanostructure on the macroscopic material properties will be investigated. The intended outcome of this project will produce advanced materials with tailored mechanical properties via streamlined and accessible approaches.	80,000.00	160,000.00	160,000.00	80,000.00	0.00	0.00	480,000.00
	National Interest Test Statement This project will utilise innovative photoinduced living radical polymerisation techniques and 3D printing to control the molecular structure of 3D printed materials, thus establishing efficient new technologies for advanced materials production and providing products for diverse high-tech applications. As such, this project specifically addresses the Science and Research Priority 'Advanced Manufacturing' by providing specialised high performance polymer materials and new technologies for their manufacture. Leveraging the knowledge gained from this work will place Australia at the forefront of a new age of material design and manufacture. In addition to the economic benefits of local jobs and revenue, this project will produce technology that may be licensed globally to fast-track the design and manufacture of materials critical to society, for instance, customised biomaterials for medical applications. In addition, this project will develop collaborations with international experts; the innovations of this project will attract significant international attention and help draw more talent to Australia.							
DP210100255 Coster, A/Prof Adelle C	The project aims to develop new stochastic mathematical models of the dynamics of protein transport and cell signalling. The mathematics will link macro scale biological observations to micro scale molecular movements to characterise the relative role that different components and processes play. Expected outcomes are robust mathematical analyses of the transient dynamics of closed, finite capacity queueing networks and biological insight into the major control mechanisms in cellular insulin signalling. The project should provide significant benefits via the delivery of new mathematical tools and analysis for stochastic networks, impacting our understanding of metabolic transport, and providing interdisciplinary research training.	67,500.00	142,500.00	150,000.00	75,000.00	0.00	0.00	435,000.00
	National Interest Test Statement This project is in Australia's national interest through its contribution to the understanding of the mechanisms underlying cellular transport and signalling, such as the insulin-driven control of glucose metabolism. We will develop mathematical models of these fundamental processes and provide a platform to understand the normal operation of these important biological systems. The outcomes of this project will enable future studies to explore dysfunction and treatment of metabolic disorders such as diabetes. In particular, the mathematical model of insulin-driven glucose transport will give new insight into a fundamental biological process, and what may go wrong in its operation. The outcomes of this project will thus have societal and economic impact, informing research into treatment protocols for type 2 diabetes and insulin resistance – an increasingly prevalent problem in Australia.							
DP210100357 Froyland, Prof Gary A	This project aims to reveal the precise mathematical mechanisms underlying the emergence and disappearance of long-lived coherent features in dynamical systems. This project expects to generate new fundamental mathematics in the area of dynamical systems, using innovative operator-theoretic approaches to carefully tease apart the lifecycles of coherent structures. The expected outcomes of this project include new mathematical theory and computational algorithms to anticipate the genesis and destruction of coherent objects, which are key organisers of complex geophysical flows. This breakthrough mathematics should provide significant benefits, such as improved prediction of eddy transport and persistence of weather and climate patterns.	70,000.00	147,500.00	150,000.00	72,500.00	0.00	0.00	440,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Mathematics is essential to a prosperous society because it is the language that underpins science, engineering and all of our technological breakthroughs. This project will advance mathematical knowledge by creating new theory and algorithms to precisely characterise the lifecycles of long-lived "coherent" features such as ocean eddies and weather patterns. Ocean eddies play a first-order role in the food web of the East Australian Current and are therefore important for the ecosystems and fisheries off the NSW and Victorian coasts. An improved understanding of eddy lifecycles will enable better planning and enhanced commercial benefits to Australia. Weather patterns such as the El-Nino Southern Oscillation (ENSO) and the Madden-Julian Oscillation (MJO) are major drivers of Australia's highly variable climate, influencing the severity of droughts, heatwaves, fire risk, and floods. The identification of coherent collections of ENSO and MJO patterns, and an understanding of their lifecycles, will help to identify periods of increased profitability or risk for industry, and aid medium-term government planning.							
DP210100422 Liang, Dr Kang	This project aims to develop next-generation self-driven nanomotors capable of long-range motion with highly controlled directionality for cell recognition, transportation and separation in complex biological environments, to allow autonomous and seamless cell sorting with high accuracy. The anticipated goal of this project is to advance the field of nanotechnology and advanced manufacturing with potential to support new applications and to value-add Australia's advanced manufacturing industry, presenting new opportunities for Australian MedTech industries with innovative, disruptive technologies to address its unique needs and to claim Australia's position within the competitive global market.	84,000.00	168,000.00	168,000.00	84,000.00	0.00	0.00	504,000.00
	National Interest Test Statement							
	This fundamental applied research is in the National Interest because this project will produce knowledge which will lead to the production of nanoscale motors and robotics, capable of self-directed speed and movement to target, transport and separate cells in complex biological environments. This research will take part in the next generation bio and medical technology, which is expected to take an increasing portion in this rapidly growing international market. With more than 1,600 organisations and 230,000 employees, the Australian life sciences sector is substantial and urgently needs disruptive technologies to grow. In particular, the biomedical device industry involves advanced manufacturing, providing high value-added products, with the need for highly skilled labour and global production chains. This project presents new opportunities for Australian MedTech industries with innovative, disruptive technologies that lead to achievable opportunities to address its unique needs and to claim Australia's position within the competitive global MedTech market.							
DP210100489 Barber, Prof Tracie J	This project is aimed at advancing the fundamental understanding of flow instability, the transition to turbulence and the effect on wall shear stress, in a dynamically constricted tube flow. The project will provide the first accurately resolved experimental flow analysis, using tomographic particle imaging velocimetry and 3D laser doppler anemometry, conducted on a novel experimental model, and will resolve, for the first time, turbulence characteristics of the dynamic constriction, using direct numerical simulation with a novel moving boundary implementation. The outcomes will provide the key link between fluid mechanics and wall shear stress, allowing future progress to be made in elucidating the causes of cardiovascular disease.	40,000.00	80,000.00	80,000.00	40,000.00	0.00	0.00	240,000.00
	National Interest Test Statement							
	This project will provide an understanding of how pulsatility affects the fluid dynamic features in a contracted tube, which varies in diameter over time. This problem has many applications in the field of vascular flows. Previous work in this field has been focused on the understanding of the fluid dynamics of static contractions, yet dynamic contractions are common in physiological conditions. The understanding of boundary layer behaviour from this project will provide the key link between wall shear stress and likely cell damage thresholds, allowing future progress to be made in elucidating the causes of cardiovascular disease and other disease states affecting vascular health. The benefits of this project lie not only in putting Australian researchers at the forefront of this field, but also in providing the fluid dynamic understanding that can be used by further Australian researchers to make progress on critical health issues, including cardiovascular disease (the leading cause of death in Australia).							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210100552 Colebatch, Prof James G	The cerebellum has long fascinated scientists for its remarkable anatomy and physiology and the critical role that it plays in motor function, and more recently for its more general functions of cognition and emotion. Developments in non-invasive imaging of cerebellar activity have opened up exiting new opportunities to probe its wider functioning. We aim to further develop these new methods in order to facilitate their availability to the wider research community, and to demonstrate their utility by application to the role of the cerebellum in learning and timing. The outcomes of this work will be of considerable benefit to a wide range of scientists and clinicians who will be able to make use of the new methods for their own research.	140,000.00	280,000.00	270,000.00	130,000.00	0.00	0.00	820,000.00
	National Interest Test Statement The research will contribute to Australia's national interest by making available to a wide range of Australian scientists and clinicians, as well as internationally, a new and powerful non-invasive method for imaging the functioning of the human cerebellum. The cerebellum lies at the back of the brain and has a very important role in movement coordination, timing and some thought processes. Among the Australian scientists who would benefit are psychologists, neuroscientists and neurologists who are interested in the role of the cerebellum in its wide variety of of functions, including motor control, learning, cognition and emotion. The project outcomes also have potential to contribute to the Australian national interest in future clinical applications for the development of new diagnostic tests and procedures for assessment of cerebellar and balance dysfunction. By examining the processes underlying timing accuracy and learning of new associations, our findings will improve understanding of motor skill acquisition such as applies to musicians and elite sportspeople.							
DP210100561 Neely, Prof Andrew J	Sixteen years after the retirement of Concorde, high-speed commercial flight is once again on the rise with the development of new supersonic business jets and small airliners as well as hypersonic transport and reusable space launch systems. Robust and efficient designs for these light-weight vehicles must address the problem of aerodynamic heating and its effect on structural performance and lifing. This project will design and perform first-of-kind experiments that reproduce the complex fluid-thermal-structural interactions representative of those experienced by these aircraft and rockets. We will then use these measurements to assess, validate and improve the current state-of-the-art of simulation and modelling approaches for design.	90,000.00	165,000.00	150,000.00	75,000.00	0.00	0.00	480,000.00
	National Interest Test Statement High-speed transport systems continue to increase in importance for long-range travel and for space access. This is of particular importance to Australia given our large size, geographic isolation and our rapidly expanding space industry with all of the opportunities that these entail. The economic viability of high-speed systems is driven both by payload capacity and reusability, two constraints that can be at odds for the structural design of the vehicle. Lightweight structures allow the vehicle to carry more useful payload for a given mission but are likely to be more prone to deformation and damage from fluid-thermal-structural interactions at high flight speeds due to frictional heating. The design tools for these vehicles are still immature and can not yet adequately predict the structural distortion and reduced lifing experienced during high-speed flight. These existing tools therefore cannot yet be used reliably to optimise the designs of these vehicles. This project will develop and perform first-of-kind experiments to provide critical missing data to further develop and validate these tools.							
DP210100812 Nakagawa, Prof Shinichi	This project aims to identify and address knowledge gaps in research on parental effects 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 parental effects on offspring traits than currently appreciated, by elucidating the role of fathers and offspring in addition to mothers. Expected outcomes of the project include advancing the field of parental effects and creating new and powerful meta-analytic methods, opening up 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.	66,145.50	139,455.50	144,609.50	71,299.50	0.00	0.00	421,510.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement This project supports two of the Australian Government's national scientific priorities in 'Environmental Change' and 'Health'. It will synthesise the evidence for how parental environment affects the offspring of human and non-human animals enabling better predictions of the impact of changing environments. The project will create a knowledge hub, freely accessible to both researchers and stakeholders in the public, to rapidly communicate research findings on these environmental impacts, thus promoting openness, trust and reproducibility in science. The project will also provide more powerful techniques for meta-analyses, widely used to synthesise evidence in the medical, social and biological sciences and increasingly used to inform policy and support evidence-based decision making by government and industry. In addition, this inter-disciplinary project will train promising and highly sought-after scientists in these analytical skills, increasing Australia's pool of future scientists and enhance its world leading reputation in evolutionary biology and health research.							
DP210100831 Kuo, Prof Frances Y	This project aims to establish powerful computational methods for high-dimensional problems - methods that are rigorous, and carefully tailored to specific applications, from physics, environment, manufacturing and finance, and often driven by uncertainty. The project will generate new knowledge in the area of high-dimensional computation, and develop technological innovations in key areas of science and industry. Expected outcomes include improved control of uncertainty in industry, enhanced international and interdisciplinary collaborations, and significant publications and presentations in international forums. The technological advancements will help boost Australia's position as a world leader in innovation.	105,000.00	210,000.00	210,000.00	105,000.00	0.00	0.00	630,000.00
	National Interest Test Statement This project has potential benefit to Australian applied science and industry, especially in advanced manufacturing and finance, and wherever the need is to quantify uncertainty. For example, in the manufacture of an aircraft component it is essential, for reasons of both safety and economy, to understand the air-flow consequences of the inevitable manufacturing imperfections. This needs, in other words, quantification of uncertainty, which is a principal theme of this project. Other potential applications are in finance, where the management of uncertainty is of paramount importance. There will be international collaborations, significant publications in international refereed journals, and presentations at international conferences. More generally, the advances in computational technology could help boost Australia's position as a world leader in innovation.							
DP210100879 Chu, A/Prof Dewei	This project aims to develop next generation haptic memory materials for the applications of artificial sensory nerves, which can precisely detect, process and respond to mechanical stimuli. The project expects to achieve this aim by mimicking the functions of biological haptic memory system and integrating highly sensitive tactile sensors and synaptic devices into artificial sensory nerves. The anticipated outcomes will be new electronic materials for a wide range of end uses in next-generation flexible sensor technologies including healthcare monitoring devices, intelligent soft robotic systems and neural prosthetics.	68,524.00	128,687.00	122,095.00	61,932.00	0.00	0.00	381,238.00
	National Interest Test Statement Technologies that facilitate preventative health represent a major opportunity for Australia's healthcare sector and the development of a major export industry. Wearable sensor systems have the potential to transform the healthcare and wellbeing industry from the current schedule-based check-ups and hospital visits to a condition-based management capability through continuous monitoring. If such healthcare practices are adopted nationally, Australia can save approximately $8-10 billion annually. Furthermore, if portable monitoring devices can be replaced with advanced wearable sensor systems integrated with predictive analytics and apps using secure cloud-hosting and regulatory compliant software architectures, we can expect even greater returns and cost-savings for the nation. The outcome of this project will be the development and translation of a range of intelligent haptic memory materials for practical applications. The project is expected to advance personal health management by monitoring a host of vital signs and meanwhile providing feedback.							
DP210100904 Hassan, Prof Mahbub	This project aims to realise a world-first photovoltaic (PV)-based system for device free ubiquitous human monitoring. By harnessing next generation flexible organic PV cells, Internet-of-Things (IoT) devices may be powered using only indoor lighting. Pilot studies show different activities can, in turn, be sensed and recognised by analysing the variations in the energy harvesting patterns in the PV-powered IoT. Given the many social, economic and environmental advantages of cost and energy-efficient sensing – including falls detection for the elderly and power savings in smart building – the proposed research promises multiple benefits while positioning Australia as an IoT innovator.	66,861.50	136,284.50	103,286.00	33,863.00	0.00	0.00	340,295.00

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	With 1 in 7 Australians above the age of 65, caring for elderly is creating a heavy burden on the national economy. The proposed Internet of Things (IoT)-based device-free ubiquitous human sensing technology can help ease this economic burden by allowing a large fraction of the elderly population, especially those in regional and rural areas to stay in their own homes while being monitored remotely. By adding value to existing IoT platforms, the proposed research is expected to bring major commercial benefits to this rising $20 billion industry. Many household IoT devices and sensors are currently powered by batteries. By enabling value-added services, this project makes the PV-powered IoTs more cost-effective than their battery-powered counterparts, contributing to the vision of a greener IoT. Therefore, this project aligns with both the "Health" and "Advanced Manufacturing" national Science and Research priority areas.							
DP210101025 Jeyakumar, Prof Vaithilingam	Robust optimisation is a powerful technology for decision-making in uncertain environments. Yet, developing numerically certifiable optimisation principles and data-driven methods that can be readily implemented by common computer algorithms remains an elusive goal for multistage robust optimisation. But it is crucial for the practical use of multistage optimisation. This project aims to develop this novel mathematical theory and methods by extending the investigators' recent award winning advances, including the von Neumann-prizewinning Lasserre-hierarchy approach. Results will provide a foundation and technologies for making superior decisions in the pervasive presence of big data uncertainty, enhancing data-driven innovation in Australia	65,000.00	130,000.00	135,000.00	70,000.00	0.00	0.00	400,000.00
	National Interest Test Statement							
	This project will further Australia's national interests in three ways: Firstly, through the development of new data-driven optimisation technologies for solving decision-making problems of engineering, science and commerce, it will contribute to improving our quantitative knowledge to harness new sources of economic growth, maximising Australia’s opportunity in today’s globalised world. Secondly, successful implementation of our data-driven optimization technology is likely to have significant impacts in numerous application areas of multi-stage optimisation, such as inventory management, energy distribution and multi-stage medical treatment planning, by improving inventory controls or reducing the distribution costs or improving the efficacy of medical treatments. This will benefit Australian society directly as well as enhancing Australia's global position as a leader in innovative technology. Finally, the cooperation of three leading European research centers built into this project will also enhance and expand Australia's capacity in international research collaboration.							
DP210101072 McNamara, Prof Luke	Criminal laws have been radically transformed to keep Australians safe from violence. This project aims to complete the first national study of how and why criminal laws have proliferated and diversified so significantly. It will employ novel conceptual tools for investigating the 'drivers', ‘processes’ and ‘modalities’ of criminalisation, and complete socio-legal studies of sexual and domestic violence, homicide, alcohol-related violence, public disorder and the activities of criminal groups. The intended outcome is new knowledge about the causes and effects of innovation in criminal law-making. This research can benefit future public debate, policy development and law reform decisions about the role of criminalisation in enhancing safety.	54,263.00	95,966.00	109,402.00	67,699.00	0.00	0.00	327,330.00
	National Interest Test Statement							
	Violence prevention is a high priority of all Australian governments. In a context where state, territory and federal governments are regularly accused of both over- and under-criminalisation, a key outcome of this project will be improved understanding of why and when the criminal law is used as a public policy mechanism for addressing violence, and the multiple forms which the criminalisation of violence takes. Australia’s national interest will be advanced by the social and economic benefits that the project seeks to generate. These benefits include: enhanced community understanding of what can (and cannot) be achieved by criminal law-making as a violence prevention mechanism; higher quality public policy decisions by governments in managing and meeting community expectations on personal safety; improvement in the quality of debate and decision-making regarding future law reform proposals; and enhanced public confidence in the criminal justice system.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101195 Ziveyi, A/Prof Jonathan	This project aims to quantify future risks of chronic illness and functional disability in retirement, proposing financing strategies aimed at enhancing healthy ageing, lifestyle quality and aged care provisions. The project devotes to devising a framework integrating government and private sector participation in funding health costs which increase significantly in older ages. The expected outcome includes sustainable retirement income scenarios for easing fiscal pressure from social initiatives such as age pension and aged care financing at the same time improving living standards for seniors. The project expects to place Australia at the forefront of research on sustainable solutions to financial challenges facing retirees.	38,339.50	113,418.50	154,730.00	79,651.00	0.00	0.00	386,139.00
	National Interest Test Statement This project addresses key policy areas of national interest requiring urgent attention as highlighted in the 2015 Productivity Commission report that called for increased analysis of “how the retirement income system can better cater for the diverse circumstances and needs of retirees, particularly in the drawdown stage where ‘one-size’ never fits all”. The project implements the idea in the 2019 Productivity Commission interim report of developing “a ‘market’ for aged care services where older people are able to choose between competitively marketed services as customers”. This project develops a health state transition model for capturing heterogeneity among older Australians to be utilised in devising fit-for-purpose retirement income and long-term care contracts for improving lifestyle quality in retirement. The model will be used for predicting prevalence of disabilities among the elderly so that appropriate intervention strategies can be implemented. Integrating private market insurance and financing solutions with government aged care and age pension provisions is of significant national interests.							
DP210101217 Bashford, Prof Alison C	This project aims to produce a modern history of the ancient mega-continent Gondwanaland. An international team intends to reorient the history of geosciences towards the southern hemisphere by investigating geologists working in Australasia, South Asia, South America, Southern Africa and Antarctica since 1788. This includes analysis of how Gondwana fossils came to fuel the industrial age. The team also aims to explain how, why and with what effect the term 'Gondwana' has retained such strong cultural purchase, well beyond the geological domain. This should productively recast ideas of a global south and improve understanding of what ‘Gondwana’, and deep geological time, mean for societies across the southern hemisphere.	78,389.50	171,263.00	184,398.50	106,525.00	15,000.00	0.00	555,576.00
	National Interest Test Statement Australian coal, oil and gas reserves are known as ‘the gifts of Gondwana’. With detailed knowledge of past Gondwana research, this project should contribute a long perspective on Australia’s resource history, assisting decision-making on future energy and environmental policy. It should advance capacity for management, interpretation, and international connection of the UNESCO World Heritage Gondwana Rainforests in Eastern Australia. Historical data and analysis on Antarctic geology and palaeontology should strengthen heritage, environmental and scientific knowledge for use within the Australian Antarctic Territory and beyond. By clarifying how historic geological surveys created coal industries across Australia, the project should contribute data and analysis to multiple coal heritage sites. Understanding of the Australian geological and cultural significance of Gondwana will be significantly expanded through engagement with top-tier historical experts on India, South Africa, and South America, whose close participation should boost the international impact of early and mid career Australian researchers.							
DP210101228 Ambikairajah, Prof Eliathamby	This project aims to investigate biologically-inspired binaural coupling models in the context of the deep learning paradigm by formulating desirable higher level auditory structures as neural network sub-systems. This project expects to generate new knowledge for developing the next generation of robust speech processing systems that are capable of mimicking the selecting listening ability of humans when faced with realistic noisy speech signals and the ‘cocktail party problem’ using innovative binaural feedback systems. This work should provide significant benefits, including improved voice biometrics and selective auditory attention capabilities in machines.	77,000.00	156,500.00	161,500.00	82,000.00	0.00	0.00	477,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement The use of speech interfaces and voice biometrics based security systems is rapidly gaining momentum, from mobile apps to smart homes; and speech-enabled services in the public domain including services from banks and government agencies. However, the listening capabilities of these systems are still orders of magnitude worse than human capabilities, and are incapable of listening to a single speaker in environments with multiple talkers and background music. The adaptive approach developed in this project for tuning to a specific speaker integrated with speech based AI will lead to a wider uptake of the next generation of voice based systems that are also more secure against speech based attacks, placing this project under the key research priority of Cyber Security. We also expect that insights obtained from this project can be transferred to the next generation of cochlear sound processing hardware, thus providing selective hearing capabilities to cochlear implant users in a noisy and multi-talker environments. Our research will lead to patentable IP which can be successfully commercialised.							
DP210101440 Lee, Dr Seojeong	This project aims to provide a new statistical analysis of the government spending multiplier by acknowledging that government spending is the sum of sectoral spending which has heterogeneous effects on the economy. An added complication is that the multiplier can also be state-dependent, meaning that its magnitude can differ across recessions and expansions. Expected outcomes of this project include a better understanding of the components of the multiplier by novel decomposition and the development of a new statistical test for the state-dependency of the multiplier. This should provide significant benefits to researchers by bringing in new tools and insights and to policymakers by providing timely guidance on fiscal policies.	56,156.50	112,313.00	112,313.00	56,156.50	0.00	0.00	336,939.00
	National Interest Test Statement In response to the GFC, the Australian Government announced a series of stimulus packages, a total of $57.1 billion during the period from October 2008 and February 2009. The Australian economy subsequently did not suffer a recession. However, whether this was due to the increased government spending or other factors is unclear. This project aims to provide statistical analysis of the multiplier under the realistic assumption that where the government spends - military, infrastructure, health or education - as well as when the government spends - recessions or expansions - are important factors that can affect the magnitude of the government spending multiplier. By developing a new statistical tool that works under the broader situation and applying it to the Australian data, the project will help answer difficult questions on fiscal policy, such as whether tax cuts stimulate the economy more than spending or when and where the government should increase spending in facing increased economic uncertainty worldwide.							
DP210101604 Lancaster, Dr Kari	This project develops new ways of doing implementation science. Scientific innovations can profoundly shape the well-being of society, especially where new technologies promise radical transformations. Yet how technologies move from evidence to practice remains little understood. This project develops an approach that understands the complexity of translating technologies into practice and investigates how evidence-making in implementation science is best done. It generates new knowledge through a world-first study of the implementation of interventions using the cases of hepatitis C and HIV elimination. Benefits include optimising implementation and better ways of evidence-making in implementation science for health and beyond.	90,241.50	181,394.50	177,989.50	86,836.50	0.00	0.00	536,462.00
	National Interest Test Statement Health spending is rising as governments invest in new technologies. Knowing how technologies are made to work in practice is therefore vital. Yet how technologies move from evidence to practice remains little understood. Many interventions are never actualised into use, others fail and most produce unexpected effects. The field of implementation science no longer treats evidence-based intervention as a matter of simple transfer but as a problem of complex translation. Intervention translations requiring human engagement, among the vulnerable or marginalised, in social environments of constraint are especially complex. Realising the promise of technologies, such as ground-breaking health treatments, is full of contingency. This needs to be understood and navigated effectively for optimal return on investment in technologies. This project moves implementation science into innovative terrain, with potential to change how intervention implementation is done in health and beyond. The empirical study of hepatitis C and HIV elimination directly addresses the Australian Science and Research Priority area of Health.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101608 Coppersmith, Prof Susan N	This project will exploit recent breakthroughs in materials growth, theoretical physics and micromagnet technology to design and build a new platform for future quantum devices and topological quantum computers. Instead of using exotic materials, we will fabricate hybrid superconductor-semiconductor devices with conventional silicon and germanium semiconductors, using the same nanofabrication techniques that industry uses to create integrated circuits. The outcome will be an entirely new approach to hosting topological modes, in an architecture that can be scaled to make topological based qubits, using industrially compatible semiconductors.	100,000.00	195,000.00	190,000.00	95,000.00	0.00	0.00	580,000.00
	National Interest Test Statement The outcomes will advance the fundamental knowledge base of quantum electronics. This is an area with enormous future potential for both the computing and semiconductor industries. The knowledge generated by this project will further advance the development of quantum computers and so consolidate Australia's leadership in the fabrication of innovative quantum devices. The new approaches to device design proposed here offer the potential for the fabrication of quantum devices, but at lower cost. The outcomes of this research will further build Australia's quantum computing capabilities. This proposal fits in the National Research Priority of Advanced Manufacturing, and will not only build Australian research capacity, but also provide a highly trained workforce in the rapidly emerging field of quantum electronic devices.							
DP210101645 Wang, Prof Jun	This project aims to develop an abrasive waterjet process technology that is expected to increase the manufacturing efficiency by 4 times for complex curved surface structures such as the integral impellers and blisks used in turbine machines and aeroengines. It will also explore the science associated with the energy dissipation process for ultrahigh velocity abrasive waterjets and the curved surface generation process by the impact of a cloud of numerous particles. The intended outcome will break a technological barrier and make it entirely possible for the wide use of integral impellers and blisks in airplanes to significantly increase fuel efficiency. The economic, social and environmental benefit is expected to be enormous.	67,500.00	132,500.00	130,000.00	65,000.00	0.00	0.00	395,000.00
	National Interest Test Statement Components with curved surfaces are commonly used in various applications such as turbine machines and aeroengines. The innovative designs of integral impellers and blisks have been found to increase both the thrust-to-weight ratio and fuel efficiency of aeroengines by about 20%. However, those innovative integral designs have placed a tremendous challenge to the manufacturing industry and their extremely long manufacturing time has severely hindered their practical applications. This project attempts to develop a new process technology using abrasive waterjets that is expected to increase the manufacturing efficiency by 4 times for complex curved surface structures and will make it entirely possible for such innovative integral impeller and blisk designs to be widely used in aeroengines and turbine machines. It is noted that a short-haul narrow-body Boeing 737-800 airplane consumes about 2.6 tonnes of fuel per fly-hour, which becomes about 10 tonnes for an Airbus A380. Thus, the anticipated impact of this research on the manufacturing industry, the economy and the environment is very significant.							
DP210101650 Holzer, A/Prof Mark	This Project aims to quantify how the ocean's biological pump, which exports newly formed organic matter into the ocean interior, responds to environmental change. The biological pump is a key control on the global carbon and oxygen cycles, and hence on the viability of marine life. New, efficient numerical models will be developed and analysed with highly innovative mathematical methods. Expected outcomes are optimised predictive models and a new understanding of the possible future evolutions of the ocean carbon cycle, acidification, and oxygenation. This should provide significant benefits such as predictions of future ocean health, identification of processes that are sensitive to change, and strategies for marine resource management.	68,500.00	140,000.00	144,500.00	73,000.00	0.00	0.00	426,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	The proposed research will contribute to Australia's stewardship of its ocean environment and marine resources. Specifically, the research will allow predictions of likely future states of ocean acidification and oxygenation, which are economically important for the viability of fisheries and ocean health in general, including the health of the Great Barrier Reef. The research will add value to CSIRO's climate prediction efforts by contributing models of ocean biogeochemistry that are vastly more efficient than those currently used. This will allow biogeochemical parameters to be objectively optimised against observations and the systematic exploration of many more potential future scenarios than is currently possible. Our approach will allow for more robust predictions, uncertainty quantification, and mechanism identification, which are not possible with the current implementation of ocean biogeochemistry in CSIRO models because of their computational expense. The research thus contributes to Australia's interest in managing climate change, which already has profound impacts on the Australian economy.							
DP210101723 Yao, Dr Lina	This project aims to develop innovative techniques for effectively and efficiently managing user preference profiles from less labelled, sparse and noisy interaction data. A unified novel learning framework along with a set of data analysis techniques are expected to be developed from this project, which will provide a non-intrusive way of conducting predictive analysis on user preference profiling via discovering human explicit and implicit interest domains. The expected results of this application will not only maintain Australia's leadership in this frontier research area, but also support many important applications that safeguard Australian people and economy such as cyber security, healthcare, and e-Commerce.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
	National Interest Test Statement							
	Preference learning is a fundamental technique that supports a wide spectrum of key applications falling on the National Research Priorities in terms of Cybersecurity and Transport. Cybersecurity. Preference inference is able to develop automatic personalised privacy preference strategies to predict users' future privacy decisions. In addition, the outcome from this project will enable an effective approach to detect any abnormal activities deviating from their preferred routines. It can be a potential means to detect and forecast terrorist activities to safeguard national security and defence, such as money transfers and communications, and to identify and track individual terrorists, such as through travel and immigration records. Transport. Preference learning reflecting the signature patterns of people can identify patterns and detect irregularities regarding individual mobility in the public transport system. This is crucial for transport planning and operation, and for other law enforcement applications (e.g., fraudulent behavior).							
DP210101784 Rogge, Prof Sven	This project aims to create a tool to systematically engineer optical properties of emitters in solids by understanding and manipulating materials atom by atom. The tool – an optically enhanced scanning tunnelling microscope – is expected to drive future developments in optical technologies. The project expects to deliver an atomic-scale understanding of rare-earth sites optimised for sensing and coherence. The expected outcomes include highly developed theoretical insights into solid-state emitters and how to control their interactions with light and other fields. The expected benefit based on the ability to engineer optimised emitters for optical sensors and quantum technologies will transform material science from exploration to design.	137,500.00	244,500.00	134,500.00	55,000.00	27,500.00	0.00	599,000.00
	National Interest Test Statement							
	This project aims to create a tool to engineer optical properties of emitters in solids by systematically understanding and manipulating materials atom by atom. The tool – an optically enhanced scanning tunnelling microscope – is expected to drive future developments in optical technologies. The project will deliver an atomic-scale understanding of rare-earth sites optimised for sensing and coherence. The expected outcomes include highly developed theoretical insights into solid-state emitters and how we control their interactions with light and other fields, transforming this material science from exploration into rational design. The development of optimised emitters for optical sensing and quantum technologies will greatly enhance the capabilities of Australian industry by enabling new types of sensors with greater sensitivity, selectivity, and noise resistance and potentially as well by enabling reliable and high-throughput quantum communication.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101892 Baker, Dr Matthew A	This project aims to design DNA-based nanotechnology for processing optical signals in synthetic biological systems. The intended outcome of this project is to develop a system for signal transduction in artificial bilayers using new DNA nanostructures. The anticipated goal of the project is to deliver: 1) light-based control of membrane protein insertion into artificial bilayers; 2) novel DNA-based pores that can transduce signals across membranes; 3) signal processing using multi-compartment biological components composed. Together, this technology allows us to use light and external signals to control biochemical pathways in synthetic systems. **National Interest Test Statement** The field of self-assembling DNA nanotechnology allows us to build programmable molecular nanomachines, which can be externally controlled by chemical, light, electrical and magnetic signals. This project will build externally-controlled DNA nanomachines for precision molecular communication across multi-compartment lipid droplet networks. This will contribute to Australia's national interest by providing an enabling new technology platform for: precision control of 'organ-on-a-chip' models for high-throughput drug screening, synthetic tissue for medical implants and replacements, and even facilitate extension of recent breakthroughs in neural prosthetics e.g. allowing tetraplegics to operate their own arms again or restoring vision to the blind. Overall this technology promises significant economic, commercial and quality of life benefit to the Australian community.	81,605.50	161,925.50	162,851.50	82,531.50	0.00	0.00	488,914.00
DP210101904 Xu, Dr Jiangtao	This project aims to assemble a library of novel chiral polymers mimicking natural peptides with precisely controlled primary structures using emerging synthetic technologies. A systematic investigation of these synthetic materials will provide an in-depth understanding of how sequence and stereochemistry influence chemical and physical properties. Employing rational design principles, desired functionality could be optimised through the selective modification of polymer structure. These materials should be able to emulate the unique properties and functionality of natural peptides/proteins, making them invaluable for biochemical applications, such as molecular recognition and asymmetric catalysis. **National Interest Test Statement** This project aims to develop a chemical toolbox to greatly advance the production of synthetic polymers. Employing rational design principles, desired functionality will be optimized through the selective modification of polymer structure. Synthetic polymers with precisely controlled sequence, geometric properties and functionality could find a broad range of applications, particularly in pharmaceutical research and development. The project will contribute to Australia's National Science and Research Priority of "Advance Manufacturing" by providing specialised high-performance polymer materials. If successful, the project outcomes could result in the development of new catalysts and polymers for bio-applications, with particular benefit to the Australian pharmaceutical industry.	60,000.00	125,000.00	130,000.00	65,000.00	0.00	0.00	380,000.00
DP210101923 Warton, Prof David I	The aim is to develop fast, modern statistical methods for analysing high dimensional data in ecology at large scales, in particular, for visualising, classifying and predicting ecological communities. The benefit of the project is a set of multivariate tools that can be used to better understand biodiversity and its response to environmental drivers, a challenging statistical problem. The proposed methods for analysing high dimensional data can provide insight into large scale questions in ecology, such as automated identification of biogeographic boundaries. The expected outcome is a powerful statistical toolset for model-based analysis of high dimensional data, introducing modern multivariate approaches to a high-impact area of ecology. **National Interest Test Statement** The natural environment is under pressure from a number of sources, including changes in land use and climate. A key step in managing this challenge is understanding how the composition of ecological communities responds to such drivers of change, and predicting how it might respond under future change, such as larger and more intense bushfires. From a statistical standpoint this is a challenging multivariate problem, because data are high-dimensional (with many, correlated variables) and discrete, with many zeros. New methods are needed to answer multivariate questions about ecological communities at large scales. The statistical tools developed in this project can be used by land managers to inform decision-making, and by ecologists to better understand their study system. The project team have a strong track record of achieving such outcomes previously. The proposed new multivariate methods will be of interest internationally in statistics, ecology and to others dealing with large, noisy data, and will assist in training a new generation of interdisciplinary researchers in a high-demand area.	67,500.00	135,000.00	137,500.00	70,000.00	0.00	0.00	410,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101978 Bao, Prof Jie	This project aims to develop a novel process control approach that utilises big process data to improve the cost-effectiveness of industrial processes. Existing monitoring systems in the industry have been collecting a tremendous amount of process operation data but little effort has been made to use the big process data to enhance process operations. Based on the system behavioural approach and dissipativity theory, integrated with machine learning techniques, this project expects to develop a novel framework for data-driven control using big process data. The outcomes are expected to benefit the Australian process industry, where many processes are controlled by inadequate logic controllers, by improving their operational efficiency. **National Interest Test Statement** Australia has very strong process industries (e.g., sugar, fertilizer, gas, steel, metal production and mineral processing), representing over $156bn turnover and $46bn value added per year. In these industries, many processes have complex nonlinear dynamics but are still controlled by simple logic controllers that do not achieve adequate performance. This project aims to develop a novel data-driven control approach to utilise the vast process database available in the industry to improve the efficiency of process operations, reducing the energy/materials consumption and improving product quality, helping improve the Australian industry's competitiveness in the global market. With Industry 4.0 turning into reality, industrial processes are becoming cyber-physical systems that generate, process, store and communicate a large amount of data. The expected outcomes of this project will provide a cornerstone of future data-based smart manufacturing. This project will provide excellent training for young researchers in this emerging area and enhance Australia's scientific reputation in the international arena.	84,467.50	170,607.50	140,252.50	54,112.50	0.00	0.00	449,440.00
DP210102085 Micolich, Prof Adam P	This project aims to create new biophysical tools for single-molecule sensing by advancing the state-of-the-art in nanoscale bioelectronic devices. The goal is to generate novel bioelectronic devices optimised for fabrication on microscope coverslip (170 micron glass) for compatibility with new low-cost platforms for advanced biological microscopy. Expected outcomes include the first organic electrochemical transistors interfaced to constrained area lipid bilayers for studying membrane proteins at single-molecule level and nanoscale transistors for electrostatically detecting motile microtubules in in-vitro molecular motor assays for biocomputation. The intended benefit is innovation in capabilities and manufacturing of bioelectronics. **National Interest Test Statement** Biotechnology is a major contributor to the Australian economy with annual revenues over $8 billion, growth exceeding 4% and generating employment for over 48,000 Australians in high-value STEM jobs. Bioelectronics and biosensors are a significant contributor to this industry; success stories in this space include the cochlear implant and glucose sensors, which improve the lives of countless Australians of all ages. This industry is highly reliant on continuous innovation, a pipeline that ultimately begins with strategic basic research like that in our project. Our aim is to push the boundaries on nanoscale single molecule biosensors trying to make devices where studies can be made simultaneously by electronic methods and new low-cost portable microscopy platforms. This involves significant advances in production methods to transfer devices from silicon wafer to the ultrathin glass used in microscopy. Our work at the interface between bioelectronics and advanced microscopy has potential applications in neural interfacing, drug studies, biocomputation, neuromorphic computing and electronic nose technologies.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
DP210102133 Fahrenbach, Dr Albert C	This Project aims to develop experimental models for chemical evolution that may have happened on the early Earth and which were important to the emergence of life. This Project expects to uncover synthetic pathways for ribonucleotide production using a combination of ionizing radiation and dry-wet cycles. Expected outcomes include an increased understanding of the range of physical and chemical parameters that will allow for ribonucleotide production to occur under the proposed geochemical settings. The knowledge gained in this Project will benefit the understanding of the chemical evolution of complex chemical mixtures relevant to early Earth environments and provide new mechanisms for how ribonucleotides could have arisen abiotically.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Australia has a proud tradition of making significant contributions to answering the “big questions”. One of the most fundamental scientific questions relates to the origins of life. This project aims to simulate chemical conditions on the early Earth to probe how elementary chemical reactions gave rise to the first RNA (DNA's molecular cousin), 4 billion years ago. By doing so, we will be able to contribute significant chemical information to a broad international coalition of researchers, including NASA scientists, geochemists and planetary modellers working towards identifying specific environmental and planetary scenarios conducive to life, not only on the ancient Earth, but potentially other planets. Keeping Australian science engaged with the largest and most advanced Space agencies in the world will greatly benefit Australia’s newborn Space Industry and maintain Australia’s excellent reputation in high profile fundamental science.							
DP210102134 Harvey, Prof Richard	The project aims to define the blueprint for ventricular septation in the mammalian heart – how, during heart development, a single ventricle becomes divided in two by a muscular wall, thus creating left and right pumps and electrical circuits serving the body and lung circulations separately. A proprietary mouse genetic model was created and will be used to probe the cellular and molecular mechanisms of septation using new technologies able to resolve biology at a single-cell level. Outcomes may include new knowledge on heart development and evolution, including how the cardiac electrical system is formed, and how cell boundaries and tissue complexity are generated. The project may advance new technologies and create new data resources.	145,500.00	261,750.00	256,550.00	140,300.00	0.00	0.00	804,100.00
	National Interest Test Statement							
	There is an important knowledge gap in how the architectural blueprint of the heart is established in utero. Understanding the formation of complex tissues at cellular and molecular resolution is fundamental to a number of burgeoning industries including bioengineering, 3D printing, cell therapeutics, drug discovery, synthetic biology and regeneration science, some of which will already bring great economic benefit to Australia. The enhanced understanding of heart formation that will flow from this project may be useful in the future for creation of novel products, processes and industries impacting human and animal health. Although well beyond the scope of this project, this might include, e.g., new ways of making complex tissues such as a pacemaker or bioengineered cardiac surgical patch, or how to build an organoid containing an important cell boundary valuable for high-throughput drug screening.							
DP210102169 Ng, Dr Derrick Wing Kwan	Drone-based communication is a revolutionised wireless paradigm for the development of highly flexible and cost-effective beyond fifth-generation (B5G) wireless systems. This project aims to develop novel communication theories and practical techniques to realise truly high-speed and ubiquitous communication required in B5G networks. The project intends to deliver resource allocation designs, robust transceiver designs and a system-level analysis as the foundations and tools to unlock the potential of this promising paradigm. The outcomes of this project are expected to fundamentally advance the knowledge of drone-based communications with significant economic values to service providers and benefits to mobile users over the world.	83,870.00	167,004.50	168,505.50	85,371.00	0.00	0.00	504,751.00
	National Interest Test Statement							
	Despite the fruitful research on wireless communication in the past decades, the provision of ubiquitous and high-data-rate communication in Australia is still challenging due to the sparse population and high-cost of infrastructure. So, developing drone-based communication for beyond 5G is crucial for the on-going productivity growth of Australia, as it can offer a highly flexible and cost-effective deployment of communication infrastructures. Hence, the outcomes of this project will accelerate the development of beyond 5G communication networks in the next decade which will equip Australian companies to seize the technology opportunity for business. Furthermore, the PhD students and research scientists trained for our project serve as a vital talent pool to Australia and they are valuable human resources to improve the national economy and the global competitive edge.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102288 Doolan, Prof Con	This project aims to understand how to control noise created by the interaction of airfoils with complex, real-world turbulence. This project is significant because it will develop novel serrated and porous leading edges tailored for complex turbulence for the first time. Using innovative experimental and theoretical techniques, the project will dramatically advance the science of aeroacoustics. The expected outcomes of the project will be substantial reductions in noise from aircraft, wind turbines, submarines and drones. This will provide significant benefits such as a reduction in environmental noise pollution, better public health and submarines with increased stealth.	110,000.00	195,000.00	130,000.00	45,000.00	0.00	0.00	480,000.00
	National Interest Test Statement This project will provide industry with new means to control flow-induced noise using efficient, passive noise control devices. The project will allow the design of quieter aircraft, thus boosting not only the civilian aerospace industry, but also supporting trade and the dissemination of ideas, foundations of the knowledge economy. The project will enable quieter wind turbines, allowing more renewable energy to be generated per square kilometre. Silent marine propellers, also possible from this project, will simultaneously enhance Defence capability and reduce anthropological noise in the oceans. This project will reduce environmental noise pollution and thus will improve public health and Australians' quality of life. The project provides high-level research training and supports international collaboration with experts from France and the UK.							
DP210102294 Konstantinou, Dr Georgios	Medium voltage DC (MVDC) systems promise to offer the required flexibility in next generation active electricity networks to enable higher renewable energy integration, take advantage of more readily available energy storage, and manifest simpler control and operation. The intended outcome of the Project is to address the challenge of developing MVDC networks via an integrated and cohesive approach, from the initial design of the individual power electronics converters, right up to network design and "system of systems" implementation. The outcomes of the Project will provide clear pathways and solutions for new topologies, facilitating Australia's and the world's transition to next generation electricity infrastructure.	79,635.00	159,259.50	132,369.50	52,745.00	0.00	0.00	424,009.00
	National Interest Test Statement Decarbonisation of the economy, greater integration and utilisation of renewable energy in a sustainable, grid-friendly manner, and the ongoing electrification of transportation are key goals that Australia needs to achieve in the near future to meet policy commitments and societal expectations. This Project aims to make breakthrough developments and advances in the field of medium-voltage DC (MVDC) systems. It will provide invaluable technical capabilities for modern electricity networks, employing an integrated approach from the conceptual to the functional level of MVDC systems; develop novel system design methods; adopt open modelling approaches and an integrated operation/protection approach, and; utilise modern methods and state-of-the-art real-time simulation facilities. The expected benefits of the Project will help future-proof national power systems, enable new and exciting engineering applications, and establish the Australia's academic and technical leadership in this globally competitive field.							
DP210102346 Seidel, Prof Jan	The engineering and utilisation of multiferroic and skyrmion materials is currently receiving tremendous attention as they offer a plethora of fascinating phenomena for fundamental research and future technological applications in nanoelectronics and high density data storage. One bottleneck for applications is the precise control of magnetism in single phase materials. The project is expected to deliver insight into synthesis and properties of new topotactic magnetic materials. The utilization of topotactic transitions (reversible stoichiometric changes in materials that lead to changes in the crystal structure) can be seen as a new concept for designing controllable multiferroic and skyrmion host materials for future nanoelectronics.	72,000.00	144,500.00	146,500.00	74,000.00	0.00	0.00	437,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Multiferroic materials and skyrmion materials are emerging classes of high-efficiency functional materials that have been shown to possess excellent properties for nanoelectronics applications in data storage and environmentally friendly and energy-efficient information processing and computing. They are also used in sensor and detector applications, for example in novel miniaturized wifi and mobile phone antenna designs. This proposal will significantly impact the development of novel synthesis and application concepts and processes based on topotactic magnetism in these materials, which allows control of the materials properties through a new concept. A better understanding of such control will pave the way to novel multiferroic materials and skyrmion host materials. This proposal will thus significantly impact the development of novel functional materials concepts through advanced materials characterisation and fabrication techniques and therefore has significant economic and environmental benefits for Australia through the development of new efficient materials for communication and nanoelectronics.							
DP210102351 Harmon-Jones, Prof Eddie	The proposed research aims to test whether greater humility is associated with less anger and aggression. Using a variety of methods from experimental psychology and cognitive neuroscience, this project aims to also examine exactly how humility may reduce anger and aggression.The project is significant in that it expects to provide a programmatic line of research suggesting ways in which anger and aggression can be reduced. This basic research aims to increase our understanding of how, when, and why humility reduces anger and aggression. In addition, the research may suggest ways in which society, educators, parents, and therapists can reduce anger and aggression in others.	48,456.00	102,651.00	105,746.00	51,551.00	0.00	0.00	308,404.00
	National Interest Test Statement							
	The proposed research will lead to a fundamental understanding of whether and how humility reduces anger and aggression. A better understanding of whether and how humility reduces anger and aggression may eventually inform interventions that will provide society-wide benefits to the Australian community, such as reducing domestic violence. Increasing humility may also increase the well-being of those who experience anger and aggression. Anger is a major contributor to aggressive behaviour and imposes substantial social and economic costs to Australia and the world. In Australia, cardiovascular disease and mental disorders are 2 of the top 3 contributors to the burden of disease, and anger influences both of these contributors. Also, information gained may suggest ways to reduce aggressive driving and road rage as well as other societal problems (e.g., online bullying).							
DP210102409 Xue, Prof Jingling	This project aims to develop an event-interleaving analysis for detecting asynchronous event-driven order violations in Android apps. This project therefore expects to deliver a program analysis foundation that can provide stronger security guarantees than the state of the art against advanced exploits that abuse such asynchronous vulnerabilities. The intended outcomes of this project are a new program analysis technology and an industrial-strength open-source framework that can significantly raise the bar on mobile software quality and security for Android, the dominant smartphone platform accounting a current market share at 87.0% with 2.9 million apps at Google Play in December 2019.	50,000.00	102,500.00	107,500.00	55,000.00	0.00	0.00	315,000.00
	National Interest Test Statement							
	This project will develop a security analysis tool for detecting and mitigating security vulnerabilities in Android apps. This will provide practical solutions to many Australia-based ICT industries (e.g., defense, finance, banking, retail, and communication), where "mobile is moving from a device for individuals to a platform for all of business' ICT needs: email, software, cloud, big data, and m-commerce", with the mobile telecommunication industry revenue being 22.0 billion in 2011-12, according to a report commissioned by Australian Mobile Telecommunications Association (Mobile Nation: The economic and social impact of mobile technology, 2013). According to the 2017 Threat Report from Australian Cyber Security Centre (ACSC), the number of cybersecurity threats is increasing in Australia: "the ACSC has observed a shift in cybercriminals' targeting and capability, specifically their development of expertise and malware to target Australia and the increased targeting of Android smartphones." This project will therefore help in enhancing Australia's competitiveness in developing its core mobile technology.							
DP210102463 Tanaka, Prof Mark M	This project aims to develop new mathematical and computational models to examine whether cultural innovations creates conditions for the emergence of new diseases. It will combine elements of microbial evolution and cultural evolution to advance a new modelling framework to consider their joint dynamics. The expected outcome is an enhanced understanding of how human behaviour influences the emergence of infections. This will bring benefits of computational models for broad use in understanding complex population processes, and training to maintain mathematical and computational skills in the Australian workforce.	70,000.00	135,000.00	130,000.00	65,000.00	0.00	0.00	400,000.00

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement When diseases like Ebola or coronavirus appear in populations, they are often triggered by people altering their behaviour or adopting new cultural practices. For example, legionnaires' disease originated in the cooling towers of air-conditioning systems, a technological advance that promoted contact with a pathogen. This project addresses a fundamental question about how cultural changes and innovations can modify microbial populations and allow new diseases to arise. This problem will be approached by surveying current knowledge and analysing new mathematical and computer models to track changes in culture and in the ecology and genes of microbes. Such models can tell us about if and when these emergence processes are inevitable, avoidable or perhaps even reversible. Setting aside biomedical aspects of particular pathogens, this project instead proposes and develops a novel perspective on emerging diseases that ultimately serves to enhance our knowledge of our own innovation-driven species. This project further serves national interest by contributing to analytical and computing skills in the workforce.							
DP210102554 Seidel, Prof Jan	Topological structures, such as domain walls, vortices and skyrmions have recently seen considerable attention due to their potential application in nanoelectronics and new electronic device concepts. These structures are key to the design and understanding of novel functionalities in ferroic materials. The aim of the project is the investigation of fundamental properties of multiferroic skyrmion materials, i.e. their nanoscale structure, surface topology, dynamics and their interaction with external stimuli. The control of these structures through external electric and magnetic fields, as well as strain and light will be investigated for applications in nanoelectronics and data storage.	55,000.00	87,500.00	65,000.00	32,500.00	0.00	0.00	240,000.00
	National Interest Test Statement Topological structures, such as domain walls, vortices and skyrmions, exist in materials with built-in order (magnetism, ferroelectricity etc.). They can be as small as 1...10 nm and therefore offer tremendous potential for new data storage devices since they overcome the size limit of current data bits. They can be generated and manipulated by low-energy external field pulses and can thus be utilized in energy-efficient architectures such as "racetrack memories". Sophisticated materials engineering is needed to find systems with optimal physical properties for these nanoelectronics device applications. This project aims to systematically create and investigate materials that contain topological structures as the basis for next generation computer and information technology in Australia. A better understanding of such materials therefore has significant economic and environmental benefits for Australia through the development of new efficient materials for communication and nanoelectronics.							
DP210102561 Banner, Em/Prof Michael L	This project aims to investigate the importance of the group structure and breaking of wind-generated waves of various scales in the air-water exchange of mass, momentum and energy. This project expects to generate new understanding in the area of air-water exchanges using an innovative approach based on direct numerical simulation of wind over unsteady water wave groups for a wide range of wind speed and wave steepness conditions. Expected outcomes of this project include generating fundamental knowledge of the unresolved physics and new parameterisations for air-water exchange rates. This will deliver more accurate and more comprehensive forecast models for weather, inland and ocean waterways, and numerous industrial processes.	78,882.00	158,439.00	154,114.00	74,557.00	0.00	0.00	465,992.00
	National Interest Test Statement Australia experiences a wide annual range of weather and ocean conditions that are fundamental drivers of our national economy. Much variability arises from the air-sea interface where significant transfers of mass, momentum and energy occur. Increased accuracy of air-sea exchange rates, especially during severe weather, is essential for the new generation of coupled earth model systems that link the air, ocean and land. This project focuses on elucidating and quantifying the role of so-called ocean wave groups in air-sea exchange. Our recent research suggests essentially that this is important and a vital missing element to a more holistic understanding of key air-sea interaction processes. We will incorporate our mix of theoretical, numerical and observational expertise into improved environment models that will improve national weather and sea state forecasts for a wide range of commercial, environmental and recreational industries. Improved forecasting translates to economic benefit in industries ranging from agriculture, defence, to energy production/management, among many others.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102576 Yang, Prof Hongyuan R	The general aim is to elucidate the fundamental molecular mechanisms that govern the biogenesis/formation of the lipid droplets. Lipid droplets store sterol esters and/or triacylglycerols, two major storage lipids that play key roles in cellular and whole body lipid metabolism. Lipid droplets are also the core components of plant oil and biodiesel. Little is known about how lipid droplets are generated. The proposed work will examine the synthesis of certain lipid intermediates such as phosphatidic acid, and their impact on the biogenesis of lipid droplets from the endoplasmic reticulum. Such fundamental new knowledge on how cells store neutral lipids will provide new strategies for enhancing plant oil and biodiesel production.	84,750.00	170,500.00	185,750.00	100,000.00	0.00	0.00	541,000.00
	National Interest Test Statement The general aim is to elucidate the fundamental molecular mechanisms that govern the biogenesis/formation of subcellular organelles, the lipid droplets. Lipid droplets store sterol esters and/or triacylglycerols, two major storage neutral lipids that play key roles in cellular and whole body lipid metabolism. This research may help develop better strategies on how to enhance the production of plant oil and biodiesel, both of which derive from lipid droplets. Moreover, since the hallmark of human obesity is the accumulation of enlarged lipid droplets within adipocytes, this work from basic cell research may eventually shed lights on whether and how interference of lipid droplet dynamics may be applied in the battle against obesity. Obesity has become a pandemic in developed nations including Australia, and biodiesel/renewable energy can help save the environment. Therefore, our fundamental research on the biogenesis of lipid droplets has great health and environmental benefits to the Australian community, and is of high national interest.							
DP210102689 Armstrong, A/Prof Ryan T	The project aims to provide new insights into the ways that Australia’s abundant energy resources can be utilized for energy security and environmental stewardship. The simulation workflows and fundamental insights on wettability and porous media flows investigated are intended to provide significant outcomes toward the national priorities. These developments are paramount for various subsurface applications, such as geological storage of CO2, oil/gas recovery, groundwater remediation and energy storage. The oil/gas industry spend hundreds of millions of dollars on core analysis for the determination of rock properties; the proposed research aims to provide the fundamental insights necessary to advance the utility of these measurement.	17,379.00	79,897.00	140,339.50	77,821.50	0.00	0.00	315,437.00
	National Interest Test Statement The main contribution of the project is to Australia’s Science and Research Priorities of Energy and Resources. Australia’s resource sector is a significant contributor to the economy; the scientific advancements gained will be transferable to technologies necessary for energy security, resource extraction and greenhouse gas storage. These technologies are key research priorities facilitating important economic sectors vital for the Australian economy. The project advances a simulation platform called Digital Rock Technology, which is a multimillion-dollar industry that is becoming an increasingly important aspect for reservoir modelling. However, there currently exist no robust way to simulate rock flow properties under realistic wetting conditions, which is known to be an important factor. The research will provided fundamental insights and technological advancements necessary for realistic simulations; ready for industry application. Beyond the oil/gas industry, groundwater and environmental industries also require the similar properties for analysis of water aquifers and to design remediation strategies.							
DP210102694 Scott, A/Prof Jason A	The research aims to establish new composite materials to enable realisation of next generation organic electrolysers for renewable hydrogen production. Water electrolysis is seen as the front-running technology in Australia's drive to be a renewable hydrogen exporter. Significant opportunity exists in adopting organic electrolysis as an alternative with additional benefits, including lower energy input and value-added chemical production (alongside H2), off-setting costs. Challenges exist with controlling organic product selectivity and restricting carbon dioxide generation. The project intends to deliver a system which uses complementary phenomena (light activation, controllable polarity, magnetic response) to resolve said challenges.	87,410.00	181,034.50	173,249.00	79,624.50	0.00	0.00	521,318.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	There is an increasing drive to direct Australia's energy reliance away from carbon dioxide-emitting processes and towards clean and sustainable energy sources such as hydrogen. A new clean energy technology will be established that simultaneously and selectively produces hydrogen and value-added chemicals from a waste organic stream. The project outcomes align with the Australian Science and Research Priority 'Energy: New clean energy sources and storage technologies that are efficient, cost-effective and reliable'. Light, a small electrical bias and a magnetic field are the energy inputs. It will deliver National economic benefits in the form of a hydrogen technology for domestic use/export which uses less energy than traditional water electrolysis systems. Further, value-added organic chemicals will be selectively produced, off-setting system costs and enabling access to new markets. The technology is novel and has a capacity for IP generation, eventual commercialisation and investment. It will deliver environmental benefits to Australia as no carbon dioxide emissions will arise from the process.							
DP210102698 Gooding, Prof John J	The aim of this project will be to develop a far greater understanding of the impact of nanoconfinement in electrochemistry. The project will generate this knowledge by fabricating electrodes with well-defined nanoconfined spaces coupled with molecular dynamic and continuum simulations of the electrochemical systems. The expected outcomes will be an understanding the impact of dimensions of the nanoconfined spaces, the surface chemistry of these spaces and the electrolyte solution, a comprehensive understanding of nanoconfinement in electrochemistry. The benefits will be a dramatic improvement in the performance of electrochemical technologies for electrocatalysis, energy storage and sensing.	70,000.00	132,500.00	125,000.00	62,500.00	0.00	0.00	390,000.00
	National Interest Test Statement							
	This research will benefit Australia by strengthening and enhancing Australia's standing in the international scientific community in the fields of electrochemistry, clean energy solutions and sensors. It will lead to high impact publications. An understanding of the importance of nanoconfinement in electrochemistry will produce valuable intellectual property in electrocatalysis and sensing. The research will contribute to the broader societal need for more efficient electrocatalysts for clean energy. The proposed research aligns with the Science and Research Priority of Australia in Energy and the Practical Research Challenge, 'New clean energy sources and storage technologies that are efficient, cost-effective and reliable'. There is a strong benefit to Australian science through the international linkages in this grant. This multidisciplinary research will contribute to the training of Australia's future, highly skilled workforce required by academia and high technology industries. The training will contribute to Australia's innovation capability in our important nanotechnology and energy sectors.							
DP210102700 Matamales, Dr Miriam	Learning from our interactions with the environment is one of the brain's most important functions, yet how and where this process takes place at the neural network level has proven difficult to establish. This Project seeks to investigate how major neuromodulatory signals in the brain coordinate the encoding of reward-based learning in large ensembles of neurons. These studies will combine novel behavioural paradigms with the most recent neuroscience techniques for functional mapping and manipulation of specific neural circuits in behaving mice. The outcomes of this research will lead to a significant shift in our understanding of the mechanisms underpinning the integration of learning in brain systems and its implications for behaviour.	59,253.50	122,523.50	129,849.00	66,579.00	0.00	0.00	378,205.00
	National Interest Test Statement							
	This project seeks to establish how major neuromodulatory signals in the brain coordinate the encoding of reward-based learning, a process that is fundamental to the integration of cognitive and emotional processes needed for decision-making. Decision-making is a core capacity at the heart of all our everyday activities that is crucial to maintaining normal health and wellbeing. A marked deterioration in this capacity is associated with normal ageing and is one of the most debilitating problems facing our elderly population. In Australia, the number of individuals (over 65) will double from 2020 to 2050, making research in this area of the highest national significance. Any pathway that reduces age-related deficits in decision-making generated as a consequence of this research will, therefore, have a substantial economic benefit as well as improve the quality of life of affected individuals and their families.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102833 Bradford, Prof Mark A	Steel lattice towers find widespread use as structural components in electricity transmission systems and as base towers in UHF and microwave communications networks. They tend be protected from bushfire damage by active backburning or clearing through their easement or right of way, because the response of towers to bushfires is surprisingly unknown, and it is not known if they can provide passive protection without clearing/backburning. A world first, this Project aims to use advanced numerical techniques to assess the fragility and resilience of lattice towers in fire using a systems approach based on fire load data available with a further goal to explore potential pragmatic strengthening strategies if necessary and feasible. **National Interest Test Statement** High-voltage transmission lines and communications networks are critical infrastructure in Australia and around the world, being vital to the economy, livelihood and social fabric of the nation. Both are reliant on the structural performance of steel lattice towers that are mostly in forest environments, often with remote access. Surprisingly, the behaviour of lattice towers in bushfires is little known, and risky backburning/clearing is needed to provide active protection. The catastrophic 2019/2020 fires in Australia have highlighted the need to examine the potential for these towers and associated systems to provide passive resistance, because of a reluctance by some to promote backburning due the toxic emissions that this brings or of the hazards of clearing. Accordingly, this ambitious Project aims to develop an advanced numerical means to assess the vulnerability of common tower types in typical bushfires that can produce temperatures of up to 1100 deg. Using this approach, the fragility of the tower systems will be quantified and, if needed, pragmatic strengthen techniques will be explored.	51,033.50	107,475.00	111,268.00	54,826.50	0.00	0.00	324,603.00
DP210102837 Sytnyk, A/Prof Vladimir	Synapses between neurons play a key role in all functions of the nervous system including learning and memory. They are mostly composed of the unique combination of proteins and lipids, which function together to enable neurotransmission. While the molecular mechanisms determining the protein composition of synapses are well characterised, the mechanisms defining the lipid composition of synapses remain unknown. The project will use advanced techniques of neuroscience and lipid research to determine the mechanisms of lipid transport and retention at synapses. The project is expected to generate new knowledge about the fundamental mechanisms of brain function, which will be useful for developing new therapeutics enhancing the brain power. **National Interest Test Statement** A white paper released in 2019 by Mindgardens Neuroscience Network estimated that neurological, mental health and substance use disorders account for >20% of the burden of disease in Australia ($74 billion in 2017). It indicated that in the future these brain disorders will have a greater cost to the Australian economy than heart disease, cancer, and respiratory disease combined. Our ability to develop therapeutics to restore brain function or slow down its loss requires understanding of the molecular and cellular mechanisms essential for brain function. This project aims to generate new knowledge about the molecular processes enabling neurotransmission in the brain. This new knowledge is expected to lead to better understanding of the causes of brain disorders and their diagnosis. It will identify new therapeutic targets in the area of brain health and thereby increase our capacity to develop therapeutics, which can be broadly used with the aim to enhance brain performance. It may be expected that it will ultimately lead to better quality of life of patients and reduced burden on society.	77,400.00	160,585.00	169,460.00	86,275.00	0.00	0.00	493,720.00
DP210102939 Sarker, Prof Ruhul A	The project aims to develop a novel framework for solving high dimensional decision problems with and without changes. This research is driven by the fact, that there is a huge gap between current research and the methodology needed to solve practical decision problems. In the proposed framework, a number of algorithms will be developed and integrated to generate robust solutions for those problems. The intended scientific outcomes include a novel framework with new techniques, developed by exploiting the impractical assumptions of existing methodologies. Practical outcomes include a robust decision-making tool and strong research training. The developed tool will provide significant cost savings through better decision making in practice.	92,500.00	185,000.00	188,500.00	192,000.00	96,000.00	0.00	754,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement This project aims to develop a novel and effective framework for solving high dimensional problems in complex decision making. Outcomes of the project will lead to an enhanced level of decision making by developing a novel computational tool that will have broad applicability across a number of different industries of importance to Australia, including finance, defence, manufacturing, the resources sector, logistics and transportation. Impacts from the application of this tool will include improved outcomes and efficiencies, leading to increased profitability for organisations through effective pricing, operation and resource allocation. The project will also benefit Australia by expanding both the national knowledge base and fundamental research capability, enhancing international collaboration and enabling us to establish a position of global leadership in this research field.							
DP210102960 Goldys, Prof Ewa M	Understanding why we age and whether aging is preventable are profound research challenges, which must be first tackled at a cellular level. Building on our advances in non-invasive colour monitoring of cell function, this project aims to uncover intimate links between cellular processes and aging in cells that must survive for many decades such as oocytes and neurons. We will explore the tantalising possibility to rejuvenate such aged cells by interfering with molecular master switches of aging. A unique machine learning approach will be applied for finding the most effective interventions. The results will have broad impact beyond the science of aging, in the areas of female fertility, neurodegeneration and immunity.	106,948.50	192,705.00	144,477.00	58,720.50	0.00	0.00	502,851.00
	National Interest Test Statement Australia is aging with estimates that by 2050, one quarter of Australians will be aged 65 years or older. This program will advance our understanding of the regulation of biological ageing. Focusing on well-defined drivers of ageing in cells, it will help develop new, optimised interventions which can modulate, slow down, prevent or reverse these aspects of biological ageing. The conduct of leading-edge research into the fundamental biology of ageing and the development of new targets for interventions will bring international recognition and attract new investment into Australian research. Future extension of this research to translational settings will allow to advance transformative new approaches for maintaining good late-life health and increase lifespan. The advent of health interventions which address the biology of ageing will have transformative impacts on health, healthcare delivery, the fabric of society and the economy at large.							
DP210103138 Waller, Prof Steven T	This project aims to identify ethics-related metrics for improving the design of transport network services, and augment the social benefits of transport systems to relevant user groups. This project is anticipated to conceive, implement and validate new methodologies to solve challenging optimisation problems aiming at promoting ethics in transport systems via the provision of incentives to transport services providers. The outcomes of this project are expected to support the emergence of ethical transport systems and to address fundamental societal and economical challenges induced by utility-driven transport services. This project will help in positioning Australia as a global leader in the field of ethical transport network systems.	89,289.50	176,414.00	168,960.50	81,836.00	0.00	0.00	516,500.00
	National Interest Test Statement This project aims to develop new fundamental techniques quantifying and managing transport network infrastructure decisions towards a more ethical, considered, balanced and equitable delivery of vital societal infrastructure services. National infrastructure industries account for 9.4% of Australia's GDP with $28.7 billion in roads alone (2017-2018) in addition to significant additional expenditures in public transport and mobility as a service. However, this massive investment (and economic activity) does not fully consider the disproportional impact of access and services across distinct protected groups of Australians in our cities and rural regions. The new techniques developed in this project will provide enhanced processes for fair transport infrastructure and service delivery to Australia and the world.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103203 Ritchie-Tyo, Prof Elizabeth	This project aims to quantify the tropical cyclone contribution to the earth energy budget to understand whether tropical cyclones feed back to the climate system. While existing literature focuses exclusively on the effects of climate change on tropical cyclone variability, this project switches this viewpoint around. One possible outcome is a better understanding of long-term tropical cyclone variability. This is particularly important for tropical cyclone vulnerable regions including the Australian east coast and the oil and gas industry off the Northwest Shelf. Furthermore, the anticipated knowledge gained by this project will inform international understanding on the impacts of tropical cyclones to the overall climate system.	67,500.00	141,500.00	119,000.00	45,000.00	0.00	0.00	373,000.00
	National Interest Test Statement Environmental change is a key national science priority. Understanding the feedback between tropical cyclones (TCs) and the climate will allow us to better anticipate long-term TC behaviour. This is important for Australia for a variety of economic reasons. First, TCs have significant impacts on the populations of Queensland and NSW. A better understanding of TC activity will help governments plan for development and emergency preparedness and the insurance industry to properly account for future risk from TCs. Second, the Australian offshore oil and gas industry is greatly impacted by TC activity. Understanding long-term TC trends helps them develop operational strategies that maximize efficiency and minimize risk. Finally, the existing scientific literature focuses exclusively on the effects of climate change on TC activity. This study aspires to quantify the effect of TC activity on the climate. This knowledge will inform international understanding on the impacts of TCs to the overall climate system.							
DP210103233 Mattick, Prof John S	For many years, the mammalian genome has been thought to be mainly junk. Recently, however, it has become evident that most of the genome specifies RNAs that do not encode proteins ('long noncoding' RNAs, lncRNAs), many of which are brain-specific. This project aims to determine the functions of lncRNAs that are expressed in the hippocampus (involved in learning) and the cerebellum (involved in movement coordination) by deleting them in mice, testing for developmental, cognitive and motor effects, and characterising the structures with which they are associated. The results of the project are expected to open new vistas in neuroscience, contributing to understanding the molecular basis of brain function and the 'dark matter' of the genome.	113,080.50	217,741.00	211,874.50	107,214.00	0.00	0.00	649,910.00
	National Interest Test Statement Australia has long been a world leader in neuroscience and the understanding of mammalian development. This project extends that leadership, and has the potential to open new vistas in the understanding of brain function and the nature of the information in the human genome. Like all discovery research, its practical applications are difficult to predict, but maintenance of Australia's preeminence in neuroscience and genome biology is an important cultural objective, and the new knowledge that will be gained has a high probability of underpinning new developments in treating brain disorders, the enhancement of artificial intelligence and the development of new principles of information processing, with potentially very large economic, commercial and social dividends.							
DP210103319 Keane, Prof Michael P	This project aims to generate new evidence on the optimal design of the federal tax system. Specifically, it seeks to determine the optimal combination of taxes on income, capital and consumption to raise necessary revenue while minimizing disincentives for work and capital formation. The project is innovative because, for the first time, it does optimal tax calculations using models that account fully for how taxes affect human capital investment and labour force participation. It aims to enhance or understanding of the optimal mix between taxes on earnings, capital and consumption, and the optimal degree of income tax progressivity. The benefit is a tax system better designed to promote economic efficiency and human capital formation.	105,140.00	220,803.00	275,601.00	345,558.50	371,216.00	185,595.50	1,503,914.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	The results of this project will help in improving the design of the Australian tax code. It is of vital national interest to assure that the tax system achieves a maximum level of efficiency. This means raising necessary revenue in a way that minimizes any negative impact of the taxes used to raise that revenue on the level and efficiency of economic activity. The area of economics that deals with this problem is known as "optimal tax theory." Unfortunately, most prior work on optimal tax system design relies on labour supply models that are oversimplified or outdated, and this can lead to potentially inferior results. We propose to do optimal tax calculations using modern labour supply models that incorporate three key features largely absent from earlier calculations: human capital investment, fixed costs of work and a participation margin, and borrowing constraints and wage risk. All three of these factors may have important implications for the optimal mix between taxes on earnings, capital income and consumption, as well as the optimal degree of progressivity of the labour income tax.							
DP210103471 Pawson, Prof Hal	The project aims to explore and explain contemporary change in the residential parks and communities (PC) and rental villages (RV) sectors, and to set out policy implications, including for housing affordability; housing legal rights; ageing support and care; and financial services consumer protection. Pitched to older persons as affordable alternatives to homeownership and to retirement villages, PCs and RVs are changing, with new large corporate proprietors introducing new business models and housing offers. Financialisation perspectives offer new critical insights into the sectors, including their relations to wider housing and economic dynamics, the strategies and operations of sector organisations, and the everyday lives of residents.	44,401.00	99,892.50	101,105.00	45,613.50	0.00	0.00	291,012.00
	National Interest Test Statement							
	Australia's population is ageing, and declining rates of homeownership and social housing provision are disrupting conventional expectations about post-retirement housing. Two neglected alternative sectors - residential parks and communities (PCs), and rental villages (RVs) - are now changing and emerging as significant housing options. The research will benefit scholarship and policy development regarding PC and RV sectors, with new evidence about the types of PCs and RVs, their place in local housing markets and economies, proprietors' business models and strategies, and residents' experiences of life in PCs and RVs and sector change. The research evidence will assist in formulating local plans for affordable housing, infrastructure and support and care for older persons, and law reform for PCs, RVs and adjacent sectors, such as retirement villages. The research will also make major new contributions to scholarship on housing financialisation, through new thinking on debt and rent relations, and on investment and speculation in post-retirement incomes and liabilities - the financialisation of older age.							
DP210103593 Wang, Prof Wei	This project aims to enhance the quality and completeness for data in data lakes by innovative and judicious use of Database and Artificial Intelligence techniques. To achieve the aim, we will develop knowledge-enhanced error correction during data ingestion, flexible and efficient data exploration, and heterogeneity-tolerant scalable data integration solutions. Its significance lies in integrating techniques from both database and artificial intelligence areas to deliver effective solutions for challenging problems in data lakes. The outcome of this project will provide new knowledge in this cutting-edge domain, and provide additional value and immediate benefits to all applications built upon data lakes.	63,443.00	128,614.00	132,068.50	66,897.50	0.00	0.00	391,023.00
	National Interest Test Statement							
	This project contributes to Australia's Science and Research Priorities towards "better models of health care and services" by "increase efficiency and provide greater value for a given expenditure", and "improved prediction, identification, tracking, prevention and management of emerging local and regional health threats". Data lakes for health data have already been used in hosptials and were found to reduce medical errors and enable prediction and counteraction of future negative outcomes for patients. The outcome of this project can deliver a scalable solution to significantly increase the quality and completeness of health data in the data lake, which will provide correct and timely information vital for prediction and decisions. This knowledge will significantly reduce medical risks and costs while enhance the delivering the best of patient care.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103621 Turney, Prof Christian S	The Antarctic is highly-sensitive to abrupt changes caused by the passing of tipping points within the climate system. Crucially, the instrumental record is too short to resolve major uncertainties surrounding future warming. The Last Interglacial (125,000 yrs ago) was 2°C warmer than today and experienced 6-11 m higher global sea levels. The role of Antarctica is vital for constraining sea-level projections. This Australian-led international project aims to determine the mechanisms and impacts of past interglacial Antarctic warming up to 2°C (relative to pre-industrial). Innovative techniques integrating horizontal ice cores and high resolution marine records will help identify polar tipping points and better plan for impacts in Australia.	150,000.00	250,000.00	145,000.00	45,000.00	0.00	0.00	590,000.00
	National Interest Test Statement In 2016, Australia joined 196 other countries by ratifying the Paris Agreement which aims to limit anthropogenic warming by 1.5-2°C. The high level of uncertainty surrounding climate impacts under such warming raises concerns over Australia's ability to successfully plan for future change. Arguably of greatest concern is the response of the Antarctic ice sheets to future warming and the impacts of these changes. This Australian-led international proposal will create a multidisciplinary research program to build world-class capacity in Antarctic science to improve our understanding of the complex linkages between ice sheet dynamics, sea level, biological systems and global climate during conditions warmer than present day. This project will benefit Australia directly through: (i) international leadership and new capabilities that will help us determine the sensitivity and feedbacks across the Antarctic to future warming as set out by 'Paris'; and (ii) communicating the research outputs to government and general public, to help create a more scientifically-literate society and reduce decision making risks.							
DP210103628 Chappell, Prof Louise A	This project focuses on a significant gap in International Criminal Court research: the contribution of judges to the ICCs poor conviction record for sexual and gender-based (SGB) crimes and their application of gender-sensitive judging in general. Significantly, it aims to provide new knowledge for judges, legal experts, and scholars to improve accountability for SGB crimes and for adopting a gender-sensitive approach to adjudication. Drawing on judicial interviews and on national court analysis, it will produce a groundbreaking book reimagining ICC cases through a feminist judgement approach and a provide valuable online toolbox for judges and academics. It will advance Australia's commitment to gender justice internationally.	63,686.50	118,401.50	109,591.00	54,876.00	0.00	0.00	346,555.00
	National Interest Test Statement This project supports Australia's interest in producing internationally relevant, cutting-edge research. It supports our national interest in a strong international justice system and our significant investment in the International Criminal Court (ICC) demonstrated through financial contributions, diplomatic influence on the Rome Statute, and its active role in the Court's governance. Gender justice is also a hallmark of Australia's approach to foreign affairs, evident in the Commonwealth Government's $55 million funding for women's empowerment in the 2019–20 budget; and Australia's successful bid for a seat on the UN Human Rights Council (HRC), in which gender equality was included as a priority pillars. Foreign Affairs Minister Marise Payne has made clear her view that gender equality is 'a fundamental human right' and that she is working 'towards a world where women and children are free from violence and discrimination'.Strengthening the capacity of the ICC and international tribunals generally to address gender justice, is core to advancing Australia's goal to advance women's equality globally.							
DP210103654 Kilian, A/Prof Kristopher A	This project aims to develop a new class of biomimetic material, where applied force modulates the chemistry and mechanics by incorporating mechanochemical responsive linkages in hydrogel networks. This work intends to generate new knowledge in the chemistry and mechanical properties of soft materials using an interdisciplinary approach involving synthesis, computational modelling, and mechanical analysis. Expected outcomes include novel hydrogel materials that are mechanochemically active, tough, and fatigue resistant, along with design criteria for force-activated molecule immobilisation and release expected to provide significant benefit forbiomedical applications, additive manufacturing, soft robotics and flexible electronics.	69,105.50	140,925.50	145,351.50	73,531.50	0.00	0.00	428,914.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	This project will result in new insight into soft materials design that is expected to have significant economic, commercial and social benefit. Such materials will advance Australia's standing in the area of multifunctional soft materials and benefit the Australian medical technology industry, which as of 2014 employed more than 19,000 people with exports valued at >$2.2B (1). Moreover, in the last 20 years, Australia has seen declines in annual mortality, disability rates, and hospital bed days, with an increase in life expectancy by 4.6 years, all of which are attributed to medical technology developments (1). 55% of the industry is located in NSW, which geographically positions the CI team well for commercialization through the established UNSW Innovations network. Other industries expected to benefit include the fast growing, >$10B international industry of additive manufacturing/3D printing, where the fundamental insight into toughening of hydrogels will facilitate the formulation of new classes of tough inks for printing multifunctional architectures. (1) https://www.mtaa.org.au/industry-statistics							
DP210103704 Deletic, Prof Ana	Frequent floods in urban areas cause damages comparable to extreme floods. This is likely to intensify with future urbanisation and climate change. Although Water Sensitive Urban Design (WSUD) offers sustainable urban drainage solutions, there are no models that can select an optimal WSUD system to deliver on a set urban flood mitigation target. The project aims to develop a new generation of fast urban flood models and the-first-of-its-kind WSUD planning tool to support industry and governments to effectively reduce the urban flooding damages. The project outcomes are also applicable for advancing early warning systems and real-time control of floods.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement							
	Climate change and urbanisation will continue to increase the risk of urban flooding. Building or upgrading large flood protection infrastructure is costly and often not feasible. We must therefore rethink our flood protection strategies. The popular stormwater management systems, known as Water Sensitive Urban Design (WSUD) are multi-functional technologies that use small-scale retention and infiltration mechanisms to reduce stormwater runoff peaks and volume, augment water supply, and treat pollution. Unfortunately, the focus in Australia has been entirely on using WSUD for stormwater pollution mitigation, while neglecting its proven benefits for mitigating frequent urban floods. This project will solidify Australia's worldwide leadership in WSUD research field, by developing computationally efficient (fast) flood models, as well as the first modelling tool for planning WSUD systems for flood mitigation at scale. By integrating this tool with the existing WSUD pollution mitigation models, the project will allow Australia to maximise its investments in WSUD implementation, while minimising flooding costs.							
DP210103727 Waite, Prof David	Sporadic influx of oxygen-rich rainwater / groundwater into subsurface waste sites induces dramatic biogeochemical changes which greatly influence the transport of contaminants present. In this project, fundamental knowledge gaps regarding the impacts of redox oscillations upon contaminant behaviour in these sediments will be addressed through a comprehensive program of field studies at a purpose-constructed experimental facility in an existing waste site, and complementary laboratory investigations. The intended outcomes are to improve understanding of contaminant mobility at the field-scale in these pervasive sites spread across the globe, and provide critical insight into their remediation using cost-effective techniques.	75,000.00	140,000.00	125,000.00	60,000.00	0.00	0.00	400,000.00
	National Interest Test Statement							
	Soil and water contamination in near-surface/sub-surface environments represents one of the most challenging environmental problems for both developed and developing nations due to immediate human and ecological health threats posed. Furthermore, due to expanding urban populations, many of these sites are now located in or adjacent to large population centres where their presence limits land development, imposing financial in addition to environmental burdens. While excavation of these sites and disposal of contaminated material to hazardous waste facilities is a possibility for small, shallow sites, the cost of this approach is frequently excessive, including at the proposed study site. In these cases, an approach involving manipulation of the natural environment, via induced/altered redox cycling in the manner investigated in this study may be the only financially-feasible option. This work will also provide significant insights for predicting the impact of alternate engineered approaches currently used at Australian waste sites (e.g. capping, installation of barriers or subsurface bioremediation).							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103769 Morello, Prof Andrea	This project aims to develop electronic devices that work as sensors of electromagnetic fields, wherein genuine quantum effects are used to reach unprecedented gains in sensitivity. It combines the significance of unveiling the fundamental limits of quantum-enhanced metrology, with the convenience of doing so in potentially manufacturable semiconductor devices. The expected outcome is a novel, bottom-up understanding of how best to utilize exotic quantum states of matter and fields for metrological advantage. These results will inform the design of the next-generation of extreme quantum sensors, with potential impact ranging from fundamental physics research to applications in mining or defense.	153,820.00	310,069.00	248,314.50	92,065.50	0.00	0.00	804,269.00
	National Interest Test Statement Australia has consistently been an international leader in sensors and detectors, ranging from atomic magnetometers, radiotelescopes and gravitational wave detectors, through to the recent landmarks in nanoscale spin magnetometry. In particular, quantum magnetometry is recognized as a subject of significant interest for Australia in the areas of mineral discovery, anti-submarine warfare and other defence applications. This project is a novel and original addition to this area of national strength. By utilizing, for the first time, a semiconductor platform to study extreme forms of quantum sensing, this research will identify the most effective strategies to deploy exotic quantum phenomena to achieve a metrological advantage. The choice of using eminently manufacturable, engineered quantum devices in silicon provides further reassurance on the potential of this research to find valuable applications in the national interest.							
DP210103780 Höllerer, Prof Dr Markus A	This project aims at tackling the challenges that coordinated collective action faces in situations of complex crisis. It will generate novel scholarly knowledge that addresses the question of how a heterogeneous collective of actors that transcends organizational and institutional boundaries can establish, sustain, restore, and organize the capacity to act and make appropriate decisions in crisis situations. The expected outcomes include an improved theoretical understanding of multi-actor collaborative governance in crisis situations by identifying obstacles and governance gaps that need to be overcome. This should provide significant benefits in terms of national and international response strategies to crisis situations of various kind.	75,791.00	152,340.50	162,134.50	175,752.50	184,388.50	94,221.00	844,628.00
	National Interest Test Statement The project centrally contributes to Australia’s national interest by conceptually informing multi-actor collaborative governance in crisis situations. With its empirical focus on the 2019/2020 bushfires, it speaks directly to the National Research Priorities for Natural Hazards Emergency Management in terms of issues, priorities, and directions. The domain of applicability of potential findings will, at the same time, transcend this specific setting, as the problem of effectively organizing and governing collective action surfaces as particularly salient in a variety of similar crisis situations, such as in environmental catastrophes of various kinds, global health crises and spread of diseases, military conflict and post-war zone redevelopment, or the management of large-scale humanitarian emergencies as in forced displacement and migration.							
DP210103790 Brown, A/Prof Julie	Globally, incorrect use of child restraints and inappropriate use of adult seat belts are widespread and longstanding problems. In Australia alone >2 million children are at increased risk of injury because of the lack of understanding about how to solve these problems. We have pioneered development of methods to allow novel user-centred approaches coupled with behavioural theory to effectively tackle these problems. In this project we will build on and extend these innovative methods to to deliver new understanding about how (i) to communicate with parents to ensure behaviours and decisions about restraint optimise safety, and (ii) user-driven design can solve problems inhibiting optimal protection of in cars.	65,686.00	151,153.00	153,487.50	117,106.50	49,086.00	0.00	536,519.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	By law every Australian child must use a restraint when travelling in a car, and >90% of children <12 years use restraints. The law requires children <7 use dedicated child restraints but for those 7 and older, parents must decide if their child needs a booster seat or can use an adult seat belt. The two main problems impacting the safety of children in cars in Australia is the ongoing high rate of incorrect restraint use, with 53-74% of children incorrectly restrained, and ongoing confusion among parents about when their children can safely use an adult belt system. There is an urgent need to find tangible solutions to both these problems as together they translate to >2 million Australian children at increased risk of injury. In this project we place the needs of Australian parents and children at the centre of a suite of innovative studies designed to solve these problems.Ultimately this work will lead to increases in correct use of restraints by children. Every 15% increase would deliver a conservative estimate in economic savings in direct hospital costs alone of > $1.4million annually.							
DP210103811 Dinger, Prof Marcel E	Genetic information underpins all life on earth and is processed to make proteins, which determine the characteristics of an organism. However, only about 2% of our whole genome is made up of genes that encode proteins; the other 98% is non-coding and its function remains poorly understood. Aims and Significance: This proposal aims to utilise cutting edge genomic technologies to generate new knowledge about how the non-coding genome regulates the expression of protein coding genes. Expected Outcomes and Benefits: This proposal will provide novel targets and methodology for gene modulation with broad applications from biology to environmental sciences.	134,931.50	268,404.00	267,512.00	187,905.50	53,866.00	0.00	912,619.00
	National Interest Test Statement							
	This project aims to provide a fundamental knowledge gain by defining the relationship between coding and non-coding components of the genome. A better understanding of the ways in which the expression of genes are regulated offer important, novel, insights that can be exploited for the advancement of gene technology. The potential benefits to the Australian community that are offered by understanding how natural antisense transcripts (NATs) operate and how transposable elements, in turn, regulate the NATs that influence gene expression are numerous. This approach has clear potential to provide new targets for modulating gene expression in a variety of settings; such as advancing human health, enhancing food production, reducing environmental impact and optimizing animal health.							
DP210103849 Gaspers, A/Prof Serge	Randomized methods have recently come into the spotlight when it comes to solving computationally "intractable" subset problems. The running time of a range of algorithms has been improved by replacing their first steps by a simple method of adding to the solution a small subset uniformly at random, and repeating the process many times. This project will explore various other ways how (not necessarily uniform) random sampling can improve the running time of algorithms; and explore the analysis of polynomial-time randomized algorithms. The project will focus on cycle cutsets and domination problems that have applications in operating systems, chip design and verification, facility location, and surveillance and monitoring.	76,270.00	146,971.50	141,403.00	70,701.50	0.00	0.00	435,346.00
	National Interest Test Statement							
	This project will design new randomised algorithms and mathematically analyse their efficiency and effectiveness. It focuses on challenging computational tasks about networks, both around eliminating cycles - with applications in operating systems, chip design and verification - and around small sets of nodes that can reach all other nodes in one step - with applications in facility location, surveillance and monitoring. The project fortifies Australia's standing globally in solving tasks with an exponential nature in a smarter way, and enhances our research collaboration with leading institutions in Europe. Our open-source state-of-the-art implementations will benefit society and help solve computational tasks using less time, energy, and memory. The prestige of having the fastest known algorithms for fundamental computational tasks, along with the know-how and utility of our implementations, will positively impact how technology companies use and view the education and research environment in Australia, enhancing industry collaboration for national benefit.							
DP210103873 Kohn, Prof Robert J	This project pursues breakthroughs which allow important questions of basic and applied science to be addressed using mathematical theories from cognitive psychology. Advances are made through an interdisciplinary effort, combining recent developments in econometric and statistical methods and cognitive science. The outcomes will advance knowledge and open up new avenues for applied research in important aspects of psychology. This research will result in new methods available to the wider scientific community which open up new horizons for understanding basic cognition, and human behavior in many domains.	60,500.00	128,750.00	128,750.00	60,500.00	0.00	0.00	378,500.00

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement Some of the most significant societal benefits from psychological science have arisen through the application of mathematical theories of cognition. These allow applied problems to be answered in more precise and meaningful ways than is otherwise possible. Pivotal applied questions remain unanswered or partially addressed, due to limitations in our science: many key psychological theories are statistically intractable. This project builds on recent advances from statistics, econometrics, and computer science to develop new methods to tackle important but challenging problems. Specifically, the project will focus on improving cognitive abilities in the aging population e.g. memory, attention, perception, problem solving, thinking and creativity. The Australian population is ageing and life expectancy increasing. The mental well-being of aged people is a key ingredient to maintaining quality of life, and promoting independence into older age.							
DP210103892 Zhao, Prof Chuan	Ammonia is one of the most produced chemicals worldwide but current manufacturing industries consume massive amounts of energy and emit harmful greenhouse gases. This project aims to develop a sustainable electrochemical system for ammonia synthesis using electricity and atmospheric nitrogen. A family of porous catalysts with nanoconfined ionic liquids will be developed to drive nitrogen reduction by enhancing the reaction kinetics. Rigorous experimental protocols and novel analytical methods will be developed for quantification of electro-synthesised ammonia. A prototype gas diffusion layer-assisted electrolyser will be demonstrated by coupling with oxygen evolution reactions for selective ammonia synthesis at a reasonable production rate.	75,000.00	150,000.00	140,000.00	65,000.00	0.00	0.00	430,000.00
	National Interest Test Statement Ammonia is one of the most produced chemicals worldwide with a key role in fertiliser production. Australia alone produces more than 255,000 tonnes of ammonia every year for use in industry and agriculture. Ammonia manufacturing currently consumes 1 to 2% of total global energy and is responsible for approximately 3% of global greenhouse gas emissions. This project will develop a green, sustainable and efficient technology to make ammonia from air and water using electricity generated from renewable sources such as solar and wind. The energy dependence of ammonia synthesis on fossil fuels will be greatly alleviated with essentially zero CO2 emission, bringing enormous social, environmental and economic benefits to Australia and the World. The success of the project could transform the way ammonia is produced and revolutionise food production. The project will strengthen Australia's leading position in areas of environmental protection, clean energy and sustainable agriculture. The key outcomes of the project will also advance knowledge in chemical science and related manufacturing and engineering.							
DP210103897 Hold, Prof Georgina L	This project aims to advance our knowledge of the structural/functional dynamics of complex microbial communities by defining stability in response to environmental influences such as nutrient stress, pathogen invasion and antibiotics/chemicals. Using innovative microbial consortia modelling, to identify communities at risk of homeostatic disruption, we will develop and test pre-emptive microbial manipulation strategies for restoring community stability. This project will yield significant global impact and economic/health benefit for humans and animals.	126,756.00	178,165.00	111,510.50	60,101.50	0.00	0.00	476,533.00
	National Interest Test Statement The emerging importance of microbial ecosystems, and their impact on our environment, is one of the most exciting scientific developments in the last decade. However microbial communities are not stable over time, and we do not have a good understanding of what makes them susceptible or resilient in the face of disturbances. The aim of this study is to better understand how complex microbial communities are affected by their environment, and to identify novel ways to pre-emptively manipulate microbial communities to retain stability. A comprehensive understanding of microbial dynamics during times of disruption may lead to the development of new products and innovations, resulting in jobs growth, productivity gains, and business opportunities within Australia.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103929 Ong, Dr Zhi Yi	This proposal aims to identify mechanisms that control environment-driven food-seeking behaviours. It seeks to do so by using modern virally-mediated and basic behavioural as well as histological techniques in a transgenic rat to characterise novel hindbrain circuits that control these feeding behaviours. This is significant as environment-driven overeating is problematic yet underlying mechanisms are unclear. This project expects to provide new knowledge on when, where and how hindbrain neurons control environment-driven food-seeking behaviours. This should provide benefits to the advancement of knowledge on the neural mechanisms of food-seeking and provide a basic science platform for future research on the study of feeding behaviours.	69,284.00	145,696.00	149,714.50	73,302.50	0.00	0.00	437,997.00
	National Interest Test Statement This proposal examines how neurons in the hindbrain that control satiation (i.e. fullness) can control our desire to seek-out highly palatable foods, particularly in the presence of environmental cues (e.g. advertisements). This is of national interest because overeating is a key contributor to the development of obesity, which is a major health issue that currently affects 2/3 of Australian adults and 1/4 of children. Yet, we still do not how we can control overeating and the underlying mechanisms of food-seeking behaviours are poorly understood. This proposal aims to enhance our understanding of environment-driven food-seeking behaviours and provide new knowledge on the pathways and mechanisms that can control overeating in the presence of environmental cues.							
	The University of New South Wales	5,398,196.00	10,684,479.50	10,263,483.50	5,494,440.00	797,056.50	279,816.50	32,917,472.00
The University of Newcastle								
DP210100285 Bucher, Dr Tamara	This project aims to use an interdisciplinary approach to further the understanding of factors influencing food choice in digital environments. There has been a gradual shift in consumer food choice environments from in-person to digital settings, including smartphone apps and online websites. This project expects to generate new knowledge on how background images used in digital interfaces could be exploited to promote healthy food choice. This can provide important benefits to the Australian society by informing guidelines and policies for the design of digital food choice environments (e.g., online grocery shops, food delivery apps, school canteen ordering systems) and digital marketing and retail strategies.	58,055.00	112,635.50	118,558.50	63,978.00	0.00	0.00	353,227.00
	National Interest Test Statement In recent years, there has been a gradual shift in consumers' food choice environments to digital settings. In 2019, one third of Australians considered shopping for groceries online. Restaurant food deliveries have an estimated revenue of over AU$ 2.8b in 2020 with an expected annual growth rate of >7%. Graphic design aspects of websites and apps strongly influence what, and how much, people purchase. The food industry uses this knowledge to promote sales of unhealthy foods. However, little is known about how specific design elements of digital interfaces could be used to promote choice of healthier foods and meals. Simultaneously, overweight and obesity cost the Australian economy AU $12b in 2018. Hence it is critical to understand how the shift towards digital food choice environments affects food choice and whether the purchase of more healthy options can be increased. This project therefore aims to investigate how design elements can be strategically used to promote healthy food choice. The findings can inform policy and practice and contribute to cost-effective health promotion.							
DP210100313 Brown, Prof Scott D	The dynamic world around us means we need to constantly adjust our decisions in light of ever-changing influences, both external (weather, traffic ...) and internal (fatigue, learning ...). This project aims to understand how these changes affect performance. This will have significance for basic science, and also practical benefits for applied psychology. This project will examine the dynamic nature of psychological processes in a range of settings: simple decisions, consumer decisions, human-machine interactions, and team performance. Theory development will lead to improved understanding of underlying cognitive processes, and transforms the measurement of decisions, which is important for applied psychological investigations.	90,000.00	154,500.00	93,000.00	28,500.00	0.00	0.00	366,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement The dynamic nature of the world today means people need to constantly adjust their behaviour in response to ever-changing influences. Those changing influences can be external (weather, traffic ...) and internal (fatigue, learning ...). This project aims to understand how these changes affect performance in crucial areas of human functioning: simple decisions, consumer decisions, human-machine interactions, and team performance. The project will lead to significant outcomes for basic science, and also practical applied benefits. This research has the potential to directly benefit Australian industry and the wider community with a better understanding of consumer behaviour and improving human-machine interactions. An outcome of the project will extend ongoing work of the research team with existing Australian end-user partners aimed at improving personnel selection and training procedures in cognitively-demanding roles, including with air traffic controllers and RAAF personnel.							
DP210100426 Kieser, A/Prof Hans L	This study aims to revisit the foundation of the modern Middle East by investigating the still valid 1923 Peace Treaty of Lausanne. Through a combined analysis of the Treaty's prehistory, protracted negotiations and paradigmatic impact, it will reassess the Conference's and Treaty's role in Modern History. By exploring international diplomacy's endorsement of authoritarian rule, demographic engineering and mass violence, it will problematise the notion of realpolitik and challenge views that the Treaty of Lausanne led to sustainable peace in Turkey and its neighbourhood. This will prompt a re-evaluation of topical questions like border disputes, the Kurdish conflict, post-Ottoman state-building, the caliphate, and the Armenian genocide.	26,618.50	53,517.00	52,877.00	25,978.50	0.00	0.00	158,991.00
	National Interest Test Statement Australia is involved in military and humanitarian missions in the Middle East, from the ANZAC at Gallipoli to the Yazidis at Mount Sinjar in 2014. It has multiple and strong, at times difficult, relations with Turkey. The Australian nation is comprised of displaced persons, among them many refugees, expellees and genocide survivors whose history of migration dates back to Ottoman Turkey and to the historical context of the Conference of Lausanne. Their experiences contribute to understanding both the history of the modern Middle East and Australian identity. The public benefit of this project lies in providing essential historical background knowledge on crucial aspects of Australian society and policy. It lies also in enhancing the quality and profile of Australia's research in modern Middle Eastern history, peace making and conflict studies. Findings will be disseminated through accessible publications and media interviews which will to contribute to more informed discourses on religion, conflicts, refugees and traumas that are related to the Middle East, Turkey and the Lausanne Treaty.							
DP210100437 Wang, Prof Shanyong	The project aims to develop a new reliable and efficient grouted soil nail system for improving the performance of loose soft soils. Important applications of the research include the mitigation of landslides, which pose a major threat to communities and infrastructure worldwide. Laboratory small scale experiments and numerical analyses will be carried out to optimize the grouting efficiency and enhance the pull-out resistance between the grout and surrounded soil in the soil nail system. This integrated project will provide a valuable tool for engineers who wish to stabilize loose fill slopes or soft grounds in Australia and worldwide.	62,500.00	117,500.00	117,500.00	62,500.00	0.00	0.00	360,000.00
	National Interest Test Statement The results of this integrated study will provide a new method for engineers who wish to use soil nails in constructing excavations, retaining walls and stabilising slopes in various types of soils in Australian and worldwide. Based on an extensive suite of experimental tests and numerical results, a series of charts and design recommendations will be developed, which has the potential to result in the reduced infrastructure costs. The results will be published in leading geotechnical journals and conferences, and also presented at seminars/workshops. The proposed research will not only provide a reduction in construction costs, but also provide a better understanding of the fundamental mechanisms behind grouted soil nail. It will also enable geotechnical engineering firms in Australia to gain a competitive edge by applying this method in various countries around the world. Nationally, Australian society will benefit from the reduction in infrastructure construction costs and protection of vegetation brought about by this new technology.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210100553 Hassan, Dr Karl A	This project aims to investigate the molecular processes underpinning the degradation of polycyclic aromatic hydrocarbons (PAHs) by bacteria. PAHs are persistent environmental contaminants linked to several human diseases, including cancer. Bacteria capable of degrading PAHs could be used to naturally and effectively reduce environmental PAH loads to below safe levels. The project will apply techniques in functional genomics and biochemistry to help define the ways that PAHs are taken up from the environment by bacteria, their fate within bacterial cells, and the ways that bacteria overcome the inherent toxicity of PAHs. The knowledge generated is expected to enhance our capacity to rationally deploy bacteria for PAH degradation.	74,394.50	137,989.50	133,618.00	70,023.00	0.00	0.00	416,025.00
	National Interest Test Statement Polycyclic aromatic hydrocarbons (PAHs) are chemical pollutants that are found widely within Australian environments and have significant negative human and environmental health effects. PAHs can be generated through events such as bushfires that are common in Australia, and can flow into ground water to contaminate water supplies and fresh water sediments. PAHs are frequent contaminants at current and former industrial sites present throughout Australia and the world, and are chemically very stable, necessitating interventive measures to expedite their degradation. Certain bacterial species are able to naturally degrade PAHs, using them as a source of food and energy. This project will investigate a bacterial strain isolated from a contaminated Australian environment that can degrade a very broad range of small and large PAHs. We aim to generate knowledge that will enhance our capacity to actively deploy this bacterial isolate for PAH degradation at highly contaminated sites and to identify or develop new strains that optimally degrade PAH and other hydrocarbon pollutants.							
DP210100709 Pontin, A/Prof David I	This project aims to reveal the origins of the slow solar wind, a continuous stream of plasma emanating from the Sun that fills the solar system and impacts the Earth. This project expects to enhance our understanding of how this solar wind is accelerated and structured using a suite of state-of-the-art computational simulations. In doing this, the project expects to provide critical physical understanding to allow interpretation of data from NASA and ESA's flagship space missions Parker Solar Probe and Solar Orbiter. Benefits should include enhanced physical understanding that will contribute to the international effort to develop reliable space-weather forecasting systems, critical for space exploration and space-based technology.	62,500.00	125,000.00	125,000.00	62,500.00	0.00	0.00	375,000.00
	National Interest Test Statement Eruptive magnetic storms on the Sun regularly reach the Earth's space environment. The economic consequences of this space weather can be severe, and include damage to satellites and power grids, corrosion of oil and gas pipelines and disruption of communication systems. Furthermore, these events may endanger the health of astronauts and those onboard high-flying aircraft. The proposed research seeks to better understand the solar wind - the stream of plasma coming from the Sun in which the Earth is embedded. As such, it will contribute to the international effort to develop reliable space-weather forecasting systems. (Given notice, defensive measures can be taken against the aforementioned effects.) In 2017 The Australian Government recognised the huge economic potential of the space sector through the formation of the Australian Space Agency. More generally, astronomy has a strong cultural impact: through the stunning images being gathered by new satellites solar physics has a great capacity to get young people interested in science, which is essential for contributing to Australia's skilled labour market.							
DP210100873 Page, A/Prof Alister J	This project aims to develop and optimise a new class of nanostructured materials – One-Dimensional van der Waals Heterostructures. These materials are nanoscale versions of coaxial cables, in that they consist of multiple nanotubes ‘stacked’ inside each other, like Russian dolls. These materials constitute an exciting new frontier in materials science, since their properties and applications are limited only by the types of nanotubes in their structure, and the order in which they are stacked. This project will pair cutting-edge experimental synthesis and molecular modelling to establish how these factors can be controlled, delivering function-designable nanomaterials with wide-ranging electronic, mechanical and optical properties.	45,000.00	92,000.00	93,500.00	46,500.00	0.00	0.00	277,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement This project is directly in the national interest, and aligns closely with current National Science and Research Priority of Advanced Manufacturing. To remain competitive Australian industries must harness methods that enable the nano- and molecular-scale manipulation of matter, towards developing advanced nanostructured materials. This project will deliver an entirely new class of advanced function-designable nanomaterials - one-dimensional van der Waals heterostructures - and establish protocols for their routine production. This project will also make fundamental and important contributions extending our ability to synthesise high-quality nanomaterials, beyond the immediate scope of the project, which underpin a suite of advanced manufacturing and alternative energy technologies important to the Australian economy, including electronics, energy generation and storage, greenhouse gas sequestration and catalysis. The project will also deliver social benefits to Australia, through training the next generation of Australian scientists and engineers in world-class Australian and Japanese universities.							
DP210101122 Giacomini, Prof Anna	Extreme events will significantly impact the severity of Australian rock cliff hazards in the coming years affecting infrastructure and public safety along major corridors and popular paths. Accurate prediction of their effect is crucial to analyse the associated rockfall risks and design mitigation measures. The project aims to provide a novel approach for the quantification of the rockfall risk by combining proximity remote sensing solutions, probabilistic models and quantitative risk analysis. The primary benefits lie in the ability to optimize protection reliability and costs and to deliver a rigorous method to support practitioners, government and emergency agencies to manage the risk, improve safety and properly allocate resources.	67,500.00	132,500.00	125,000.00	60,000.00	0.00	0.00	385,000.00
	National Interest Test Statement It has been predicted that exposure to extreme weather events will substantially increase worldwide and associated economic costs for Australia are expected to triple within the next thirty years. Extreme events will significantly impact the rate and severity of Australian rock cliff hazards in the coming years affecting infrastructure and public safety along the densely populated coastal fringes and along popular paths in the most well-known National Parks. The research aims at building and improving Australian's capacity to respond to environmental change by providing a reliable assessment of the risks associated to natural hazards, such as rockfalls and rock instabilities, and cost-effective mitigation measures design. The study will enhance Australia's capability to predict and quantify the risk along rock cliffs facing major transportation infrastructures and popular recreational area, increasing public safety and providing fast and reliable decision-making capability for local council, state governments and emergency management agencies.							
DP210101487 Stewart, Prof Mark G	The project will develop probabilistic models to predict the likelihood and extent of casualties and other losses from terrorist car bombing threats. Car bombs comprise a large quantity of explosives, and produce primary fragments such as wheels, engine block, parts of door panels and other shrapnel that pose a serious safety hazard to people exposed in a street or other mass gatherings. An improved understanding of safety risks will assist in setting safe evacuation distances. A quantitative assessment of terrorism risks will also allow the effectiveness of security measures to be assessed to provide cost-effective levels of protection that are acceptable to society.	115,518.50	199,809.00	164,964.00	151,971.50	71,298.00	0.00	703,561.00
	National Interest Test Statement The project will develop stochastic models to predict the likelihood and extent of casualties and other losses from a terrorist Vehicle Borne Improvised Explosive Device (VBIED – also known as a "car bomb") threats. Risk-based decision-making for assessing risk acceptability and risk mitigation from terrorist VBIEDs will allow loss mitigation to be maximised leading to optimal security expenditures. The setting of realistic and risk-based safe evacuation distances if a VBIED is detected, or blast-mitigation measures designed to prevent or ameliorate mass casualties will benefit the security and emergency services, business and the public. The risk-based approach will provide a means to allocate funds to places of mass gatherings and infrastructure systems shown to have high risk of loss of life in the event of a terrorist attack. This will reveal the efficiency of risk-mitigating options such as bollards, walls and barriers, and suggest improved resource allocation. Maximising risk mitigation will minimise damage, loss of life, and other economic and social impacts in the event of a terrorist attack.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102073 Melchers, Prof Robert E	This project aims to quantify the development of the long-term (25-100 year) protective effect of calcareous deposits on the marine corrosion of mild steels. This is significant because such steels used extensively in major and very expensive coastal and offshore infrastructure. The project outcomes will improve scientific understanding, including the role of microbiological activity. It will develop and calibrate corrosion prediction models using classical and recently available 100 year data from Europe, the Pacific, Australia and also new project-specific experimental data. These models are expected to be of benefit for Australian engineering consultants in maintain their internationally competitive edge in offshore engineering. **National Interest Test Statement** The corrosion of steels in seawater is a significant problem for coastal and offshore facilities. Protection measures are expensive and not always economic or feasible. In some but not all seawaters calcareous deposits have been observed. These are very protective. The conditions under which they develop, and their long-term (25-100 year) effect on corrosion of steel infrastructure are not known. Their effect on aggressive bacterial corrosion also is not known. The project aims to improve scientific understanding of these issues. This will have practical implications for steel marine infrastructure. It will contribute to keeping Australian marine corrosion research at a leading-edge international position. Importantly, it will continue to help Australian consultants to compete internationally for offshore and coastal engineering work.	67,500.00	135,000.00	135,000.00	67,500.00	0.00	0.00	405,000.00
DP210102239 Johnson, Prof Sarah J	The IoT (internet of things) is the backbone of intelligent transportation, healthcare, energy and smart home systems. To accommodate the exponentially increasing number of IoT devices, a dramatic paradigm shift towards non-orthogonal uncoordinated (grant-free) massive access is underway, where devices transmit data opportunistically over shared channel resources. This project aims to develop new receivers for such uncoordinated massive access, where the receivers will be trained to identify transmitting devices, recover their data, and resolve any collisions. These outcomes are expected to emerge as a game changer in IoT communications, benefiting national and international industry to meet future telecommunications needs for the IoT. **National Interest Test Statement** The Internet of Things, or IoT, refers to the billions of devices around the world that connect to the internet to share data. Thanks to inexpensive processors and wireless communications, it’s possible to turn anything, from a pill to an embedded sensor to a self-driving car into part of the IoT. The IoT facilitates applications such as intelligent transportation systems, healthcare monitoring, smart homes, retail, banking, smart grids and environmental monitoring, with embedded devices seamlessly monitoring their environments, processing information and communicating wirelessly with other devices. It is forecast that the IoT-Commerce market could be worth more than $100 billion in Australia, or equivalent to around 20 per cent of consumer retail trade by 2040. To facilitate the massive number new of IoT devices attempting to access limited wireless radio frequency resources new communication technologies are required. This project addresses a key national and international industry need to design the communication technologies required for the future internet of things.	65,000.00	132,500.00	135,000.00	67,500.00	0.00	0.00	400,000.00
DP210103025 Yu, Prof Jianglong	This project aims to develop a novel technology of poly-generation for the large-scale production of hydrogen and activated carbon materials using Australian brown coal through a high-pressure entrained-flow pyrolysis process, which is combined with a flameless catalytic H2 combustion process. The scientific goal of the project is to gain a detailed scientific understanding of the mechanisms of radical reaction pathways for the high-pressure pyrolysis of brown coal, and the mechanism and kinetics of the catalytic flameless combustion of H2. The project outcomes will meet the needs of Australia's recent national hydrogen initiatives and lead to an industry demonstration to convert Victorian brown coal to NO-free and carbon-free clean power.	59,023.50	122,365.00	126,252.50	62,911.00	0.00	0.00	370,552.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Victorian brown coals represent a large reserve, low-cost energy resource in Australia with the total reserves of 430 billion tons. This project, through an improved understanding of the science underlying the high-pressure pyrolysis of brown coal, will lead to the development of a novel approach through which Australia's abundant brown coal becomes an essential feedstock for large-scale production of hydrogen energy and porous activated chars. The project delivers fundamental, applied and translational research outcomes for carbon-free power generation Novel H2 production technology using brown coal using Victorian brown coal. This research, upon success, will lead to the development of synergistic and efficient means for the Australian coal and energy industries to transform from the present-day's carbon-based energy systems towards hydrogen-based power generation free of carbon and free of NOx. This will, in turn, bring significant economic, environmental, and social benefits to Australia and create local job positions. The project will further strengthen Australia's global leadership in clean energy R&D.							
DP210103304 Chalup, A/Prof Stephan K	This project will expand on the superhuman visual capabilities of deep neural networks to allow us to analyse the topology of 3- and 4-dimensional manifolds. While these spaces still count as low-dimensional, 4-dimensional manifolds typically are beyond human visual comprehension. The topology of a manifold describes its essential properties such as the number of connected components, holes, tunnels and cavities of various dimensions. Traditional methods from computational topology fail in large practical applications due to computational restrictions. We propose an approximation that overcomes previous limitations and can open new doors to data analysis in material science, medical imaging, dynamical systems and other applications.	70,000.00	137,000.00	135,500.00	68,500.00	0.00	0.00	411,000.00
	National Interest Test Statement							
	The structural analysis of porous materials such as coke, certain metals, sponges and coral assists in the understanding of how these materials perform and is essential to advances in many industries. This project will provide a new computational approach in analysing the essential geometric structure of materials. The outcome of the project will be of benefit to applications critical to major Australian industries, for example, applications in the coal or minerals industries where the new detailed geometric analysis will allow for better quality control which will help to make Australian exports more competitive. It will also have other national benefits such as improved safety in the transport industries where the method will provide better control of critical material properties such as energy absorption under crash impact.							
DP210103383 Fleming, Prof Andrew J	The proposal aims to develop a new microscopy method for imaging nano-scale structures buried below the surface of a sample; for example, metal conductors in a computer processor chip. The expected outcome is a new method for creating subsurface images with an application focus on semiconductor device inspection and quality control. The proposed microscope is expected to create new economic opportunities including new commercial products, intellectual property, and the potential for a start-up venture. The benefits to Australia should include the creation of new job opportunities and the development of local expertise in a high-value market sector.	35,000.00	70,000.00	70,000.00	35,000.00	0.00	0.00	210,000.00
	National Interest Test Statement							
	This proposal aims to develop a new microscope for measuring the structure of features below the surface of semiconductor devices such as computer processors. The current method for inspecting these devices involves cutting the chip to expose internal structures, which is destructive and cannot be used for mass manufacturing. As the feature size reduces, the demand for inspection methods that provide quality control is rapidly increasing. This proposal addresses the current technology gap and will speed up the development of new products and improve the yield of fabrication processes. The semiconductor fabrication market is a high-value industry with a global sales revenue of $720B in 2019 and annual growth rate of 12%. The market for inspection equipment is $9.5B with an annual growth rate of 14%. Australia has a history of success in niche semiconductor applications but market participation is low compared to our base of expertise. This proposal will increase Australia's participation in this high-value market and develop local expertise in an emerging technology sector.							
	The University of Newcastle	898,610.00	1,722,316.00	1,625,770.00	873,362.00	71,298.00	0.00	5,191,356.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
The University of Sydney								
DP210100039 Gale, Prof Philip A	This proposal will exploit a new strategy in the design of anion receptors that function in water by employing the microenvironment formed in aggregates of these molecules. The outcome of the project will be a series of new materials designed to selective bind particular anions, a deeper understanding of how to design novel anion-selective materials and control the assembly of these systems. The materials will have potential uses in processes where the removal of particular anions is required. Potential applications include desalination, radioactive waste remediation, corrosion-resistant coatings and removal of anions during dialysis processes.	55,000.00	130,000.00	130,000.00	55,000.00	0.00	0.00	370,000.00
	National Interest Test Statement This proposal seeks to develop new knowledge in anion complexation (from an initial discovery in Sydney in 2019) that will result in a new series of materials with the ability to selectively remove a particular anion from a mixture of chemical species in water. This technology will be applied across a wide variety of applications. For example, sulfate selective materials could be used to improve dialysis processes whilst removal of chloride from aqueous streams in certain industrial processes can reduce corrosion and improve efficiency. IP generated during the project will be protected by the University of Sydney. The grant will also provide important training opportunities for a postdoctoral research associate, PhD student and honours students working in a cross-disciplinary area including synthesis, supramolecular chemistry techniques, materials chemistry and molecular simulations.							
DP210100129 Joshi, Prof Nalini	Modern science derives its power from mathematical models and tools that enable us to predict their behaviours. The project aims to construct new models given by dynamical systems that move consistently from one tile to another in a lattice of higher-dimensional shapes called polytopes. The construction is expected to lead to new functions with properties that will provide extensions of current models of growth processes. The intended outcomes of the project include predictive tools that describe nonlinear special functions and information about their symmetry reductions. This should provide significant benefits, such as new mathematical knowledge, innovative techniques, and enhanced scientific capacity in Australia.	82,273.50	165,893.50	168,615.00	84,995.00	0.00	0.00	501,777.00
	National Interest Test Statement Mathematics is essential to our society. It provides a logical, quantitative and analytical basis that underpins advances in science, engineering, medicine and technology. The benefits of the project to Australia lie in three directions. First, it will add to Australia's achievements in excellent, internationally-competitive research. Second, it will increase research training and career opportunities for our future society. Third, it will enhance Australia's standing internationally through collaboration. The specific outcomes of the project will increase future tools available to model areas such as electricity supply and predicting epidemics. Such improvements in decision-making will also contribute to Australia's economic growth by ensuring stable energy supply and improving health outcomes.							
DP210100162 Fish, Dr Alexander	The proposed project will utilise innovative ergodic theoretic approaches to enable us to address important questions in Additive Combinatorics (Number Theory) and Fractal Geometry. In particular, we will resolve long-standing inverse additive problems for infinite sets, discover sum-product phenomena in Number Theory, and find a plethora of finite configurations in fractal sets. We will also extend the structure theory of one of the most popular mathematical models of quasi-crystals to a more extensive class of groups. This project will make significant contributions to Additive Combinatorics and Ergodic Theory and will bring the Australian research in these fields to ever greater heights.	60,000.00	120,000.00	110,000.00	50,000.00	0.00	0.00	340,000.00

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement The contributions of this project to the cutting edge research in Number Theory and Dynamics will be invaluable; for instance, connecting these two fields will not only enable significant advances, but will also greatly enrich one of the most prominent areas of Number Theory - Additive Combinatorics. It is impossible nowadays to imagine our lives without such basic things as online banking, online shopping, or simply using your phone; all would not have existed if not for the Number Theory discoveries. The role of Dynamics on advances in modern technology is hard to underestimate. For instance, it plays a vital role in our understanding of fluid and aerodynamics as well as modern forecasting and climate science. This project will advance knowledge and will raise the profile and international reputation of Australian research in Ergodic Theory (Dynamics) and Additive Combinatorics (Number Theory). It will also contribute to educating new generations of Australian researchers by attracting masters and postgraduate students to modern fascinating areas of mathematics.							
DP210100251 Coulembier, Dr Kevin D	The goal of this project is to make fundamental advances in the structure theory of tensor categories. Such categories play crucial roles in numerous fields of mathematics, physics and beyond. New methods, theory and examples will be developed, inspired by algebra, representation theory and geometry. These will then be applied in the foundational study of tensor categories for (dis)proving several of the most important open conjectures in the field. This will open new perspectives for applications in other areas, most notably in representation theory. Other benefits include enhanced international collaboration and scientific capacity in Australia.	55,979.50	151,774.00	155,464.00	59,669.50	0.00	0.00	422,887.00
	National Interest Test Statement Direct impact outside academia from mathematical research is not always obvious, but advances in mathematics have almost entirely underpinned the essential competences that enable our technology driven world. Beyond our usual reliance on wireless communication and internet availability, the mathematics of this proposal - representation and category theory - is enabling the next generation of computing (such as quantum computing, machine learning, signal processing, sensor development and neuroscience). Unseen by the broader world, representation and category theory contribute everyday to keeping Australians connected, informed and safe and ensure Australia remains globally economically competitive in key sectors. It is impossible to overstate the value of fundamental research in mathematics for the world we want to live in today and tomorrow. This project will also help maintain Australia's prestigious international standing in category and representation theory, strengthen the ties to a vibrant international community, attract top international researchers and train a new generation of mathematicians.							
DP210100458 Borghesi, A/Prof Francesco	The Jesuit translations of the Confucian canon not only provided the first European window into Chinese philosophy but also changed the intellectual and cultural history of Europe. This project examines the rich history of these translations and their dissemination, and interrogates how Confucian ideas influenced the development of Enlightenment philosophy. It will produce the first comprehensive history of these translations and make available to anglophone scholars primary and secondary sources in various European languages and Chinese. The project will advance our understanding of the personal and textual networks through which the first substantial philosophical exchange was conducted between Europe and China.	42,174.50	75,978.00	72,800.50	38,997.00	0.00	0.00	229,950.00
	National Interest Test Statement This project will advance our understanding of the role Chinese philosophy played in the emergence and development of the Enlightenment. It will shed new light on the origins of key Enlightenment values as they first emerged in the European context and trace how these influences evolved as the Enlightenment expanded. In this way, the project will be able to elucidate the values at the heart of Western civilization, including Australia's democratic system. It will strengthen Australia's academic networks with China, Europe and the United States, and it will build capacity by providing training for higher-level language students. The project will also generate wider social and cultural benefits for Australian society. It will provide important new tools and strategies for improving cross-cultural relations and it will generate valuable insights into the linguistic challenges that need to be considered in cross-cultural relations.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210100521 Ormerod, A/Prof John T	The project aims to provide new frameworks for fast flexible feature selection and appropriate modelling of heterogeneous data through structural varying-coefficient regression models. The outcomes will be a series of new statistical methods and concepts enabling more powerful modelling of complex bioscience data. The project will create the science for building reliable statistical models taking model uncertainty into account, impacting how results will be interpreted, and with accompanying software. This will be a significant improvement in the assessment of model confidence in the food and health research priority areas including areas such as meat science, Huntington's disease, and kidney transplantation.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement New statistical modelling technologies are required to accurately learn with confidence from ever changing and complex data sources. As information is collected and available in unprecedented volume, so too must new statistical methodologies be continually developed to ensure that the predictions and conclusions drawn from the data are correct. The benefits of the project to Australia are in three main directions: First, our research will greatly benefit Australia ranging from the Meat and Livestock industry, Australian decision makers who rely on accurate forecasts to decide on challenges in economy and health. Second, we will train researchers to make a difference for our future society. Third, we will enhance Australia's international standing through collaboration and by creating statistical technology that benefits the world. Ultimately, our research will contribute to Australia's economic growth, protection of natural resources and improved health outcomes.							
DP210100544 Fernandes, Prof Sujatha	Some of the most invisible, yet essential work in the global economy is done by low wage migrant workers. The proposed research aims to understand why migrants acquiesce to exploitative conditions, using a literary analysis of novels and ethnography of migrant workers in Sydney, Mumbai, and New York. It offers an urgent contribution to social science and policy debates over labour, collective action, and the nature of inequality in global cities. Expected outcomes include new ways of conceiving migrant worker agency and new frameworks for theorising power. Immediate attention is needed to address the ongoing exploitation of migrant workers and to provide information for policymakers to craft interventions to regulate low wage migrant work.	36,356.00	78,904.00	77,861.50	35,313.50	0.00	0.00	228,435.00
	National Interest Test Statement This research will offer important social, cultural, and economic benefits to Australia. The proposed program of research will bring social benefits by encouraging awareness in Australian society of the problems posed by migrant labour exploitation. Through humanising migrant workers it will also help to create deeper cultural understanding of who migrant workers are and the experiences that they encounter. The project will contribute to knowledge about an understudied area, that of migrants working in low wage jobs in cities, and will provide economic benefits through the creation of regulations that can produce quality jobs for Australians and migrants. The project will also enhance research capacity within the fields of Sociology and Political Economy by allowing CI Fernandes to draw on her networks and build on the research that she carried out in the United States, and to apply the frameworks she has developed to the Australian context. It will give her a strong grounding from which to mentor early career scholars, which will strengthen the research capacity of Australia in a vital area.							
DP210100919 Rickles, Prof Dean	The problem of quantum gravity, involving the bringing together of the two pillars of modern physics (general relativity, describing spacetime and gravity, and quantum theory, describing matter and the strong, weak and electromagnetic forces), remains unresolved despite over a century of searching. Following on from a productive pair of earlier ARC fellowship projects, this project aims to continue the historical investigation of the quest for quantum gravity, from 1957 to 1988, with a view to opening up avenues for new solutions and new ways to crack longstanding roadblocks through a highly collaborative, interdisciplinary approach.	59,500.00	106,500.00	88,000.00	84,500.00	58,500.00	15,000.00	412,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Understanding the true nature of quantum gravity is an ongoing and very unresolved global scientific challenge. This is the first major attempt to write the history of how research into quantum gravity has been approached in the twentieth century and it will reinvigorate and potentially transform research in this field. It will significantly enhance Australia's position as a global leader in the history of the philosophy of science and thus our strengths in technology and scientific innovation more generally. Physicists and philosophers of science will better understand the historical and theoretical context of their work, which will open the door new collaborations and approaches in the field both in Australia and globally, leading to advances in solving the problem itself. Government, industry leaders and the general public will be better placed to understand the scientific significance of quantum gravity and thus the potential consequences of these discoveries for the development of new technologies and applications in the future that will benefit Australia.							
DP210100956 Kaiser, Prof Brent N	Improved nitrogen use efficiency (NUE) in crop plants is required to achieve sustainable plant agriculture practices that maximise productivity while minimising nitrogen fertiliser-dependent pollution. Current high-input monoculture plant production systems suffer from poor NUE and can contribute to local and global nitrogen pollution outcomes. Improving how plants manage their nitrogen uptake will improve NUE and help support Australian plant agriculture. This project will investigate novel technologies that re-engineer nitrate transport activity. The project will also investigate the biochemical and molecular links between nitrogen uptake on root development required for improved plant growth.	95,512.00	211,721.00	215,427.00	99,218.00	0.00	0.00	621,878.00
	National Interest Test Statement							
	Greater nitrogen use efficiency (NUE) is a fundamental trait plants require to achieve sustainable plant agriculture practices that maximise productivity and quality while minimising nitrogen-dependent pollution to the environment. Current high-input monoculture agricultural plant production systems commonly suffer from poor NUE. Improving plant nitrogen uptake will help to ensure long-term genetic improvements to common Australian crops (wheat, barley, Maize, Chickpea) that help mitigate the impacts of climate change on plant production while reducing pressure on the costs of production (fertiliser) and the indirect costs of reactive nitrogen pollution entering the environment. This project specifically will test the functional role of nitrogen transport proteins in regulating root development to enhance nitrogen uptake in Australian agricultural crops.							
DP210101084 Oldroyd, Prof Benjamin P	Using honeybees, the aim is to show how a mutation in a single gene creates a new species. This gene causes a shift from sexual to asexual reproduction, allowing workers to clone themselves (virgin birth), thus turning a formerly cooperative species into a social cancer. Observing a real-time speciation event driven by a single gene is an incredibly rare opportunity and enables this project to determine the socio-genetic mechanisms that reduce gene flow between neighbouring populations and to explain how expression of the gene is regulated. Further, because clonal reproduction often leads to invasiveness in social insects - a dangerous outcome - understanding the origins of virgin birth is also critical to understanding invasiveness.	47,651.50	101,621.50	96,728.50	42,758.50	0.00	0.00	288,760.00
	National Interest Test Statement							
	About 1/3 of Australian agricultural production depends on insect pollination and the honeybee is the only species used for broadacre pollination. The almond industry alone rents 180,000 colonies per year to pollinate $500 million worth of almonds. That’s nearly half of the commercial beehives in Australia! Alarmingly, honey bee populations are under pressure worldwide, mostly from the Varroa mite, which is still absent from Australia. This project will study the origin and consequences of a genetic aberration that causes social cancer in bee colonies. Carriers of this mutation become parasites of other colonies and destroy them. Such parasites have caused the demise of large parts of the commercial beekeeping industry in South Africa and are therefore on Plant Health Australia’s list of the most feared exotic apiary pests. This project will provide deep understanding of the ways in which a single genetic switch changes a honeybee from a cooperative organism into a social cancer, and thereby changes the essential character of a species from beneficial insect into a pest.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101102 Dullin, Prof Holger R	Stability theory of steady states, travelling waves, periodic waves, and other coherent structures in nonlinear Hamiltonian partial differential equations is a cornerstone of modern dynamical systems. In particular it is of utmost importance to reliably compute eigenvalues, which determine the stability or instability of such structures. This project will develop methods to compute the spectrum of Hamiltonian operators in more than one spatial dimension. It will use the powerful geometric tools of the Maslov index and the Evans function. We will use these to simultaneously advance, and bring together the theories of the two dimensional Euler equations and Jacobi operators.	52,500.00	105,000.00	102,500.00	50,000.00	0.00	0.00	310,000.00
	National Interest Test Statement The project will develop and apply new methods for determining the stability and instability of the equations that describe dynamical systems. This research will enhance Australia's global reputation for excellence in the mathematical sciences. The project will provide outstanding training for research students in analytical and computational methods that are crucial for Australia's high-tech industries. The outcomes of this project will be of direct interest to Australian industry, as the systems that are investigated here are ubiquitous throughout scientific and engineering sectors, and more broadly (for example, in finance). Specifically, this project aims to develop new tools to solve long standing problems in fluid dynamics that are of direct importance to Australia's resource, energy and manufacturing industries.							
DP210101358 Mai-Prochnow, Dr Anne	This project is focused on understanding the interaction of cold atmospheric plasmas with biofilms, with the aim of biofilm eradication and ultimately offering an environmentally friendly alternative to current detergents and antibiotics. The research expects to elucidate the fundamental mechanisms of action for breakthrough plasma intervention technologies, which are sufficiently active to cope with the resistant nature of biofilms, yet are of low energy, do not adversely affect surface properties and critically leave no residual chemistry. This should provide significant benefits by delivering a new method to tackle the ubiquitous problem of biofilm contamination in food, water and medical areas.	73,839.00	147,900.50	151,901.00	77,839.50	0.00	0.00	451,480.00
	National Interest Test Statement Most bacteria exist in surface-attached communities called biofilms and are protected from many attempts to remove them. This project aims to investigate the activity of cold atmospheric plasma, a lightning-like state generated with a high voltage from normal air. This plasma and resulting plasma water are very effective in killing microorganisms and will revert back to normal water after use and not leave any toxic residues. An understanding of the mode of action of this technology will benefit a range of industries because results can be applied to food, medical and environmental settings. Developing a cold plasma technology that can easily be applied to remove unwanted biofilms from food and food production equipment, water systems and medical devices can save costs and lives. It will minimise food waste and reduce human infections by preventing and treating biofilm contaminations. The project will benefit Australia nationally and provide a competitive international advantage by developing a cutting edge, innovative technology and evaluate its mode of action.							
DP210101426 Maton, Prof Karl A	This project aims to advance understanding of the distinctive knowledges that rural students bring to school and develop teaching practices that build on these rural knowledges to unlock the potential of this significant student population. The project involves collaborating with rural primary schools, teachers, students and communities to identify rural knowledges, study classroom practices in detail, and develop sustainable teaching practices that help students connect rural knowledges and school knowledge. Expected outcomes include a framework of place-based teaching practices and resources that will benefit rural schooling, teacher education, and the education of communities crucial to the nation's future wealth and welfare.	77,941.00	154,561.00	155,729.00	79,109.00	0.00	0.00	467,340.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement Rural, regional and remote education includes 47% of Australia's schools and over 29% of students. These students trail their peers on literacy, numeracy, qualifications, and university education. Their potential can be unlocked by teaching that builds on the knowledge these students already possess. This project will collaborate closely with rural teachers, students and communities to better understand the distinctive experiences these students bring to schooling. Through detailed classroom studies in rural primary schools, the project will develop classroom practices that help students connect their rural knowledges with school knowledge. The result will be a framework of sustainable teaching practices and a toolkit of resources that will empower teachers to support rural students' learning. These outcomes will provide policymakers with better understanding of how to support education in rural communities. The benefits will be seen in improved student learning, improved staff retention in rural schools, and educating a workforce crucial to the future prosperity of Australia.							
DP210101467 Birney, A/Prof Damian P	Aims: The project aims to model cognitive flexibility as a dynamic process within people that varies across situations and occasions using advanced data analytics. Significance: The project intends to generate new knowledge in intelligence theory using recent advances that overcome known theory-testing limitations that have historically been ignored. Expected Outcomes: An authentic account of cognitive flexibility and a new paradigm for developing and testing models of dynamic change within people. Benefits: Dynamic models are needed to understand authentic problem-solving and cognitive function. The advances benefit research and applied areas where dynamic processes are important, including education, work, and cognitive aging.	76,932.00	158,238.00	169,629.50	88,323.50	0.00	0.00	493,123.00
	National Interest Test Statement Intelligence has historically been considered static, stable and largely unchangeable across time. The benefits of the project will be seen in enabling a more authentic conceptualisation of intelligence that includes cognitive flexibility as a set of processes critical to managing change across different situations and tasks. A validated dynamic theory of intellectual functioning that supports a real notion of change is critical to programs that hope to enhance performance in both complex, dynamic environments and everyday life. It has socio-political implications, including for policy decisions regarding the investment of funds to support education, selection and training in groups historically aligned with low performances on static tests of intellect, such as the elderly, low SES, and other disadvantaged groups in the Australian community. It will benefit other researchers by reinvigorating theorising in intellectual processes related to, for instance, cognitive training and rehabilitation. It will provide analytic methods necessary to investigate change and dynamics in a range of psychological processes.							
DP210101483 Graham, A/Prof Nicole	Resolving the problem of environmental degradation on agricultural land, which is 60% of Australia's land surface, is a major challenge. By engaging with farmers whose innovative practices have generated environmental and productivity benefits, this project aims to investigate the co-constructive relationship between land ownership, land use decision making and geography. The project tackles conventional accounts treating private property rights in agricultural land as unavoidably opposed to environmental goals. A key projected outcome is a set of rich case studies showing how geography shapes land use decision-making. This new approach provides much-needed evidence to inform law reform that transcends the public law/private rights impasse.	28,806.50	67,146.00	56,937.50	18,598.00	0.00	0.00	171,488.00
	National Interest Test Statement This project tackles the seemingly intractable tension between public environmental regulation and private property rights in agricultural land. Given the importance and scale of the agricultural industry in Australia, how that agricultural land is used and managed is of critical national environmental significance. The project combines legal and geographical expertise and engages directly with innovative farmers who have worked successfully for decades, examining how specific geographical conditions informs and shapes land use decision-making processes. Their environmental and commercial success is testament to the possibility and power of agricultural adaptation, but the legal and regulatory framework has often worked as a barrier to their innovations. Through rich case studies, informed by farmers' experience, applicable law and local geographical information, the project aims to inform agricultural practice and spark legal reform that avoids treating the private property rights of agricultural landowners as necessarily opposed to environmental sustainability.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101511 Peres Da Costa, Prof Neal S	This project aims to restore the musical sound world of early New South Wales, from local Aboriginal songs to imported European settler music. It aims to develop new creative research methodologies applicable to the study, teaching and understanding of musical interactions in the early colony. By digitally embedding the recorded outcomes and documentary materials within an accessible web repository, the project aims to disseminate new knowledge of musical soundscapes. The project expects to transform the way we talk about and understand the sound worlds of Indigenous and settler musical cultures, with benefits for academic, music professional and amateur researchers.	88,448.00	167,168.50	140,386.50	61,666.00	0.00	0.00	457,669.00
	National Interest Test Statement Australia has a vibrant and internationally renowned performing arts culture, with excellent specialist ensembles devoted to performing ‘early music’ from Europe, innovative popular music artists and skilled Aboriginal performers. But little is currently known about the earliest histories of how music in Australia sounded. This project will build a publicly-available corpus of musical sounds informed by rigorous historical research, combined with innovative techniques that will recover the sounds of the early period of Australia’s colonial history. This research makes a contribution to the Australian government’s identification of understanding Australia’s history, society and culture as a current research priority, and also engages cutting-edge research with contemporary performing arts.							
DP210101632 Lay, Prof Peter A	The aim is to gain insights into the bioinorganic chemistry that occurs when immune system cells encounter pathogens and the soles of virulence factors and immune system enhancing roles of metal ions. Pathogenic bacteria and fungi accumulate chromium (Cr) in their membranes/outer capsules, which we discovered is likely to be a previously unknown, but important, virulence factor. Hyperaccummulation of nickel (Ni) is also involved in virulence, whereas vanadium (V) enhances the immune system response to these pathogens. Fundamental insights into these roles of Cr, Ni and V will be investigated using advanced spectroscopic, imaging and biochemical techniques. These insights will provide new knowledge on the innate immune system.	100,000.00	200,000.00	200,000.00	100,000.00	0.00	0.00	600,000.00
	National Interest Test Statement Virulence factors in microbial infections both increase the severity of diseases and make them more difficult to treat. Therefore, it is essential to identify such factors and learn how they can be overcome in order to optimise health outcomes. Improved health outcomes also have considerable economic benefits through improved productivity, as well as the potential for development of new treatments of considerable commercial potential and high level training of researchers for a skilled research workforce. While the outlined research is fundamental in nature and such fundamental research can take a decade or more to translate into the clinic, the outcomes could have a relatively quick impact on measures that can be take to reduce exposure of the community to virulence factors.							
DP210101636 Kobakhidze, A/Prof Archil	The observed asymmetry between matter and antimatter in the visible universe arguably represents the major challenge to contemporary particle physics and cosmology. This project explores new theoretical, phenomenological and computational aspects of the electroweak phase transition and the generation of the cosmic matter-antimatter asymmetry in the early universe together with their links to new physics that may manifest at present and future high-energy colliders and gravitational wave observatories.	68,500.00	138,000.00	144,500.00	75,000.00	0.00	0.00	426,000.00
	National Interest Test Statement This project addresses some of the most fundamental questions about the universe we live in. It will further cement Australia’s reputation as a leader in fundamental physical science. The project will train students in theoretical physics, the cutting-edge of STEM research, and allow them to develop strong analytic and computational skills, critical thinking and evidence-based decision making. These skills are in critical demand beyond academia, in many areas of industry and policymaking. The project, therefore, will contribute to enhancing the quality of the workforce in Australia, especially in STEM-focussed industries. The outcomes of this project include new analytical and computational methods for exploring cosmic matter-antimatter asymmetry. These analytical and computational tools will represent the state-of-the-art for solving complex strongly-coupled dynamical systems, and have potential to find wide applications in Australia’s technology and financial sectors.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101691 Alais, Prof David M	Perception and action are usually studied separately, often under limited, non-ecological conditions. Recent evidence shows both functions are intrinsically linked and mutually influence each other. This project exploits new technologies to study dynamic perception in free-moving observers in real and virtual multisensory environments. The project will establish the mechanisms underlying the perception/action link and reveal how perceptual stability is achieved despite dynamic input that changes with action. It will generate new understanding of how the brain integrates its twin functions of perceiving the multisensory world and acting upon it, and will generate useful knowledge for virtual, remote and robotic applications.	86,500.00	166,500.00	165,000.00	85,000.00	0.00	0.00	503,000.00
	National Interest Test Statement The way we interact with the world is about to change dramatically. We will have to adapt to transformative new technologies such as virtual and augmented reality, smart cities, autonomous vehicles, and increasing interaction with robots. This project examines how human perception and its ability to integrate information will be affected by this revolution. We will advance the study of perception into the virtual and multisensory realm using active participants to test how sensory systems deal with the vast information increase and how action in complex environments flexibly alters or even restricts perceptual processing. The project will establish the principles of optimal perception in active multisensory virtual environments, reveal its limits, and will train young scientists in essential skills for a virtual future. This will provide scientific training in areas central to future technologies that will transform our lives. The knowledge gained will help shape development of effective human-centred applications in areas such as virtual work, remote training and effective human/robot interactions.							
DP210101738 Whittington, Dr Camilla M	By using newly developed epigenomic techniques and two Australian lizards that exhibit egg-laying, pregnancy and a rare transitional form of reproduction, this Project aims to watch “evolution in action” to determine how genetic changes enable the evolution of complex traits. The expected outcomes are a new synthesis of how genomic architecture underpins the transition from egg-laying to live-birth, and the first computational model illustrating how transitional reproductive forms are maintained. The benefits include development of Australian expertise in state-of-the-art technologies, new international collaborations between the University of Sydney and Harvard, and significantly enhanced knowledge of vertebrate evolution and diversity.	93,604.00	180,251.00	163,867.50	77,220.50	0.00	0.00	514,943.00
	National Interest Test Statement This project will determine how genetic changes enable the evolution of complex traits, through an investigation of two Australian lizards and their unique reproduction. The outcomes of this project will inform our understanding, as well as our ability to predict, the adaptability of Australian species to rapidly changing environments. In addition, this project will inform the development of new, fit for purpose conservation strategies for Australian animals and ecosystems - strategies that can appropriately respond to a harsh new norm. Finally, through a new synthesis of animal reproductive biology, the project may lead to advances in Australia’s agriculture sector, as well as in medicine. This work thus contributes to Australia’s economic development and our ability as a nation to safeguard the biodiversity that ensures the future of our natural environment.							
DP210101745 Betts, Prof Alison V	This project aims to reveal the backstory to the remarkable development of bronze working in ancient China by studying complex pathways by which metallurgical knowledge spread there from Eurasia through the crossroads region of Xinjiang. It will generate new knowledge through the innovative use of mass elemental analysis of ancient metals from Xinjiang, providing important evidence for early metallurgical techniques. Expected outcomes include enhanced understanding of the role of developing technology in the consolidation of regional power and its impact on social inequality. Partnerships between Australian, Chinese and UK institutions are expected to expand Australia’s research capability in archaeology, ancient mining and metallurgy.	86,373.00	176,252.50	179,886.50	122,142.00	32,135.00	0.00	596,789.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement This project will contribute to Australia's national interest, including our understanding of the impact of technology on social and economic relations in human societies, through its innovative, archaeological focus on the socio-economic impact of the first human use of metals. The strong emphasis on graduate training, its integrated international collaborative structure, as well as the development of academic partnerships between two high-profile Australian institutions and colleagues in Beijing (China) and Cambridge (UK), will enrich Australia's research capabilities in archaeology, mineral geology, mining and metallurgy. Although the focus of the project is mainly historical, it will offer highly relevant insights for a country like Australia, in which natural resources play such a critical role in the economy and in the broader society.							
DP210101827 Sharpe, Prof Ann Louise	The experience of pain is a ubiquitous experience, and persistent pain is common and causes enormous personal and societal burden. Anyone who has been in severe pain will understand that pain captures attention, but the role that attention plays in increasing pain perception is poorly understood. This project will test a new conceptual model that calls for a change in the paradigm underlying research into attention and pain. We will use novel experimental tasks in virtual reality environments to address these important gaps in our knowledge. The project will significantly advance our fundamental understanding of the role of attention in pain perception and pave the way for translational research to reduce the substantial burden pain causes.	82,824.50	171,802.50	170,294.00	81,316.00	0.00	0.00	506,237.00
	National Interest Test Statement One in five Australians have chronic pain and we know that physical factors do not predict those who develop persistent pain versus those who recover. Significant progress has been made in understanding some psychological processes that contribute to increased pain perception and these have been successfully used to develop interventions to prevent and/or treat persistent pain. While it is accepted that attention contributes to the amplification of pain, the basic processes that amplify or attenuate pain are poorly understood. The current project takes a fundamentally new perspective to research attention and pain that will uncover the basic processes involved in amplifying pain, and will allow those processes to be harnessed to attenuate pain. This will provide enormous benefit to the Australian community, by paving the way for translational research that will allow us to reduce pain perception and provide an alternative to the reliance on medications with significant adverse effects (such as opioids) to manage pain.							
DP210101859 Xu, Dr Chang	This project aims to enhance the security of networks and information systems by empowering them with intelligent deception techniques to achieve proactive attack detection and defence. In recent times, the fictitious environment – honeypot designed by human experience becomes popular to attract attackers and capture their interactions. However, rules-based construction of honeypots fails in preserving the privacy, boosting the attractiveness and evolving the system. The project expects to advance deep learning and yield novel DeepHoney technologies with associated publications and open-source software. This should benefit science, society, and the economy by building the next generation of active cyber defence systems.	80,000.00	160,000.00	160,000.00	80,000.00	0.00	0.00	480,000.00
	National Interest Test Statement The proposed research aligns with Australia's national research priorities for discovering and understanding of vulnerabilities, threats and their impacts; enabling improved risk-based decision making, resilience and effective response to cyber intrusions and attacks in cybersecurity. Developments from this project will enhance the intelligence of cyber detection and defence systems, which will benefit local industries and make Australia more worldwide competitive. In addition, the proposed solutions will be beneficial for digital protection of the business and will ensure employees, as well as customers, are not at risk from potential threats. As a result, the business' potential outputs can be increased and customer confidence can be inspired. Additionally, this project will provide a fertile environment for participants to gain advanced research experience, and therefore advance Australia's skill base.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101981 Vickers, Prof Adrian H	Australian Anglocentrism raises important questions about the dynamics of living in a multilingual society. This project aims to mobilise Australia's considerable and under-utilised non-English language resources in order to rethink our migrant and settler history. It asks what difference language makes in the ways people engage with, and ultimately think of themselves as 'Australian' or not. For the first time, a rich multilingual archive will be used to examine Australia's history from non-English perspectives. Outcomes include a framework outlining the role of language diversity in shaping Australian identity which will equip scholars, policymakers and the public to confront the challenge of cultural pluralism today.	121,270.50	245,690.00	228,426.50	229,092.00	125,085.00	0.00	949,564.00
	National Interest Test Statement Typically, accounts of key events in Australian history have been based on English language sources, yet a wealth of settler and migrant materials is available in languages other than English on such events. Using this 'multilingual archive', the project aims to re-examine six significant events in the development of national consciousness. By identifying and analysing relevant materials, it seeks to demonstrate how users of languages other than English participate in Australian society. It is innovative in combining the study of languages with the study of Australian history, thus creating new knowledge not only on the key events, but also on how people imagine themselves as being, or not being, Australian. The creation of the archive and framework for analysis will benefit researchers and enhance the capacity of historians and libraries by opening up new perspectives on Australian history. By broadening Australia's understanding of the social, cultural and intellectual history of nation-building, the hoped for outcome is creating a new inclusiveness in identifying with Australia.							
DP210101984 Fekete, Prof Alan D	Safe, lasting storage of data, and efficient access to it, is vital for all aspects of computing, ranging from e-commerce applications, and data-management in governments. For the storage of data, persistent key-value stores are central in modern computing platforms. However, contemporary key-value stores have not been designed for emerging extreme heterogeneous computational systems with future hardware accelerators and storage capabilities, including graphics processor and flash-based memory. This project will devise an adaptive key-value store framework for heterogeneous systems. Our new framework will adaptively harvest the performance potential of future hardware such that applications can cope with fast-growing data sets.	72,500.00	150,000.00	152,500.00	75,000.00	0.00	0.00	450,000.00
	National Interest Test Statement Almost every computer-based application, from e-commerce to government services, depends on a component called a persistent key-value store that saves information for the long-term and allows the programs to access it as they run. There are many existing designs for key-value stores. Still, they do not perform as well as one would expect when deployed on the emerging hardware platforms with new forms of flash-based memory and computing accelerators such as graphics processors and FPGAs. This project will provide adaptive key-value designs for future heterogeneous computing platforms. Our work will allow Australian organizations to get better performance from the hardware as it becomes available to them, and so cope with their fast-growing data sets. Also, by offering a carefully designed efficient approach, this reduces the risk of systems being built using roll-your-own flawed but fast designs, which could compromise security.							
DP210102002 Troy, Dr Laurence J	This project will investigate the disintegration of two interrelated pillars of Australia's post-war 'suburban settlement' – home ownership and income security – and the consequences of this for patterns of urban change. Drawing on the concept of social citizenship, the project will explore the implications of this process through the life trajectories of 25 to 40 year olds. The research will generate new knowledge by extending our understanding of how structural changes in employment opportunities are disrupting established patterns of housing demand for this group. The knowledge generated will inform policy makers and wider debates on the longer term implications of the break-down of home ownership on the Australian model of citizenship.	41,500.00	119,500.00	132,500.00	54,500.00	0.00	0.00	348,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	This project goes to the core of the structure and stability of Australian society. The relationship between housing and employment is central to Australia's economic, social and cultural future yet remains under-researched. The project will generate new knowledge that will assist policymakers to find solutions to the declining accessibility of home ownership for younger Australians. Specifically, developing an understanding of how younger Australians are navigating a pathway through changing employment and housing opportunities will help induce a better fit between housing policy goals and wider aspirations of economic growth, wealth creation and social equity. The outcomes will therefore support more integrated policy platforms to better underpin Australia's economic and social security.							
DP210102099 James, Prof David E	Stress has a major impact on all life forms and is considered one of the key determinants of healthy ageing. This project aims to unravel a highly novel pathway through which many different forms of stress converge to induce a conserved stress response in mammalian cells. Major outcomes include rewriting the textbook on how stress is sensed by cells and how cells respond to this stress and will provide novel approaches and technologies for studying stress in a broad range of organisms and systems. This project will benefit all efforts to understand stress and aid efforts by others to ameliorate stress-mediated health defects across the animal kingdom	77,500.00	179,000.00	195,000.00	93,500.00	0.00	0.00	545,000.00
	National Interest Test Statement							
	There are numerous kinds of stress in the Australian environment including UV radiation, extremes of temperature and unhealthy nutrition and the stress response governs the future health of not only humans but also Australian flora and fauna. We have discovered that different kinds of stress trigger similar mechanistic responses in cells. The novel aspect of this project is our exciting data showing that many of these mechanistic responses are linked together in one stress response pathway. This is exciting as it resolves many controversies in this important field and provides major advances in our thinking about how best to manage stress. An immediate outcome of the study is that persistent exposure to various kinds of stress is a major determinant of healthy ageing in a range of animals including humans and so our work will provide new knowledge in this area providing fresh approaches for how to improve healthy ageing. Strikingly a similar stress pathway may also be involved in coral bleaching and so we envisage common strategies for dealing with these disparate kinds of stress in the future							
DP210102145 Li, Dr Liwei	This project leverage breakthroughs in microwave photonics and integrated photonics for advanced sensing with wide range of applications in Internet of Things and healthcare. It develops compact and cost-effective micro-resonator sensors for unmanned aerial vehicle (UAV) applications in harsh environment, high-performance magnetic field sensor and high-density magnetic field sensing array with scalability. Outcomes herald disruptive, compact on-chip sensing techniques for reliable, high-resolution, low-noise and real-time sensing. Profound benefits include disaster management, environmental monitoring, industry growth, and major economic benefits underpinning a huge market encompassing UAV sensing and medical devices.	67,500.00	135,000.00	135,000.00	67,500.00	0.00	0.00	405,000.00
	National Interest Test Statement							
	This project capitalizes on advancements of microwave photonics and photonic integration to develop innovative frontier technologies for advanced sensing. The proposed compact and high performance sensors will lead to breakthroughs in unmanned aerial vehicle sensing and magnetic field sensing, which will bring significant national benefits in environmental monitoring, disaster management, internet of things and healthcare diagnostics. This project will strengthen the development of end-user-driven sensing devices and systems, and increase Australia's opportunities in the fourth industrial revolution by transforming the industrial world via advanced sensing technologies, thus leading to new job opportunities and having high-impact outcomes in commercialization and economic growth.							
DP210102187 Chen, Prof Min	Some photosynthetic organisms have a remarkable ability to accumulate long-wavelength absorbing photopigments, such as chlorophyll f, in response to the changed light and nutrient environments. The project aims to demonstrate that the structure and function of undefined chlorophyll f-binding proteins can be changed and controlled in desired light and nutrient conditions. The optimised photosynthesis strengthens their adaptation capability and challenges the long wavelength limits of photosynthesis. The research outcome will provide tools and a molecular blueprint for the adaptation of photosynthesis with optimised energy transfer pathway and efficiency for potential future molecular applications.	83,000.00	175,000.00	171,500.00	79,500.00	0.00	0.00	509,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	This project will address key, fundamental scientific questions about photosynthesis and its efficiency. Photosynthesis plays a dominant role in the energy cycle of the environment, and this research will advance our understanding of the Australian environment, both natural and agricultural. The direct outcomes of this project will include the creation of new scientific knowledge about photosynthesis that will benefit Australia's biotechnology and agriculture sectors. Specifically, this new scientific knowledge has the potential to be used by Australian plant breeders to improve crop yields and address issues of sustainability in food production. This project will also train researchers in key skills in biotechnology that are critical for Australia's highly skilled workforce.							
DP210102193 Davis, A/Prof Wendy L	Lighting consumes approximately 18% of electricity, but only a fraction of the light emitted into buildings actually supports occupants' vision – the rest is wasted. This research aims to reduce the energy consumed by lighting by developing strategies for illuminating only the portions of architectural environments that are visible to occupants, thereby reducing unnecessary light. The impacts of gaze-dependent lighting on energy consumption and the visual environment will be characterized and design guidelines will be generated to facilitate the development of innovative lighting systems that consume less energy by producing less light, without negatively impacting the visual experiences of building occupants.	25,844.50	40,844.50	30,000.00	15,000.00	0.00	0.00	111,689.00
	National Interest Test Statement							
	This research will contribute to Australia's environment and economic national interests. Lighting consumes a significant portion of electricity generated (16-20%), but much of the light emitted into architectural spaces goes undetected by building occupants – it is wasted energy. The approach to architectural lighting investigated and developed in this research will enable lighting manufacturers and designers to minimise this wasted light and ultimately reduce the energy consumed by lighting. The global lighting market is estimated to be in the 96-110 billion USD range. At present, Australia is not a leader in lighting product innovation and development, and most lighting products are imported from overseas. However, the country has a highly educated lighting workforce and there is substantial potential capitalise on intellectual property arising from this research.							
DP210102218 Anderson, Prof Barton L	This goal of this project is to identify the information the visual system uses to extract the three-dimensional structure and material composition of objects. This project aims to generate an advanced understanding of the information that supports these perceptual abilities and to advance our understanding how this information is learned from exposure to natural scenes. The findings of this work are expected to benefit our understanding of the human visual system, and to provide insights into the information needed to advance the development of deep neural networks (machine learning) that exploit the same information used by humans to guide our behavior and recognize objects and materials.	60,000.00	121,000.00	122,500.00	61,500.00	0.00	0.00	365,000.00
	National Interest Test Statement							
	We use visual information about the three dimensional structure and material composition of the world to guide our behavior and to identify objects. The human visual system remains unequaled in its capacity to extract information about the three-dimensional shape and material properties of objects and substances. The goals of the proposed research are to identify what information is used to extract this information; how this information is learned from exposure to real world stimuli; and to develop a set of stimuli and training protocols to train deep neural networks to achieve a comparable level of performance. If successful, our research will result in economic and commercial benefits by advancing the capacity to develop automated systems capable of reconstructing explicit models of three-dimensional shape and their material composition for use in a broad range of industry applications.							
DP210102321 de Roos, A/Prof Nicolas	Online search platforms and 'open data' policies are emerging to empower consumers with price information for decision-making in markets, yet also can enable collusive pricing. This project aims to study the competitive impact of search platforms by combining large, real-time datasets on firm pricing and consumer search with natural and field experiments. The project expects to facilitate the development of new models of collusion, consumer search, and platform adoption. This should yield substantial benefit by modernizing competition policy for the digital age through novel data-driven screens for collusion, and policies to encourage platform adoption and enable consumers' use of data in decision-making to increase competition in markets.	55,879.00	70,879.00	82,411.50	85,021.50	17,610.00	0.00	311,801.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Online information platforms are revolutionizing markets both in Australia and worldwide, yet little is known about their impact on competition in markets. This project leverages large, real-time datasets on companies' pricing and consumers' search decisions along with policy experiments to create new economic models of collusion and consumer search that will inform competition policy in the digital age. This includes the creation of data-driven screens for collusion, and incentive- and information-based policies for encouraging the adoption and use of online search platforms. By promoting informed decision making by consumers and discouraging collusive pricing among companies, this project will help ensure competitive outcomes in Australian and international markets where online search platforms and `open data' policies are emerging such as healthcare, banking, energy, petrol, or superannuation. Moreover, our research will inform the targeting of platform adoption and use policies to help socio-economically disadvantaged groups reduce both their discretionary and non-discretionary cost of living.							
DP210102343 Harris, Prof Justin A	When animals or people learn that a cue, or their own action, is followed by something important, they respond in anticipation of the outcome or to control it. This project investigates how these learned responses can be reduced ("extinguished") when the conditions that established them change. It will help solve 2 outstanding theoretical and practical problems: what makes some learned behaviours resistant to extinction or prone to relapse after being extinguished? The project will identify the factors that are most directly responsible for resistance and relapse. This could pave the way to finding solutions for the major problems that bedevil therapies designed to treat human behavioural disorders, such as addictions, gambling, and anxiety	111,784.00	202,762.50	183,394.00	92,415.50	0.00	0.00	590,356.00
	National Interest Test Statement							
	Animals and people learn about cues that predict something important and how their own actions can cause important outcomes. They stop responding (known as extinction) when the cue or action is no longer followed by the outcome. In humans, extinction is a primary goal for behaviour therapies that aim to eliminate a variety of problem behaviours that create significant social burden (e.g. addictions, gambling, anxiety disorders). However, the success of extinction treatments is limited because some environmental conditions establish responding that is resistant to extinction and responding that has been extinguished is prone to relapse. Therefore, we need a better understanding of the processes that underlie extinction. Our understanding of extinction has largely come from studying laboratory animals. Indeed, both resistance to extinction and relapse are well established effects in animal studies. The current project builds on recent theoretical developments and exploits methodological advances to reveal what is learned during extinction and what makes behaviours resistant to change or prone to relapse.							
DP210102356 Hancock, Prof Gregory J	This project will develop new and innovative ways of constructing steel structures using the rising factory concept. The rising factory is a 10 storey enclosure where the final high-rise building is safely constructed within a watertight envelope which rises as the building progresses. The project will perform the necessary research to make possible high-rise steel structural systems consisting of hot-rolled (heavy gauge) and cold-formed (light gauge) steel structural members and connections which can be used in the rising factory. The main benefits of the rising factory are the waterproof construction environment and the substantially increased safety as a result of no external cranes.	50,179.50	100,667.50	97,325.50	46,837.50	0.00	0.00	295,010.00
	National Interest Test Statement							
	The construction industry is one of the largest employers in Australia. There is a continuing need to develop efficient and safe construction worksites which better fit with the high safety standards expected throughout the Australian workplace. The rising factory concept for high-rise construction allows for a much more efficient industry especially in the residential sphere where speed, efficiency and quality of construction are especially important. The use of high-rise for residential continues to increase and is becoming more important in Australia. The use of pre-fabricated construction elements adds to both the efficiency and safety of construction. There are also substantial energy savings resulting from the reduced need for pumped concrete placement in the urban environment. There are no external cranes on the construction site making it much safer and the workplace is completely enclosed and waterproof for a healthy working environment.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102378 Piguet, Prof Olivier	This proposal will investigate the hippocampus, a highly inter-connected structure containing many subregions. Although considered the memory centre of the brain, we still do not know the exact roles of these subregions during memory processes. Using novel brain neuroimaging acquisition methods and analyses, this project aims to map the internal structure and functions of the hippocampus and its functional networks under different memory conditions and how these functions change with age. The intended outcome of this proposal is to provide the foundations for the first integrated model of human memory and its biological basis and to generate a benchmark against which future development of memory interventions and retraining can be measured. **National Interest Test Statement** How memories are created in the human brain, how they are affected by emotion, and how they change over time remains poorly understood. This is despite the fact that changes in memory capacity is the most common complaint as people get older. The benefits of this project will be seen through a better understanding of how human memory is organised, by understanding how memories are processed in the brain's memory centre: the hippocampus. This project will contribute to the scientific profile of Australia by supporting the competitiveness of local researchers in this fast-evolving field. Additional downstream benefits will be to the Australian social fabric by providing a benchmark for future evidence-based interventions for individuals experiencing memory difficulties, thereby reducing potential financial burden associated with loss of independence.	60,842.50	133,800.00	130,590.00	57,632.50	0.00	0.00	382,865.00
DP210102526 Chan, Prof Hak-Kim	Bacteriophages (phages) are viruses that kill pathogenic bacteria without causing harms to the eco-balance. They can provide a safe and highly effective antimicrobial measure for biocontrol when formulated properly. This project aims to develop a mechanistic understanding of the physicochemical factors responsible for stabilising and deactivating phages in a wide range of formulations. It will create new knowledge on key relationships between phage chemistry, phage-excipient interactions and phage stability. The research outcomes would significantly benefit Australia by enabling commercial development in the high value-adding area of environmentally friendly antimicrobial products. **National Interest Test Statement** Pathogenic bacteria cause the death of plants, animals and humans, costing Australia significant financial burden. The project will lead to the development of a green and efficient antimicrobial formulation technology using naturally occurring bacteriophages ('bacteria-eaters' or phages) to kill bacteria including multidrug resistant superbugs. The use of phages is environmentally friendly as it does not rely on toxic chemicals or antibiotics. Commercially, the research will generate new IP on this rapidly expanding field of phage formulation and delivery. Socio-economically, the research outcome can be directly applied to benefit the agriculture, livestock and biotechnology industries, through enabling novel formulation of phages for antimicrobial use to improve productivity in a wide range of settings including crops, livestock, humans and environments. Of particular concern are the financial and emotional impacts of pathogenic outbreak on individual growers, farmers and their families which can be alleviated by a better antimicrobial control via phage preparations resulting from the research outcome.	94,796.00	179,002.50	175,585.00	91,378.50	0.00	0.00	540,762.00
DP210102593 Wardle, Prof Glenda M	This project will advance ecosystem forecasting by accounting for how legacy effects from extreme environmental events – prolonged droughts, floods, heatwaves and fires – persist into future years in vulnerable dryland ecosystems. As highly stressed environments are expected to leave increasingly large impacts on flora and fauna and exacerbate desertification, answers are urgently needed to understand and mitigate these impacts. This project will foster new appreciation of ecosystem features that build resilience to change, or that lead to collapse. Benefits include better forecasting tools to manage ecosystems at risk, improved security of biodiversity and food production in Australian rangelands, and training of early career researchers.	58,000.00	121,000.00	127,500.00	64,500.00	0.00	0.00	371,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement This project is designed to deliver new knowledge that will help to plan for, and mitigate against, the effects of environmental extremes on the condition of rangeland ecosystems. This advanced understanding of how ecosystems endure extensive wildfires, droughts and flooding rains is urgently needed as these extreme environmental events are expected to become more frequent in the future. Rangelands are crucial to the socioeconomic welfare of remote and regional communities, as well as to maintaining food security and biodiversity, so this project will have substantial practical outcomes in supporting the activities and stewardship of those who live on the land. Forecasts of biodiversity change over periods of weeks to months and years will be relevant for on-ground management interventions and early evaluation of their effectiveness. The use of an updatable forecast cycle framework will provide decision-makers with the science evidence required to improve the sustainability of land management policies. There is also potential to provide dynamic state of the environment reporting for these ecosystems.							
DP210102611 Qiu, A/Prof Buhui	The project will develop an innovative machine-learning-based approach for measuring, monitoring and evaluating bank lending activities and risk disclosures to take advantage of the big data available. It will use multidimensional data to produce more relevant metrics for assessing bank risks and risk disclosure quality and apply them in regulatory policy evaluation. The project findings will significantly advance the knowledge on mitigating banking misconduct. They will also equip regulatory authorities with an efficient monitoring tool and an early-warning device to promote better lending and risk disclosure practices, and foster a more transparent and stable financial system to support financial intermediation in Australia and worldwide.	100,361.00	188,922.00	147,783.00	59,222.00	0.00	0.00	496,288.00
	National Interest Test Statement The Australian economy's largest sector, financial and insurance services, has been plagued by a series of shocking scandals and revelations from the 2017-2019 Royal Commission’s inquiry into the misconduct in the Banking, Superannuation and Financial Services Industry. Australians have paid a high price for the widespread misconduct witnessed, and there is an urgent need for a more efficient, reliable and effective tool to detect problematic banking practices in real time to minimise misconduct. The project aims to address the problem by embracing the power of machine learning in developing an innovative and systematic approach for measuring, monitoring and evaluating bank lending activities and risk disclosures. It will fully exploit the big data available to evaluate regulatory reforms, such as the recent Open Banking initiative and the introduction of Consumer Data Rights in Australia, to improve our knowledge on the effectiveness of regulations. The project will shape future policy making to enhance banking sector integrity and resilience. It will advance Australia's research excellence in banking.							
DP210102674 Wang, A/Prof Zhiyong	This project aims to develop novel graph neural network based deep learning algorithms for fine-grained human action recognition. This project expects to bring human action analysis to the next level and to significantly advance the analysis of subtle yet complex human actions. Expected outcomes of this project include theoretical advances on graph representation based deep learning algorithms for spatial-temporal data, and enabling techniques for more objective human action analysis in many domains such as sports and health. This should provide significant benefits to any application domain involving big and complex spatial-temporal data for finer analytics and better knowledge discovery.	74,259.00	146,305.00	147,949.00	75,903.00	0.00	0.00	444,416.00
	National Interest Test Statement This project will advance the discipline of human action recognition, which concerns the automatic recognition of human movement in videos and plays a critical role in applications involving human activity, including health monitoring, sports analytics, human-computer interaction and security surveillance. The project will have (i) economic health benefits, such as more efficient gait-based diagnosis and treatment of Parkinson’s Disease and like neurogenerative disorders, in-home health monitoring and robotically assisted surgery; (ii) cultural benefits in terms of enhanced fine-grained physical and tactical analytics for sports and sport coaching; and (iii) economic benefits to industries such as transportation, banking and retail resulting from more accurate security surveillance. The disciplinary advances of the project in complex spatial-temporal graph data and deep learning techniques will position Australia at the leading edge of this emerging field. The scientific outcomes of the project will provide significant underpinnings for research in biology, health, social network and security.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102688 Svetiev, A/Prof Yane	The project aims to study peer review of Australian financial regulators by their international peers. Transnational peer review is increasingly used in transnational regulatory networks, international organisations and regional trade partnerships. However the conduct and effects of such peer review are opaque. The project aims to shine new light on the function and legitimacy of transnational peer review as it applies to Australian financial regulators. A key expected outcome is to develop a normative understanding about whether transnational peer review enhances the efficacy and accountability of Australian financial regulators given the more limited oversight of such regulators by parliaments and courts.	36,500.00	68,500.00	69,500.00	37,500.00	0.00	0.00	212,000.00
	National Interest Test Statement The project aims to contribute new understanding about how financial regulatory agencies are influenced by their international peers, and whether transnational peer review is an effective addition to the existing accountability mechanisms for specialised and independent regulatory agencies. The empirical findings and their normative implications will be of interest at a time of significant public focus on Australia's financial regulatory framework. The results will be communicated to policymakers, regulators and the legal profession, as well as scholarly audiences. The project would contribute to better regulatory governance by opening up the black box of regulatory activity and equipping (1) regulators to better decide how and when to seek review by their international peers; (2) policymakers and courts to enhance their oversight of regulators exercising administrative discretion by using transnational peer review output; and (3) aid agencies to better target aid for regulatory capacity-building.							
DP210102901 Lei, Prof Chengwang	The project aims to develop a novel passive strategy using fluid-structure-thermal interactions to enhance passive cooling by natural convection and improve the energy efficiency of engineering systems. Comparing to the existing strategies, the new strategy does not require driving fan or pump and is quiet, reliable, self-adaptive and economical. The Multiphysics embodied in the proposal is at the leading edge of the field. Expected outcomes include advanced understanding of the complex Multiphysics and design rules for enhancing passive cooling by natural convection using flexible baffles. The research is expected to bring direct economic benefit to relevant industry and significant environmental and social benefit to the general public.	50,000.00	100,000.00	100,000.00	50,000.00	0.00	0.00	300,000.00
	National Interest Test Statement The efficiency of waste heat removal from computers, portable devices and many other domestic and industrial processes is a primary constraint on system performance. Heat may be removed passively by natural convection or actively by forced convection. Passive cooling by natural convection is advantageous as it does not require driving fan or pump and is compact, quiet, reliable and economical. This proposal aims to develop an innovative, self-adaptive and low-cost strategy to enhance passive cooling by natural convection. The research will make passive cooling strategies more attractive and viable and bring direct economic and commercial benefits to Australia. Broader adoption of passive cooling strategies in domestic and industry processes will also bring significant environmental and social benefits to the nation as it reduces power consumption and improves work environment. Further, the research will significantly enhance Australian researchers' capacity in tackling complex fluid-structure-thermal interactions and secure Australia's world leading position in the cutting-edge Multiphysics research.							
DP210102943 Macia, A/Prof Laurence	This project aims to investigate the role of maternal gut microbiota on foetal immune development, revealing the interaction of gut microbiota-host immunity at the early stages of new life. Significantly, the research will examine the time window when microbiota by-products from the mother reach the foetus and affect the development of immunity. Maternal by-products will be identified using cutting-edge methods to unravel the complex systems interactions in the developmental process. Outcomes include new fundamental knowledge about maternal gut microbiota composition and its relationship to the growing foetus, with benefits in informing pregnant women about their lifestyle choices, particularly their dietary habits, during pregnancy.	76,837.50	148,760.50	149,037.50	77,114.50	0.00	0.00	451,750.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	This project seeks to understand how during pregnancy, the trillions of bacteria that inhabit the mother's gut, also called gut microbiota, affect foetal development in utero. The research focuses on the development of the immune system – the body's natural system of defence – given its key role in physiological homeostasis across the human lifespan. Project benefits from this leading-edge research include: -> understanding how environmental cues in utero might influence foetal development and homeostasis throughout life. -> new insights into what a 'good' gut microbiota really means, and how it contributes to better immunity, including much-needed new knowledge to resolve the challenging experimental design around gut-microbiota-host interaction. -> new learnings about how to optimise the maternal gut microbiota through diet, to help ensure optimal development of the immune defence system of the foetus. -> promoting awareness for pregnant women about their lifestyles and dietary habits, as related to their gut microbiota and their baby's emerging development.							
DP210103103 Rasmussen, Prof Kim J	The project will produce a design framework for additively manufactured (3D printed) metal structures. The project will develop open source algorithms for predicting (i) mechanical properties of 3D printed metals for given printing parameters and (ii) internal stresses and distortions arising from the printing process. Underpinned by experiments on structural components and structural reliability analyses, models will be calibrated for the nonlinear analysis of 3D printed structures, and a methodology will be set out for designing 3D printed metal structures with acceptably low probability of failure. The project will enable structural engineers to safely and efficiently design 3D printed metal structures and components.	68,927.00	145,055.50	135,155.00	59,026.50	0.00	0.00	408,164.00
	National Interest Test Statement							
	The construction industry is poised to rapidly adapt 3D printed metal structures as printing technologies are enhanced and the cost of printers continues to decrease. However, the uptake is hampered by the lack of guidelines for the structural design of 3D printed metal structures. The design framework developed in this project will enable the Australian construction industry and related industries to exploit the opportunities offered by the latest metal printing techniques, with far-reaching national benefits including greater structural efficiency, reduction in material consumption and wastage, streamlined design-to-build process, greater on-site safety, and greater architectural freedom and ability to build components that cannot be built with existing methods. The analysis and design tools developed in this project will benefit the end consumer and enable Australian structural engineering firms to enhance their preeminent record of producing innovative structural solutions and maintain their competitive edge nationally and internationally.							
DP210103119 Bedding, Prof Timothy R	This project will use data from NASA and ESA space missions to address important unsolved problems in stellar astrophysics. The data will be used to study oscillations in stars, revealing details about their interiors that cannot be obtained by other means, to measure the ages of stars and understand their internal rotation. The project aims to deliver breakthroughs in our understanding of stars, and of the processes that shaped the Milky Way galaxy. Expected benefits include training postgraduate students, building strong collaborations with international researchers, and enhancing Australia's reputation for world-leading astronomical research.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement							
	This project will strengthen Australia's leadership in astronomical research. It will develop close international ties between the University of Sydney and world-leading US and European institutions involved in the project. These collaborations will include visits by world leaders in stellar astrophysics to Australia, and promote the exchange of knowledge and the development of collaborations with Australian scientists. The collaboration with the University of Hawaii will give Australian researchers and students access to the world's two premier optical/near-infrared observatories in Chile and Mauna Kea. More broadly, this research employs state-of-the-art methods in data analysis, and the outcomes of this project have potential to enhance Australia's technology sector. This project will produce highly-skilled experts trained in the analytical and computational skills that are required in modern data-intensive industries.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103160 Dehghani, Prof Fariba	This project aims to develop a technological platform for the fabrication of miniaturised and flexible sensors that enable the quantitative detection of important bioactive compounds such as fatty acids and biogenic amines. By utilising multi-enzymatic reactions in solid phase and engineering task-specific inks, chemiresistive sensors will be printed seamlessly as a whole. The sensors will respond to complex target biomolecules via a series of enzymatic reactions through which the analyte will convert to much simpler, reactive and hence measurable molecules. This project will enable to design miniaturised sensors for point-of-care detection of biomolecules that cannot be yet evaluated by the end users.	86,674.00	176,724.50	183,208.50	93,158.00	0.00	0.00	539,765.00
	National Interest Test Statement The project will develop miniaturised sensors capable of detecting bacterial activities at point-of-care patient treatment and new bioactive compounds, e.g. related to food spoilage and fermentation. The outcomes of the project will contribute to the innovation and economic advancement of diverse Australian industries including food, agribusiness, healthcare, environment monitoring and defense. Australian small and medium enterprises (SMEs) stand to gain from greater competitiveness nationally and internationally in developing new high-end sensors and devices capable of detecting bioactive analytes which cannot be measured by current sensing mechanisms. Specifically, small, compact and easy-to-handle biosensors will be developed including enzymatic sensors for point-of-care applications.							
DP210103410 Vucetic, Prof Branka	Fostered by continuous technology advances, a vision of the Industrial Internet is emerging, in which equipment, machines, and industrial robots are interconnected to each other and to the cloud, allowing remote control of industrial processes and critical infrastructure, to intelligently optimise their behaviour with minimal human intervention. Moving from the state-of-the-art small pilot projects to a global Industrial Internet requires wireless systems with consistent high reliability, low latency and massive connectivity. In this project we will develop new communication-theoretic principles and technologies for wireless networks meeting the demands of critical industrial and infrastructure applications in the Industrial Internet era.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
	National Interest Test Statement The new theoretical framework and wireless technologies will secure significant advances in the cellular communication industry and allow automation of various processes and services, either by replacing the wireline infrastructure at the network edge or adding connectivity to processes that today are still done manually by humans. Combined with AI and computing, the developed wireless technologies will make possible new classes of advanced applications, foster business innovation, and spur economic growth. They will enable automation of factories, energy grids, transportation and healthcare. The main benefits of industrial automation will be in enhancing operational effectiveness and improving workplace and worker safety. Social benefits of the new wireless technologies will be derived from enhancing infrastructure, promoting sustainable industrialisation, and advancing innovation.							
DP210103484 MacCann, A/Prof Carolyn E	This project aims to understand when and why people attempt to regulate others' emotions, and to evaluate which regulation processes are most effective. We will study regulation attempts as they occur over minutes, days, and months in interactions between romantic couples and between nurse co-workers. This project extends the study of emotion regulation to others' emotions as well as one's own. The major project output will be an evidence-based theory of extrinsic regulation. Project benefits include applications of this new knowledge to programs and policies that reduce negative emotions and stress in healthcare workers and couples, reducing workplace burnout, on-the-job errors, relationship breakdown and their associated economic costs.	65,000.00	129,500.00	129,500.00	65,000.00	0.00	0.00	389,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Understanding how Australians can successfully diffuse the negative emotions of their co-workers and romantic partners has clear economic and social benefits for Australia. Our project will identify which processes for regulating other people's emotions are likely to succeed. This new knowledge can be used guide policy and training programs to help decrease the negative emotions Australians experience in daily life. Reducing negative emotions can reduce healthcare costs as well as the economic burden of sick days, workers compensation claims and on-the-job errors caused by burnout. Current estimates are that workplace stress and burnout cost the Australian economy $14.8 billion per year, such that reducing stress would have considerable economic benefit for Australia. Moreover, reducing negative emotions in romantic relationships may reduce marital unhappiness and divorce rates, where a parliamentary inquiry estimated that relationship breakdown costs the Australian economy $6 billion per year.							
DP210103539 Liu, A/Prof Zongwen	All biological organisms, from plants to living creatures, can heal minor wounds and damages. Based on the recent breakthrough by the CI's team, this project aims to design and develop a new oxide containing multiple elements in a form of (AlCoCrCu0.5FeNi)3O4 that can resist damages through a self-repairing mechanism. Fabricated by radio frequency (RF) magnetron sputtering, this extraordinary self-repairing phenomenon makes this new material highly desirable as a coating to protect structures and machinery working in hash conditions. Therefore, it has broad applications in space technologies, nuclear power facilities and aerospace industry, as well as in shipbuilding industry.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
	National Interest Test Statement							
	The proposed research will lead to broad commercial applications. When used as a surface coating, the self-repairing functionality of the (AlCoCrCu0.5FeNi)3O4 entropy stabilized oxide can protect space structures, like satellites, spaceships and probes, against cosmic irradiation damage and the impact of space debris. The self-repairing also makes this oxide thin film highly resistant to nuclear irradiation, so it is desirable in nuclear industry. Besides its self-repairing functionality, this oxide thin film also possesses high hardness, high thermal stability and high resistance to corrosion, so, it can be applied as a protecting coating in many other fields. It can be broadly used as a coating for tools and machinery to resist abrasion and friction damages. Like the AlCoCrCu0.5FeNi high-entropy alloy, the (AlCoCrCu0.5FeNi)3O4 entropy stabilized oxide also displays excellent hydrophobicity. The hydrophobicity, together with its high hardness, high thermal stability, and a limited conductivity, makes this entropy stabilized oxide thin film an ideal coating material in aerospace industry.							
DP210103885 Cesare, A/Prof Anthony J	We recently identified that fundamental mechanisms which protect chromosome ends (i.e. "telomeres") are not conserved between somatic and embryo-derived stem cells. This discovery is without precedent and challenges the dogmatic expectation that cellular functions promoting genome stability are conserved in stem cells. We term the unexpected protective capacity of pluripotent chromosome ends "telomere privilege". Here we will uncover the molecular, genomic, and proteomic regulators or telomere privilege; determine the breath of telomere privilege in stem cell lineages; elucidate the functional significance of telomere privilege; and exploit telomere privilege to study fundamental biology related to telomeres and the DNA damage response.	87,223.50	185,771.00	190,722.50	92,175.00	0.00	0.00	555,892.00
	National Interest Test Statement							
	The discovery of stem cells that can be programmed biologically to grow any cell type is revolutionising our ability to grow new organs in a dish for replacement of damaged tissue. Stem cells can be derived from embryos or adult sources. Adult stem cells would have many advantages if the technology to exploit them could be fully developed, but natural ageing of cells through erosion of molecules that protect cells' DNA limits this technical approach. This project will develop technology that promises to arrest stem cell ageing, building on the research team's recent discovery that age-induced erosion of these protective molecules is reduced in some types of stem cell. This discovery is of great interest to Australian and international researchers, and the biotechnology sector. The project will contribute state-of-the-art technology to Australian enterprise and facilitate workforce participation thus contributing to our nation's growing capacity in biotechnology.							
	The University of Sydney	3,427,093.00	6,938,896.50	6,832,616.00	3,539,142.50	233,330.00	15,000.00	20,986,078.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
University of Technology Sydney								
DP210100271 Elder, Prof Murray J	The project aims to resolve important and longstanding open problems in Geometric Group Theory and Theoretical Computer Science. Since the 1980s researchers have conjectured that the geometric property of being geodetic is equivalent to several purely algebraic, algorithmic, and language-theoretic characterisations. The project team's expertise in geodesic properties of groups, the interaction between formal languages and groups, and the theory of rewriting systems, together with recent breakthroughs by the team ensures that significant results can be expected. Benefits include training research students and postdoctoral researchers in cutting-edge techniques, and advancing fundamental knowledge in mathematics and computer science.	65,000.00	142,500.00	152,500.00	75,000.00	0.00	0.00	435,000.00
	National Interest Test Statement This project concerns the theory of how computers work. We aim to resolve a number of key and foundational open problems that have confounded computer scientists and mathematicians for many decades. Resolution of these problems, and the deeper understanding of algorithms and computing systems that will ensue, promise significant national benefit. Applications to data security, network optimisation and algorithm development will present competitive advantages for the Australian software, cyber-security and emerging quantum computing industries. The project will also develop Australian expertise and reputation in these critical industries by training Australian students and early career researchers who will be the future high-tech industry leaders.							
DP210100347 Huete, Prof Alfredo R	This project investigates how climate change is altering the phenology, plant diversity, and airborne pollen exposure in Australia's highly productive dry grasslands. The project is expected to answer key questions on shifting grasslands and grass pollen relationships with grass phenology and diversity by merging satellite analysis of phenology with seasonal airborne pollen measures of grass concentrations and diversity. Expected outcomes of this project will be better management options to safeguard allergy sufferers and improved ecological and pollen forecasts under climate change and extreme events. This project should provide important public health benefits and disease mitigation strategies to Australia's urban and remote areas.	85,500.00	184,000.00	176,000.00	77,500.00	0.00	0.00	523,000.00
	National Interest Test Statement Changes in plant growth patterns due to climate variability and extreme events have important consequences to human health and the Australian economy. This research contributes to Australia's national interest through pioneering knowledge of our changing grasslands and associated altered patterns of pollen exposure to human health. Grasslands have immense economic, health and environmental value through their role in public health (grass pollen aeroallergens), biosecurity (weed invasions), food security (grazing industry), and biodiversity. This project should improve decision making capabilities in the area of health risk and pollen forecasting for management and mitigation of aero-allergenic diseases in Australia’s population. The project should also provide improved decision making capabilities during extreme drought, heat, and wet events. Lastly, the utilisation of satellite data in health care management and grassland monitoring benefits the newly founded Australian Space Agency and promotes Australian contributions to the international space community.							
DP210101004 Bugeja, Prof Martin	The Australian Corporations Act requires public companies to hold an annual general meeting (AGM) of shareholders. This project aims to address several important issues regarding the integrity, transparency, effectiveness and consequences of voting at Australian AGMs in relation to: show of hands voting, AGM characteristics and technology use, and director elections. As there is limited prior research on these matters this project expects to generate significant new knowledge. The project outcomes will provide significant benefits as the findings will support moves towards best practice in governance and thereby enhance public confidence in the integrity of the Australian financial market.	60,924.50	103,001.00	76,492.00	34,415.50	0.00	0.00	274,833.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	The effective operation of voting at Australian AGMs is critically important as it is the only mechanism by which many shareholders can express views on firm governance. Given this crucial function, it is limiting that there is currently no evidence on the integrity, nature and effect of voting at Australian AGMs. Ensuring that the principle of "one vote, one value" applies in practice at AGMs is critical in fostering investor and consumer trust in Australian financial markets. In recognition of this point, the Australian Securities and Investment Commission (ASIC) has identified AGM culture and conduct as important. This project's novel and rigorous empirical evidence will inform current regulatory debates, and facilitate targeted enforcement by regulators. Since the effective governance of listed firms is crucial to the confidence of shareholders when making investment decisions, this project contributes to the Australian national interest through its potential to have economic and commercial benefits.							
DP210101093 Lin, Prof Chin-Teng	This project aims to discover new knowledge of cognitive conflict and develop models and algorithms that enable intuitive physical human-robot collaboration to jointly conduct laborious tasks in complex, unstructured environments. It proposes to build on responses in the human brain when a robot does not operate in a way the human expects. Conflict models and prediction method are planned using advanced machine learning algorithms. The model and algorithms are intended to be integrated into an innovative brain-robot interface for field testing in a real-world industrial task. Translation of the outcomes to industry is expected to produce substantial economic and societal benefits through improved productivity and safety.	72,082.00	147,702.00	153,786.50	78,166.50	0.00	0.00	451,737.00
	National Interest Test Statement							
	This project is designed to deliver significant and immediate impacts to assistive robotics research and its applications. This research will enable the development of intelligent assistive robots that can collaborate with humans in industrial applications where humans are still needed to do physically intensive tasks, spend long periods of time resisting large forces, have to adopt awkward body postures, and work in dusty and noisy environments, for example in manufacturing, construction, mining and health. Applications of the research are expected to produce substantial economic benefits for Australia in improved productivity, reduced cost of injuries, support for the nation's skills base and new business opportunities. This project meets the Australian National Science and Research Priorities on advanced manufacturing, health, and the economy.							
DP210101100 Wu, Prof Chengqing	This project aims to study gas explosion resistance of non-cement-based ultra-high performance concrete after fire hazards. Fuel gases such as natural gas and hydrogen are becoming increasingly more popular in Australia. Due to their wide flammability range, there is considerable concern about the potential fire and explosion hazard. Until now, there is limited knowledge on this topic and conventional concrete has been proved incapable of handling this multi-hazard scenario. The expected outcomes of this project include a detailed knowledge of multi-hazard scenario and a safety design with the non-cement-based ultra-high performance concrete. Successful delivery of this project ensures structural safety in Australia and wider community.	51,999.00	119,725.00	107,221.50	39,495.50	0.00	0.00	318,441.00
	National Interest Test Statement							
	Natural gas has become a popular energy source in Australia. Due to its wide flammability range, there is considerable concern about the potential fire and explosion hazard. In recent years, there has been increasingly more reports on the gas explosion hazards in the manufacturing process and residential use. Until now, the knowledge of the gas explosion is still scarce and its effect to nearby structures is even less known. In addition, despite the conventional concrete has been proven incapable of resisting such hazards, there is no study on high performance concrete under coupled gas explosion and fire loads. The outcomes of this project will enable in-depth knowledge on the gas explosion and provide engineers with the tools needed for preliminary analysis and design of non-cement based ultra-high performance concrete structural members against coupled gas explosion and fire hazards.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101146 Phillips, Prof Matthew R	This project aims to combine advanced nanocharacterisation techniques with complementary expertise in semiconductor growth to produce high-quality gallium oxide that will enable fabrication of high efficiency, cost-effective power electronics. These state-of-the-art devices are urgently required to significantly reduce power conversion losses to maximise the performance and benefits of electricity generation systems using renewable energy sources. The availability of superior oxide materials with bespoke electrical properties will enable the construction of fast high-voltage electronic switches, converters and other components with enhanced performance and unique capabilities.	57,500.00	117,500.00	90,000.00	30,000.00	0.00	0.00	295,000.00
	National Interest Test Statement The oxide semiconductors developed in this project will enable the fabrication of superior power electronics for use in renewable power technologies (solar, wind, hydro and geothermal) that will reduce energy consumption and cut greenhouse gas emissions by replacing bulky and less efficient power devices and systems now in use, providing major economic, environmental and social benefits to Australia. The latest technologies in materials characterisation and fabrication techniques for oxide growth are utilised in this research project, creating excellent research training opportunities for future Australian scientists. The project will position Australia as a key international player in the development and commercialisation of high-performance practical all-oxide power electronic devices with enhanced and new capabilities.							
DP210101336 Vidal-Calleja, Dr Teresa A	Autonomy in robotic systems currently relies on conventional sensors such as lasers and cameras. Alternative sensing modalities as in the case of active electromagnetic sensors are commonly used to detect flaws, cracks and assess infrastructure's integrity, however, fundamental research questions preclude their use for robotic perception. This project will develop the theory and algorithms to enable perception tasks such as localisation, mapping and recognition with unconventional sensors. The outcomes of this research have the potential to improve the effectiveness of critical civil infrastructure maintenance technology through accurate and reliable inspections, and the reduced need for human intervention.	55,054.50	138,859.00	133,859.00	50,054.50	0.00	0.00	377,827.00
	National Interest Test Statement Much of the world's critical infrastructure is ageing and requires regular inspections and maintenance to prolong working life, increase resilience and minimise failures. Autonomous robots will play an increasingly essential role in the inspection and maintenance of critical infrastructure. This project will lead to new and improved solutions through the use of unconventional sensing modalities, such as non-destructive testing, that will enable the next generation of infrastructure robotics to be developed and deployed. The project has a clear potential to bring significant benefits to society by greatly improving the efficiency of critical infrastructure maintenance through faster, lower-cost, enhanced inspections, both helping infrastructure owners to improve maintenance efficiency and productivity, and reducing risks to public and workforce safety that are inherent when infrastructure is not adequately maintained.							
DP210101337 Donnelly, A/Prof Sheila	The completion of genome projects for several helminths of veterinary significance has provided novel insights into the fundamentals of helminth biology. One outcome is the identification of microRNAs, a subclass of small regulatory RNAs which in plants and mammalian cells control diverse biological processes at the posttranscriptional level. We have discovered the presence of helminth miRNAs within host cells with the ability to mimic mammalian miRNAs to modulate innate immune responses. This project will discover how helminths hijack the mammalian miRNA machinery to regulate host gene expression and thus support long-term infection. The outcomes will highlight new avenues for the control of these persistent worm infections.	101,114.50	204,251.00	182,860.00	79,723.50	0.00	0.00	567,949.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	The annual cost associated with parasitic diseases in livestock in Australia has been estimated at >$ 500 million. Treatment of these disease relies heavily on a small number of drugs. However, due to the emergence of resistance, the use of chemical products to control parasitic infections is not sustainable in the long term. In addition, there is a global shift in consumer awareness about chemical residues in food, and the detrimental impact they have on the environment and personal health. Accordingly, there is revived interest in the identification and application of non-chemotherapeutic means of control. Although there have been significant advances in parasite research, challenges remain in understanding how precisely helminths interact with their hosts, and how to use such knowledge to develop new ways of combating these parasitic infections. This project will identify parasite-derived miRNAs which are critical to their infectivity, a fundamental step on the road to discovery and development of new therapeutic approaches in the treatment of parasite infections.							
DP210101347 Chen, A/Prof Ling	This project aims to tackle the challenging problem of anomaly detection in large-scale networks by leveraging graph embedding techniques. It expects to deliver a series of innovative graph embedding algorithms targeting optimised anomaly detection. By addressing under-developed research challenges, such as the versatile types of anomalies and lack of anomaly labels, the established theories and devised methodologies will advance frontier technologies in both graph anomaly detection and graph representation learning. By uncovering anomalies with high efficiency and accuracy, this project will contribute to multiple real applications from fake review detection to financial fraud identification, bringing both social and economic benefits.	58,927.50	120,393.00	125,477.50	64,012.00	0.00	0.00	368,810.00
	National Interest Test Statement							
	This project will develop effective and innovative solutions to detect anomalies, representing irregular entities, patterns, and behaviors, in large-scale networks. The delivered theoretical foundations and frontier technologies will enhance Australia's competitiveness in this research field. The developed solutions will enable efficient and accurate anomaly detection in large-scale networks to be applied in a wide range of domains, from identifying fraud in cybersecurity, finance, and health care to uncovering fake news, fake product reviews and misleading political opinions in online platforms. This will provide considerable social and economic benefits to all Australians, whether they be victims of fraud or consumers who shoulder the burden of losses caused by fraud.							
DP210101348 Sui, Dr Yulei	This project aims to develop learning-based software vulnerability detection techniques to improve the reliability and security of modern software systems. The existing techniques relying on conventional yet rigid software analysis and testing techniques are ineffective and/or inefficient when detecting a wide variety of emerging software vulnerabilities. The outcomes of this project will be a deep-learning-based detection approach and an open-source tool that can capture precision correlations between deep code features and diverse vulnerabilities to pinpoint emerging vulnerabilities without the need for bug specifications. Significant benefits include greatly improved quality, reliability and security for modern software systems.	47,500.00	97,500.00	102,500.00	52,500.00	0.00	0.00	300,000.00
	National Interest Test Statement							
	The success of this project will advance the state-of-the-art software vulnerability detection for large-scale, fast-evolving and error-prone software systems. The expected research outcome includes significant contributions to building a reliable and secure software foundation, thereby benefiting a wide variety of software systems in Australia. It will also have a wide impact on any industry with a significant ICT component impacting millions of Australians every day. As fundamental research, the proposed approach will not only complement the existing techniques but will also open up new research opportunities to provide a new infrastructure for pinpointing emerging vulnerabilities. This innovative trustworthy software toolchain will benefit Australia's ICT industry, where software ecosystems are commonplace, e.g., defence, social network, finance, banking, retail and communication.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101353 Luo, A/Prof Zhen	This project aims to establish a new computational design methodology to address current challenges facing creation of ultralight structures with ultra-high-performance characteristics. The latest technologies in structural topology optimization and its correlated numerical simulation and structural analysis methods will be unified towards an integrated design framework. Expected outcomes include an advanced generative design platform for discovering novel geometries to underpin new meta-structure architectures, validated by appropriate fabrication techniques considering their geometric complexity. Such capabilities will benefit defence, civil, aerospace, energy and transport industries that pursue competitive advantage through innovation.	63,832.00	130,202.00	133,311.50	66,941.50	0.00	0.00	394,287.00
	National Interest Test Statement World leading engineering achievements, such as the Airbus A380, are only possible through the development of advanced composite structures by optimisation techniques. The new computational design-manufacturing methodology that has been described in this project will significantly enhance opportunities in creating new cellular structures, critical when most traditional design-manufacturing methods fail. This aligns well with the National Research Priorities in Advanced Manufacturing, as technologies and techniques realised from this project will considerably improve Australia's competitive advantage in a vibrant frontier domain. It will usher a field with substantial challenges towards achieving practical applications in numerous markets. It resolves a crucial current bottleneck in revolutionising architected cellular structures and promotes their applications in Australian industries, e.g. defence, transport, biomedical, energy, civil and environment. The project will benefit the global composite market worth $132 billion by 2024, and the additive manufacturing market to $37 billion by 2027.							
DP210101354 Taylor, Prof Stephen L	It is well understood that the provision of financial reports to external stakeholders impacts their decision making. Yet the extent to which externally reported financial measures such as earnings can resolve uncertainty, and their influence on corporate investment decisions is largely unknown. This project identifies how disaggregation of earnings into market-, industry- and firm-specific components explains differences in the quality of financial information, and the implication for accounting standards regulating the reporting of periodic performance. It applies the resulting insights to identify an uncertainty reduction role for financial reporting, and the way in which information contained in earnings impacts investment decisions.	42,076.50	77,017.00	69,881.00	34,940.50	0.00	0.00	223,915.00
	National Interest Test Statement Australia's economic growth and prosperity is heavily dependent on corporate investment. Yet there is limited evidence of how financial performance impacts investment decisions. By disaggregating earnings into market-wide, industry and firm-specific components, this research will yield rigorous empirical evidence that can inform economic, regulatory and industrial policy aimed at promoting economic growth. It will also provide novel insights into a fundamental concern for regulators and accounting standard setters regarding the extent to which accounting measures such as profitability are comparable (i.e., the extent to which similar economic transactions and outcomes result in similar accounting outcomes). Current moves to fundamentally change the way in which periodic income measures are reported by international accounting standard setters are indicative of this concern. The research will facilitate a leadership role by Australian accounting and securities market regulators in developing evidence-based policy with respect to methods of financial reporting and proposed audit market reforms.							
DP210101360 Petrou, Dr Katherina P	This project aims to quantify how ocean warming and acidification will alter natural diatom assemblages and silica production rates to predict changes in the cycling and transfer of carbon and silicon in the future ocean. This project expects to generate new knowledge of environmental controls on diatom silicification and their ocean-scale implications by integrating the disciplines of physiology, molecular biology and quantitative modelling. Expected outcomes include essential advancements in future simulations of marine productivity and silicon cycling and a deeper understanding of threats to marine life from climate change. This should provide significant benefits such as improved valuations on the sustainability of ocean ecosystems.	98,000.00	186,500.00	167,500.00	79,000.00	0.00	0.00	531,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement Australia's marine environment is a vital resource for our island nation. Our ocean territory equates to more than double our landmass, and our 'Blue Economy' is worth more than $74B a year. Climate change is having profound impacts on our ocean ecosystems, with warming and acidification posing a threat to the biological, economic and social systems that depend upon them. Diatoms are a key group of phytoplankton, important for sustaining marine food webs. Their silica-based structure also aids their export to the deep ocean making them an essential link in marine silicon and carbon cycles. This project aims to resolve how diatoms will respond to warmer, acidified oceans and advance our understanding of how ocean condition influences their role in marine food webs and nutrient cycling. The expected improvements to estimates of marine productivity and ocean chemistry will help policy-makers to better manage the future sustainability of important fisheries and marine industries, delivering environmental, scientific and economic benefit for the Australian community.							
DP210101361 Shon, Prof Ho Kyong	The pharmaceutical industry is one of fastest growing industries in Australia. Manufacturing pharmaceutical products requires the use of hazardous and expensive organic solvents, which are toxic for the environment and expensive to recover due to the energy intensive thermal process required. This project aims to discover and manufacture a novel, low-cost, chemically robust nanomaterial-based membrane using an industry scalable inkjet printing process. The membrane will be resistant to organic solvents while efficiently recovering valuable and hazardous organic solvents with minimum environmental footprint. It will effectively provide for the future growth of the Australian pharmaceutical industry while also having global applications.	71,880.50	150,380.50	123,898.00	45,398.00	0.00	0.00	391,557.00
	National Interest Test Statement Organic solvents which are high value chemicals but toxic for environmental release are widely used. Further, hazardous and expensive organic solvents are poorly recovered and often released into the environment. These issues would be ameliorated via the development of a high performing membrane that could withstand complex organic solvents while efficiently recovering valuable and hazardous organic solvents and pharmaceutical products using a cost-effective, pressure driven process. The successful development of a chemically stable, low-cost membrane comprised of high separation efficiency nanomaterials would establish new markets for material and membrane manufacturing in Australia and provide significant opportunities for global competitiveness among Australian pharmaceutical companies. This research also addresses increasing societal concerns about the environmental impacts of chemical wastes and footprints involved in current massive organic solvent recovery systems.							
DP210101367 Langford, A/Prof Nathan K	This Project aims to enhance the power of high-tech quantum simulators to meet the demands of computer-modelling intensive industries such as drug and vaccine design and new energy. Aligned to Australia's innovation agenda and Advanced Manufacturing priority, the Project expects to maximise the performance of near- and mid-term quantum simulations using innovative quantum programming techniques related to digitisation and control. Expected outcomes include: better understanding of limits in industry-scale quantum computers and improved error mitigation techniques. This should generate long-term productivity increases across a range of important sectors of the Australian economy that benefit from access to more powerful computer modelling.	98,350.50	218,584.50	231,527.00	111,293.00	0.00	0.00	659,755.00
	National Interest Test Statement Quantum computing is shaping up to be one of the most influential high-tech industries of the 21st century. With predicted applications benefiting broad sectors of society and the economy, it promises to deliver a technology revolution with the same lasting impact that transistors have had on the computing industry in the last century. High-value applications include improved information security, cheaper drug design and rapid vaccine development for disease prevention, and more efficient energy production and transport systems. It is no longer if, but when the quantum computing revolution will arrive, and Australia has a unique opportunity to further its position as a global leader in this rapidly growing industry. By developing innovative digitisation and control techniques for enhancing the power of near-term quantum computers to simulate the behaviour of complex quantum systems, a task that is generally impossible to solve with classical computing technology, this Project aims to minimise the timeline to applications with commercial and societal impact and capture economic benefit for Australia.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101382 Lu, A/Prof Dylan D	This project aims to address the need for longer lifespan of power conversion systems which can withstand failure of its key components. This is achieved through developing more reliable power converter circuits whilst reducing the stress of the components. This project will generate new circuit design and control techniques for power and energy systems, especially in dealing with reliability issues. Expected outcome of this project includes reduction of failure rate of power converters by at least 50%. This should provide benefits for many sectors including emerging technologies in particular renewable energy, electric vehicles and energy storage systems seeking reliable power supply and for the environment with reduced e-waste production.	54,373.50	112,859.00	119,878.00	61,392.50	0.00	0.00	348,503.00
	National Interest Test Statement Thanks to the abundant natural resources and maturing technologies, Australia has in recent years increased in the uptake of renewable energy and energy storage systems for many areas such as wearable power device, local electricity generation, and electrified transportation. While the sources and loads such as solar PV panels and electric machines respectively can operate for 20 some years, the power supply equipment, which interfaces with the sources and loads, only lasts for 10 years on average. The consequence is catastrophic for losing electric power due to the power supply equipment failure, in particular our increasing reliance on renewable energy sources. Hence this project aims to develop a new generation of power conversion systems that would withstand circuitry failure and extend its lifetime. This is important as the country is seeking solutions to securing more reliable and affordable electricity.							
DP210101389 Wang, Prof Guoxiu	This project aims to develop room-temperature sodium-sulfur batteries for renewable energy storage. Sodium-sulfur batteries are ideal for large-scale energy storage, owing to high energy density and low cost. However, there are significant challenges in attaining practical sodium-sulfur batteries with high capacity and safety. By developing novel high capacity sulphur cathodes, dendrite-free sodium metal anodes and quasi-solid-state gel polymer electrolytes, this project expects to achieve high-performance sodium-sulfur batteries with high capacity, long cycle life and enhanced safety. Expected benefits will arise from deployment of sodium-sulfur batteries and advances in energy storage technologies that are efficient and cost-effective.	67,492.50	137,389.00	148,228.50	78,332.00	0.00	0.00	431,442.00
	National Interest Test Statement This project is expected to deliver a new type of rechargeable battery that can store energy at the scale needed for Australia’s electricity grid. The proposed research addresses a significant problem, namely how to affordably, efficiently and safely store and provide energy, particularly for Australia to secure its energy sector, reduce reliance on fossil fuels, and integrate more renewable energy into smart electricity networks. In particular, this project will solve a safety problem in room-temperature sodium-sulfur batteries by replacing a flammable electrolyte with quasi solid-state gel polymer electrolytes. Sodium-sulfur batteries have many ideal characteristics for energy storage compared to lithium-ion batteries that are common today. The anticipated research results have strong commercialisation prospects. It is envisaged that the outcomes of this project will create an Australian legacy in more secure and reliable low-emission energy, new business opportunities in renewable energy industries, and job opportunities in the energy and manufacturing sectors.							
DP210101393 Zhang, Prof Ying	This project aims to develop novel approaches for efficient and scalable similarity queries on big streaming graphs which are large-scale graphs where graph nodes and edges may arrive or expire at high speed. Three key challenges are expected to be addressed including high speed, large variety, and big volume of streaming graphs. Expected outcomes include new theories, novel indexing and query processing techniques, and advanced distributed algorithms 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 e-commerce, cybersecurity, health, social networks, and bio-informatics.	85,000.00	170,000.00	170,000.00	85,000.00	0.00	0.00	510,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement Similarity query on big streaming graphs is a fundamental problem for a broad spectrum of applications. The success of this project will bring breakthroughs in technological advances in the processing of big streaming graphs including new theories, novel indexing, scalable processing techniques, complexity analysis, and system development. This will ensure Australia to take a leadership and be in the forefront of this research field. The project also has a great value to the development of local industry including e-commerce systems to detect financial fraud and predict customer preferences, cybersecurity systems to monitor network attacks and detect malware, and social network analysis to identify potential terrorist. Moreover, the project will also facilitate the training of national most wanted IT professional talents.							
DP210101411 Zhang, A/Prof J. Andrew	This project aims to develop foundational technologies for an innovative perceptive mobile (cellular) communication network that is also capable of ubiquitous radio sensing. It is expected to generate groundbreaking theorems and algorithms that will significantly advance the knowledge of joint communication and sensing. The intended outcomes are an innovative large-scale sensing solution capable of real-time 3D-plus radio imaging of the world, and enhanced communications with improved quality and reliability. The technology will revolutionize traditional communication-only mobile networks. It will enable and boost expansive radio sensing applications in e.g. transportation, energy, agriculture, and security.	78,320.00	152,630.00	148,890.00	74,580.00	0.00	0.00	454,420.00
	National Interest Test Statement This project is expected to lay the foundation for delivering revolutionary ubiquitous radio sensing networks, that can significantly drive the global initiatives on, e.g., smart cities and smart cars. Integrated with existing communication infrastructure, the perceptive mobile network saves billions of dollars that would otherwise be required for building a separate wide-area radio sensing network. It will enable numerous socially and economically important applications at low cost, e.g., resilient and efficient transport systems with large-scale traffic scheduling and vehicle tracking, pedestrian density and movement mapping, automatic street lighting control, animal migration tracking, and factory emission monitoring. It can also lead to more efficient spectrum usage by allowing spectrum sharing between communication and radar. This project is expected to generate intellectual properties in the forms of technical publications, patent disclosures, and a prototype system. It will help to establish and strengthen Australia's scientific and technological leadership in this emerging technology.							
DP210101561 Qiu, Prof Dr Xiaojun	This project aims to pioneer a new generation of smart sound control panels made of digital acoustics elements for broadband sound control. The project expects to generate a break-through mechanistic understanding of energy dissipation among the acoustical, mechanical and electrical components in the proposed devices. It is expected that these devices will have superior sound absorption performance from 50 Hz to 10 kHz, and will be low cost, compact (<10 mm thick), environmentally sustainable, clean (fibreless), and be adaptive to environments. It will provide a solution for broadband sound control, which is critical for many domestic, industry, and military applications to create a quieter and more comfortable sound environment.	58,835.50	127,328.00	139,139.00	70,646.50	0.00	0.00	395,949.00
	National Interest Test Statement The expected outcome of this project is a new generation of smart sound control panels for broadband sound control, which can reduce the thickness of traditional sound absorption structures (e.g., a micro-perforated panel or a layer of porous material backed by a 500 mm deep cavity) from 500 mm to 10 mm, but with better sound absorption performance in the frequency range from 50 Hz to 10 kHz. It can be used in many domestic, industry and military applications (e.g., 3D sound reproduction in virtual reality, traffic noise control, and quiet aircraft and ship design) for creating a quieter and more comfortable sound environment. In particularly, the project responses to the calling from Department of Defence Science and Technology for exploring how acoustic metamaterials can provide enhanced stealth capabilities to Defence platforms. It is expected that this project will contribute to the national innovation agenda, expand Australia’s knowledge base in acoustics and mechanical engineering, and provide high quality researcher training to build capability to support Australia’s advanced manufacturing sector.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101610 Seymour, Prof Justin R	This project aims to identify links between increasingly frequent Marine Heat Wave (MHW) events and outbreaks of microbes that cause disease in marine animals, reduced aquaculture yields and human health hazards. Pathogenic bacteria from the Vibrio genus exhibit a preference for elevated seawater temperature and this project will test the hypothesis that episodic MHWs will trigger blooms of dangerous species. Using innovative ecogenomic tools, this project will track the impact of MHWs on the dynamics of pathogenic Vibrio within coastal habitats, oyster farming facilities and coral reefs. The benefit of this project will be essential new knowledge on an emerging threat to Australia's valuable marine estate, food security and public health.	87,900.00	199,300.00	211,550.00	100,150.00	0.00	0.00	598,900.00
	National Interest Test Statement The increasing regularity of marine heat waves represents a tangible and devastating impact of climate change on Australia's $50 billion/yr marine estate. An emerging, yet largely over-looked implication of these events, is the potential for outbreaks of marine pathogens from the Vibrio genus, which includes dangerous human pathogens that cause severe gastrointestinal and skin infections in swimmers, fisherman and consumers of seafood, and are responsible for a global health burden exceeding $1 billion/year. Other Vibrio species cause disease in habitat-forming marine organisms, that reduce the resilience of critical marine ecosystems including coral reefs, while several species cause disease within aquaculture industries, threatening global food security. The proposed research will use cutting-edge genomic approaches to deliver critical new mechanistic knowledge on the dynamics of marine pathogens in coastal environments to provide a strong foundation for the development of strategies to monitor, predict and manage the threat of increased marine pathogen outbreaks within the Australian marine environment.							
DP210102021 Viney, Prof Rosalie V	This project will develop an innovative method for decision makers to achieve more equitable allocation of scarce health care resources. Health programs and treatments affect not just health (survival & health related quality of life) but also broader aspects of well-being (e.g. dignity, autonomy, safety). Our current methods for evaluating value for money in health do not capture these aspects. The project will provide benefit by allowing health system decision makers to achieve fairer allocation of resources across diverse health conditions, interventions and patient populations. Expected outcomes include a new tool for assessing interventions and measuring population health incorporating both health and social outcomes.	94,386.00	181,060.50	166,674.50	80,000.00	0.00	0.00	522,121.00
	National Interest Test Statement Value for money is central to decision making for health and social programs- we must use scarce resources wisely to provide the best outcomes for the population. To do this, our tools need to measure benefits across all interventions, from those that focus narrowly on extending life to those which aim to improve overall wellbeing, which encompasses health related quality of life and other outcomes: independence, dignity, safety, autonomy. This project will develop a new approach to valuing outcomes of health and social interventions, to capture these broader impacts. It will develop a new instrument that measures effects on health and other outcomes and the trade-off between these. It will do this by using a novel approach to combining dimensions of quality of life and by undertaking discrete choice experiments to measure trade-offs between the different dimensions of health and social outcomes. The new approach will allow existing measures of outcome to be combined to provide a new measure with the capacity to measure value for money in a broad range of populations, conditions and settings.							
DP210102449 Ying, Prof Mingsheng	Quantum software is indispensable for unleashing the super-power of quantum computing. This project aims to develop, for the first time, effective techniques for reasoning about the equivalence of quantum programs, with applications for verifying quantum compilers and quantum cryptographic protocols. The successful development of the outcomes and tools proposed in this project will significantly advance the knowledge on logical and mathematical foundations of quantum programming theory and thereby help Australian industries to build frontier technologies for quantum software engineering – in particular for quantum compilers – as well as establish and preserve their competitive status in the quantum computing era.	67,500.00	135,000.00	135,000.00	67,500.00	0.00	0.00	405,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Quantum programming is flourishing into a productive research field and competitive international industry. This project will establish a comprehensive framework and verification techniques that will provide efficient algorithms and practical tools to help analyse the correctness of quantum compilers and the security of quantum cryptographic protocols. The outcomes will complement Australia's strong research success in quantum hardware, consolidate our position in the global research community and benefit Australian ICT industries by contributing essential theoretical support for Australian quantum start-ups. This project addresses the National Science & Research priority goal of improving cybersecurity for all Australians. It will benefit society and the economy and, in particular, will provide individuals with secure quantum technology.							
	University of Technology Sydney	1,623,549.00	3,353,681.50	3,266,174.00	1,536,041.50	0.00	0.00	9,779,446.00
University of Wollongong								
DP210100164 Agostinho, A/Prof Shirley F	This project aims to investigate learning practices of professionals working in professions effected by digitalisation. The project expects to generate new knowledge about how professionals' learning practices shape and are being shaped by evolving work practices. Expected outcomes of the project include new conceptual thinking about professional learning, and a contemporary and nuanced evidence base to inform innovative teaching and learning solutions for individuals, workplaces and education providers; particularly higher education. This project should provide significant benefits for a national policy on lifelong learning to address Australia's agile skills development needs.	44,330.00	121,410.00	157,063.00	119,450.00	39,467.00	0.00	481,720.00
	National Interest Test Statement							
	This project is expected to have important economic and social benefits for Australia by identifying current and evolving professional learning needs of its workforce being significantly effected by digitalisation. The discovered knowledge will inform how professional learning can be designed and scaled to meet Australia's growing demand for agile skills development and lifelong learning. It is expected to be beneficial for: 1. Individuals to help them self-regulate their own professional lifelong learning; 2. Employers and professional bodies to cater for and anticipate their employees/members learning needs; 3. Education providers, particularly universities, to co-design with employers and professional bodies coherent and innovative teaching and learning offerings; & 4. Government to inform a national policy on lifelong learning. The flow-on effects are expected to benefit the Australian economy through a more adaptive and responsive workforce and benefit the Australian community through greater job satisfaction and enhanced wellbeing at work; ultimately ensuring a sustainable innovative workforce.							
DP210100167 van Oijen, Prof Antoine M	This project aims to develop the technology to visualise and understand the molecular processes responsible for the faithful copying of cellular DNA in the presence of roadblocks caused by chemical pressures and competing intracellular events. Understanding this process is important as DNA replication is responsible for copying the DNA genetic blueprint of cells and is crucial to all life on earth. This project will have as key outcomes the development of novel molecular visualisation technology and the first molecular description of the dynamic processes used by the DNA-replication machinery to navigate roadblocks. These outcomes should provide significant benefits including enhanced collaboration and scientific capacity in Australia.	97,835.00	198,424.00	202,347.00	101,758.00	0.00	0.00	600,364.00
	National Interest Test Statement							
	By developing and using methods to visualise at the molecular and cellular level how cells copy their genetic blueprint, this project will generate new diagnostic technology and provide insight into the processes that keep organisms viable. By visualising and understanding what happens to the DNA-replication process under environmental and chemical pressures, this project provides critical knowledge and tools to protect agriculture, environment, and health. As such, this project has the potential for economic, commercial and environmental impact by introducing new monitoring and diagnostic tools and generating knowledge applicable across sectors. By developing new techniques to study dynamic biological processes, this project will boost the research capacity of scientists nationally and internationally. This project will also provide training for students and young researchers in cutting-edge techniques, putting them at the forefront of biophysical and biochemical research around the world.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210100365 Dixon, Prof Nicholas E	This project aims to understand how new DNA is made so quickly and without mistakes in cells that are about to divide, in spite of competition from other processes happening at the same time on the DNA that should stop or interfere with it, such as the synthesis of RNA. The project expects to use the latest available methods to uncover what the microscopic natural machines that make DNA and RNA look like, and how they compete with each other for access to DNA. Potential outcomes include the identification of processes that can be compromised by small molecules that may be developed into new antibiotics. This would be of great benefit - new antibiotics are urgently needed as one approach to countering the threat of antimicrobial resistance.	122,901.50	243,419.00	223,196.00	102,678.50	0.00	0.00	692,195.00
	National Interest Test Statement Bacteria are able to proliferate at remarkably rapid rates. This is exploited when using bacteria as ‘cell factories’ for the production of high value products (vitamins, growth factors, molecular medicines), but is a problem when fighting pathogenic bacterial infections. Understanding how bacteria proliferate so rapidly will provide key fundamental information for exploitation in medical biology applications. This project is designed to establish at the structural level how blocks to DNA synthesis are removed and how the DNA copying machinery is able to make DNA so rapidly without making mistakes. We will use cutting-edge techniques, generating data of use for research science, synthetic biology and for use in antibiotic discovery and development. This project will furthermore provide excellent research training to students and early career researchers in a revolutionary area of structural biology, preparing the next generation of our workforce with experience of contemporary research tools. This project fits within the Health NRP under the “.. emerging local and regional health threats” research challenge.							
DP210100717 Li, Dr Bo	This project aims to establish the timing and processes of human settlement in East Asia during the Middle and Late Pleistocene. Through studying a series of key archaeological sites in southwest China using the most recent innovative scientific approaches in luminescence dating, sedimentary DNA and lithic analysis, we expect to provide new insights into the human prehistory of East Asia over the last 300,000 years. This should provide significant contribution to addressing major debates about the timing, rate and route of dispersal of modern humans out of Africa, across south Asia and into Australia.	47,204.50	96,894.00	87,524.00	37,834.50	0.00	0.00	269,457.00
	National Interest Test Statement This project will deliver outcomes in Australia’s national interest through environmental, commercial and cultural benefits spanning the sciences and humanities. Advancing our knowledge of how humans have coped with climatic and environmental changes in the past can help inform our understanding of the resilience and adaptability of Aboriginal people as they settled this continent, and thereby enhance our appreciation of the rich cultural heritage and knowledge of Indigenous Australians. The development of advanced methods of sediment dating and DNA analysis during this project will increase demand for these services by end-users in industry, government and the private sector, including consultancies and organisations involved in cultural heritage management and the research and protection of Australia’s soil, water and other natural resources. Through this collaboration exploring our shared human past, this project will also help enrich Australia’s international relations by highlighting our deep cultural connections across the ages.							
DP210100739 Rogers, A/Prof Kerrylee	This project aims to model the response of mangroves and adjoining communities to sea-level rise. Australia’s coastline supports some of the most extensive and diverse mangrove forests globally, and mangrove response models are urgently needed to plan for Australia’s coastal future and global sea-level rise adaptation. Bringing together world-leading specialists in geomorphology and spatial analysis, we will project the response of Australia’s mangrove shorelines to sea-level rise, indicating the implications for blue carbon stocks, adjoining communities, infrastructure and assets. Significant benefits will be provided to sustainable coastal management and national carbon accounting efforts.	80,000.00	155,000.00	145,000.00	70,000.00	0.00	0.00	450,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement This project brings together leading experts in the response of mangrove forests and coastal landscapes to sea-level rise (SLR). The maps and models generated will provide coastal planners and managers with confidence when planning for coastal ecosystem adaptation to SLR, and the effects of SLR on adjacent infrastructure and assets. Carbon accumulation is a critical component of mangrove adaptation to SLR, and the models generated will be used to quantify future carbon sequestration and account for the carbon currently stored within coastal landscapes. The outcomes of this research are crucial for Australia's efforts to plan for SLR and mitigate climate change through increasing carbon sequestration. This project provides significant new knowledge that will have important environmental, legal and social implications and will put Australia at the forefront of knowledge advancement within the international community interested in the fate of coastal ecosystems, shoreline changes, and the effect of SLR on coastal infrastructure and assets.							
DP210101264 Vella, Dr Stewart V	At a time when over half of all Australians participate in organised sports it is critical to ensure that these environments are psychologically safe. The problem is that community sports clubs have no clear guidance on how to fulfil this substantial responsibility. There have been urgent calls for the development of psychological safety and mental health guidelines which have yet to be answered. This project will deliver the knowledge to underpin effective psychological safety and mental health guidelines for community sports with national impact. When implemented, this knowledge will help sports clubs to provide a psychologically safe environment, and promote the mental health and wellbeing of all Australians involved in organised sports.	58,000.00	117,181.00	120,704.50	61,523.50	0.00	0.00	357,409.00
	National Interest Test Statement Sport is central to the Australian identity and improving wellbeing is a national Science and Research Priority. This project will lead to social benefits by helping Australia's community sports sector to facilitate psychologically safe, wellbeing enhancing environments for all participants. Tangible benefits of the knowledge that will be delivered include: i) a robust understanding of the needs of the community sports sector in providing psychological safety and promoting the mental health and wellbeing of all participants; ii) knowledge of the usability and acceptability of psychological safety and mental health guidelines in sport, as well their potential real-world impact; iii) when implemented, the provision of safe and wellbeing-enhancing sports environments in which to participate for all Australians; and, iv) flow on economic and social benefits nationwide from high levels of psychological safety and reductions in the dropout rate from organised sport, for example. Overall, the development of psychological safety and mental health guidelines fills an urgent need in Australia and worldwide.							
DP210101425 Hadi, A/Prof Muhammad N	This project aims to develop ultra-high performance geopolymer concrete thin-walled structures for the critical infrastructure in the marine environment. It is expected that this project will develop novel design rules for ultra-high performance geopolymer concrete thin-walled structures based on experimental testing, numerical modelling, validation, and simulation. This project is expected to increase the durability of coastal infrastructures and significantly reduce the loss of their capacities due to corrosion-induced damage. The development of ultra-high performance geopolymer concrete thin-walled structures is a significant engineering discovery, which is in line with the Australian government 2030 vision for sustainable development.	47,500.00	107,500.00	115,000.00	55,000.00	0.00	0.00	325,000.00
	National Interest Test Statement Infrastructures in Australia, especially reinforced concrete structures located along the vast Australian coastline, are exposed to, and potentially vulnerable to, the effects and extremes of climate and weather causing degradation and loss of capacity and durability. In marine structures and structures located in moist atmospheres, steel reinforcing bars are prone to corrosion. The corrosion of steel reinforcement reduces the lifespan of the structure, increases maintenance costs, and increases the potential for structural failures. It is noted that in 2010, the annual cost of corrosion to the Australian economy was estimated to be between 36 billion and 60 billion dollars. Also, ordinary Portland cement used in the concrete causes about 5-7% of the total global carbon dioxide (CO2) emissions into the atmosphere. The proposed project will develop ultra-high performance geopolymer concrete thin-walled structures, which will ensure the durability of the coastal infrastructure and contribute significantly to the Australian economy and environmental sustainability.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101436 Cortie, Dr David L	Heat management is critical to many technologies for sustainable energy, electronics, protective equipment and energy-efficient buildings. The phonon is the quantum particle representing a travelling vibration and is responsible for the transmission of heat in solids. This project will study the new mechanisms for phonon transport in solids modified with embedded nanoparticles, which operate as phononic filters. Neutron spectroscopy provides a tool to measure the phonon density of states which is critical for developing a mathematical model of thermal boundary resistance. This is expected to identify mechanisms for ultra-low thermal conductivity leading to potential applications in thermoelectric generators and heat-resistant materials.	52,500.00	105,000.00	105,000.00	52,500.00	0.00	0.00	315,000.00
	National Interest Test Statement This project is designed to discover knowledge to develop novel composite materials that can limit the flow of heat using a combination of bulk solids embedded with nanoparticles. The goal is to identify which shapes of nanoparticles, and which forms of materials, are the most efficient at modifying the motion of heat across solid–solid interfaces. To achieve this, the project will deploy landmark scientific infrastructure that has recently become available in Australia to perform neutron spectroscopy in order to study the vibrations in the materials at an unprecedented level of detail. This will assist in developing a mathematical theory to model the thermal properties of nanoscale solid–solid interfaces. As heat flow across interfaces is universally important in technology, it is anticipated that a predictive theory will have a diverse range of applications including enhanced thermoelectric generators, integrated circuitry, sustainable buildings and personal protective equipment.							
DP210101475 Palmisano, A/Prof Stephen A	Virtual reality (VR) is a breakthrough technology with a host of applied uses. Unfortunately, many people become sick when using head-mounted displays (HMDs). Our project proposes, and aims to test, a new theory of this cybersickness. We intend to quantify the sensory conflicts produced by HMD VR for the first time and measure their effects on perception, eye-movements, balance and well-being. The project will 1) determine the causes of, and conditions responsible for, cybersickness; and 2) offer practical information on how to prevent it. These outcomes are expected to directly benefit, and greatly improve HMD use in, fields ranging from defence, education, entertainment, gaming, medicine, real estate, simulation training and tourism.	30,500.00	65,500.00	69,000.00	34,000.00	0.00	0.00	199,000.00
	National Interest Test Statement Head-mounted display (HMD) based virtual reality (VR) has enormous potential. This can clearly be seen by the apps already developed for its use (e.g., for architecture, archaeology, business, defence, education, engineering/manufacturing, entertainment and the arts, health & safety, medicine/psychology, research, real estate, sport, telecommunications, tourism, and urban design). Unfortunately, cybersickness is greatly limiting the uptake and demand for this revolutionary technology. By finding ways to reduce this sickness and make HMDs more acceptable to users, this project will provide exciting opportunities for Australian gaming and simulation training industries. Without the threat of cybersickness, VR will also be able to enrich our children's classrooms (with virtual field trips), better inform our urban design (with first-person virtual walk-throughs), enrich global communications (with fully-immersive social media platforms) and make it possible for Australians to virtually visit important historic landmarks without any impact on cultural heritage preservation.							
DP210101486 Guo, Prof Zaiping	This project aims to develop metal-carbon dioxide batteries with high specific energy densities for carbon dioxide capture as well as energy conversion and storage. Metal-carbon dioxide batteries are promising not only for conversion of waste carbon dioxide to value-added chemicals, but also for storage of electricity from renewable power and balancing of the carbon cycle. By combining experimental work and theoretical modelling, this study will explore novel electrode materials via catalyst design and understanding of the underlying reaction mechanisms. The outcomes will revolutionize battery technology and position Australia as a global leader in the critical transition to a decarbonized economy.	80,175.00	160,137.00	165,952.50	85,990.50	0.00	0.00	492,255.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement Australia will benefit enormously from this project through its economic, commercial, and environmental impact, especially in carbon dioxide emission reduction and utilization. The proposed metal-carbon dioxide battery system will advance energy storage technology whilst simultaneously assisting the implementation of clean energy in a smart grid in an efficient, safe, and sustainable way. This project addresses a critical bottleneck in carbon dioxide conversion and utilization technology that has constrained the practical uptake of high performance materials. The principal benefits include new fundamental knowledge and the development of an innovative energy storage system with long cycle life and high safety. Industries that rely on carbon based chemicals will benefit in the long-term from outcomes of the project, and most importantly, the environment will benefit through reduced greenhouse gas emissions.							
DP210102215 Dou, Prof Shi Xue	This project aims to develop essential technologies for ammonia-mediated energy storage, hydrogen production, and electricity generation. This project expects to generate new understandings on designing novel multi-atom-cluster catalysts for the critical ammonia synthesis, electrolysis, and oxidation processes using interdisciplinary approaches. The expected outcomes of this project include multi-functional electrocatalysts, fundamental insights of principles for electrocatalyst design, and prototype technologies. This should provide significant benefits for the harvest of clean energy, the safe utilization of hydrogen, and the development of carbon-free fuels, which are essential for optimizing the energy structure of Australia.	93,601.00	189,592.50	193,288.00	97,296.50	0.00	0.00	573,778.00
	National Interest Test Statement Strategically, the proposed research project will provide solutions to energy crises and make the realization of the carbon-free fuel. This will provide direct and clear benefit to Australia: retaining its scientific leadership, alleviating its environmental pressure by reducing carbon dioxide emissions, and optimizing its energy structure towards a more efficient, renewable, and reliable energy future. This project will also boost a series of new technologies, including the high-efficiency storage of clean energy, safe, and large quantity transport of hydrogen, and emission-free electricity generation using non-carbon fuels. These cutting-edge technologies will comprehensively make significant economic and social impacts, with great benefits for millions of Australians by establishing a sustainable energy future. Moreover, through cultivating next-generation material scientists, this project would also provide potential benefits for Australia's research community through high-quality training.							
DP210102911 Alici, Prof Gursel	This project aims to establish novel non-invasive human-machine interface systems based on multi-modal sensing and machine learning to intuitively command and control robotic and autonomous systems safely interacting and cooperating with humans. This will be achieved by harnessing the synergies across design optimisation, multi-modal sensing, additive manufacturing, machine learning, and assistive and cooperative robotic devices. Expected outcomes are a novel human-machine interface methodology, a new multi-purpose wearable data glove, and function and application-specific machine learning methods for cutting-edge applications in assistive robotic devices such as a prosthetic hand, advanced manufacturing, construction and agriculture.	53,662.00	111,250.00	113,365.50	55,777.50	0.00	0.00	334,055.00
	National Interest Test Statement An ageing population and increasing cost of manufacturing industry pushing Australian jobs overseas put significant financial burdens on the national health and welfare systems. In line with progress in many technological areas to develop robotic and automation systems, assistive robotic devices offer an effective solution to these global challenges, provided that the devices interact and communicate with their users in a close-to natural way. This project harnesses the synergies across design optimisation, wearable sensors, additive manufacturing, machine learning and assistive devices to establish a non-invasive, affordable, easy and safe to wear human-centered interfacing system to intuitively command and control these robotic devices. The project outcomes will have both fundamental significance and practical applications in physically assistive devices such as prostheses, orthoses and rehabilitation devices, robotic mobility aids, advanced manufacturing, defense, construction, space, and agriculture to deliver significant social, economic, and scientific benefits for Australia.							
	University of Wollongong	808,209.00	1,671,307.50	1,697,440.50	873,809.00	39,467.00	0.00	5,090,233.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
Western Sydney University								
DP210100115 Ellsworth, Prof David S	Phosphorus (P) is in low supply in soils around the nation, and limits plant production in the Australian landscape, as well as for many tropical forests worldwide. How scarce P restricts photosynthetic capacity has remained elusive. We will determine how Australian plants achieve high phosphorus-use efficiency despite low P concentrations in leaves and soils. We will synthesise knowledge of how plants maintain productivity with low P availability, and inform global models how to represent P biogeochemistry and photosynthesis to improve C-cycle estimates. The understanding of plant photosynthetic and P-saving mechanisms that emerge should provide benefits through improved ecological models and enhanced management of primary production.	66,000.00	137,500.00	133,500.00	62,000.00	0.00	0.00	399,000.00
	National Interest Test Statement As a nation with rich natural mineral resources but where phosphorus-scarce soils predominate, we seek to provide Australia-specific knowledge of how phosphorus constrains plant production. We aim to achieve phosphorus-use efficiency through informing species selection and management best-practices in forestry, bioremediation and ecological management. The project is expected to improve knowledge about phosphorus limitations for incorporation into land surface and earth systems models. This will help the development of effective management strategies for sustaining productivity in the face of rising atmospheric CO2, and enhancing carbon-mitigation efforts involving afforestation and bioremediation plantings. Maintaining the productive capacity of Australian woodlands, plantations and paddocks should provide social and economic benefits while aiding environmental quality.							
DP210100175 Hawkins, Prof Gay	Australia is facing a waste crisis and government and industry are promoting the Circular Economy as a solution. This project investigates innovative cultural and economic practices in three waste streams: single use plastics, organics and bulky household waste, to understand how they realise or redraw the circle. The project develops empirical evidence to advance thinking about how novel waste economies are organised and the cultural and social innovations they generate. Outcomes include national and international case studies of innovative waste economies, social learning events with industry stakeholders and academic publications. Key benefits provide evidence of how different waste practices enable more sustainable ways of living.	46,257.00	101,558.00	108,243.50	52,942.50	0.00	0.00	309,001.00
	National Interest Test Statement Australia is facing a waste crisis and the Circular Economy has emerged as a key strategy for reform. This represents a significant national opportunity to shift waste policy away from trucks, landfill and recycling towards a focus on how economies can be organised in more sustainable ways and how everyday waste practices can be changed. This project contributes to the current push for reform by investigating innovative waste economies in three problematic waste streams: single use plastics, organics and bulky household waste. Selected case studies focus on national and international best practice and cover both rural and urban settings. Economic, socio-cultural and environmental innovations in these waste economies will be examined. Project findings will give practical solutions for reconfiguring waste economies to make them more circular or sustainable, while addressing the social and cultural benefits and challenges involved. Improving environmental management via more sustainable waste economies and practices will contribute to the government's environmental research priority.							
DP210100460 Power, Dr Emma R	Mounting evidence points to difficulties faced by Australians reliant on government income support in meeting market costs of essential needs. This project investigates whether and how 'shadow care infrastructures' – a wide range of formal and informal material and social supports – enable the survival, well-being and flourishing of income support recipients. Focusing on people with disabilities, unemployed and asylum seekers, the study evaluates the benefits and harms such infrastructures produce for those receiving and providing care, and the wider community. It examines risks and opportunities to scale up emerging care infrastructures identified as critical to making ends meet for income support recipients in contemporary cities.	58,444.50	121,028.50	122,766.00	60,182.00	0.00	0.00	362,421.00

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	This research will produce economic and social benefits for Australia by helping to develop more effective, efficient and comprehensive welfare interventions. Current budget estimates of Australia's income support system do not encompass the full extent of support for low-income earners. This pioneering research will investigate the range of 'shadow care' infrastructures that help low income earners to make ends meet. This will promote knowledge sharing about care infrastructures that are practical, innovative and beneficial and which could be bolstered and scaled-up. The research will inform more beneficial and caring welfare policies that will enable improved social, educational, health and workforce participation outcomes for all Australians.							
DP210102081 Singh, Prof Brajesh K	Soil communities, among the most abundant and diverse in nature are responsible for many critical ecosystem functions, including nutrient cycling and climate regulation. This project will determine whether consideration and quantification of interactions between different biotic communities – specifically among plants, soil microbes and animals, within and across trophic levels - can address underlying shortcomings in predictions from classical biodiversity-ecosystem function theory. By advancing understanding of biological complexity and its impacts on ecosystem functions, the project will provide a unifying framework for understanding variation in ecosystem functions across scales, ecosystem types and multiple environmental disturbances.	92,500.00	185,000.00	185,000.00	92,500.00	0.00	0.00	555,000.00
	National Interest Test Statement							
	Natural and managed ecosystems are critically important to Australia and are a significant part of our heritage. This project will provide new insights regarding the multiple dimensions of soil biodiversity essential for productive and resilient ecosystems. With this new knowledge, managers will be better able to identify elements of our soil biodiversity meriting conservation. The outcomes of the project will help protect vulnerable ecosystems of Australia, including our dryland ecosystems, via improving sustainability of biodiversity, soil health and ecosystem functions. Our goal is to provide scientific support for key stakeholders including land-managers and government agencies to help advance and improve natural resource management and conservation policies.							
DP210102730 Ghannoum, A/Prof Oula	This project aims at genetically manipulating sugar sensing pathways in the model C4 grass Setaria viridis, and at replacing sugar sensors in the model C3 crop Oryza sativa (rice) with those from S. viridis. This project expects to elucidate the impact of altered sugar perception on crop photosynthesis and yield. Expected outcomes includes advancing a novel "pull" approach to improve yield in C3 crops by using C4-like sugar sensors to reduce feedback regulation of photosynthesis which in turn limits productivity. This is in contrast to previous 'push' approaches aimed at directly increasing photosynthesis. Hence, this project provides significant benefits by contributing to the next green revolution needed to lift agricultural yields.	69,500.00	154,000.00	164,500.00	80,000.00	0.00	0.00	468,000.00
	National Interest Test Statement							
	Climate change, water shortages and population growth are threatening food security in Australia and worldwide. Improvements in crop yield potential by traditional breeding methods have been stagnating over the past decades. Engineering enhancements in photosynthetic capacity, as a means of Improving crop productivity, has been difficult because photosynthesis is governed by multiple traits and genes, and genetic improvements of photosynthesis must integrate whole plant feedbacks. In this project, we propose to indirectly manipulate photosynthesis by altering sugar perception and feedback regulation by sink tissues. Hence, our research aligns with the National research priority of Enhanced food production. Our project focusses on a model C4 grass related to maize, sorghum and sugarcane, which are more productive and drought-tolerant than C3 crops (eg, wheat and rice), and are prominent Australian crops. We also focus on rice, a leading staple crop worldwide and important export crop for Australia. Hence, our project will contribute to the economic and environmental benefits of the Australian community.							
DP210103177 Seymour, Dr Kiley	This project aims to generate a detailed mechanistic understanding of the neural circuitry underlying human visual perception. Through an international collaboration with the world-renowned Max Planck Institute, Germany, the project will exploit powerful new tools to measure human brain activity in cortical layers to test major theoretical models of human vision. The anticipated results are expected to significantly advance our basic understanding of how the human visual system parses complex visual input into objects and visual scenes, which may inform the development of artificial vision systems.	60,000.00	125,000.00	127,500.00	62,500.00	0.00	0.00	375,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	The human brain is the fundamental organ allowing us to perceive and interact with our world. Animal research provides insight into the neural circuitry of animal brains, but conventional human neuroimaging is limited in its ability to measure human brain circuits non-invasively at a sufficient spatial scale. This project overcomes that limitation by using Magnetic Resonance Imaging at an unprecedented magnetic field strength to measure human brain activity at a resolution previously reserved for invasive electrode experiments in animals. The results are of immediate relevance to human neuroscience and psychology and will impact the design of new artificially intelligent systems, computer processors, and neuromorphic technologies that mimic the human brain. This collaboration with the Max Planck Institute, Germany, will provide Australian scientists and students with access to world class facilities and training in the most advanced methods for studying human brain function.							
	Western Sydney University	392,701.50	824,086.50	841,509.50	410,124.50	0.00	0.00	2,468,422.00
	New South Wales	13,683,095.50	27,644,425.00	26,948,669.00	13,922,779.00	1,264,964.50	329,525.00	83,793,458.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
Northern Territory								
Charles Darwin University								
DP210100228 Bird, Prof Steven	We will develop the first systematic account of Aboriginal language programs and what makes them effective and sustainable. The project will create a substantial evidence base, leading to a comprehensive model of language revitalisation and how it operates in each place, and for whom. The model will show how local and national organisations can invest in Aboriginal languages, and what kinds of returns they can expect. The project involves a two-way collaboration with Aboriginal people across the country that will elevate their voices and build their capacity for designing and evaluating programs, businesses and technologies for keeping Aboriginal languages strong.	57,750.00	118,667.50	125,502.50	64,585.00	0.00	0.00	366,505.00
	National Interest Test Statement The project will develop the first systematic account of Aboriginal language programs and what makes them effective and sustainable. This will help local and national organisations to know how to invest in Aboriginal languages, and what kinds of returns they can expect. It will build local capacity to design and evaluate programs, supporting local decision-making. In this way, the direct benefits of the project are cultural, keeping our languages strong so that Australia's first voices can continue to be heard. Strong cultural identity supports community wellbeing and improved race relations, contributing to national reconciliation, a social benefit. Aboriginal languages are tied into local country and so keeping languages strong supports caring for country, an environmental benefit. Language programs provide culturally meaningful work for Aboriginal people, linked to stable employment and to participation in the local economy, with pervasive commercial and economic benefits.							
DP210102176 Christian, Prof Keith A	This project aims to understand the fundamental ecological relationships between animal hosts (frogs, geckos) and bacteria on their skin by separating host effects from environmental factors that determine skin microbiome composition. The research is significant because it will generate new knowledge needed to understand how skin microbes function in providing protection against disease. Expected outcomes include the provision of essential information that will guide future research efforts on the factors that determine a healthy skin microbial community (which is needed before skin diseases can be combated). The research will provide significant benefits, including more targeted conservation efforts to combat wildlife skin diseases.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
	National Interest Test Statement This project will lay the foundation needed to develop much needed new tools for early warning indication of changes in wildlife health. Preserving wild Australia is undeniably important and waiting for mass deaths is too late. The costs can be severe. In economic terms, our nature values underpin tourism, education and community cohesion (social and cultural). Environmental sustainability is one of the eight ‘UN Millennium Development Goals’, and addressing wildlife diseases is crucial in a rapidly changing world. Sampling microbes is easier and more cost effective than invasive techniques that involve sampling animals or their tissues. Better tools for monitoring the health of animals could eventually be applied to species that are culturally significant, and to those that are commercially or economically important, such as the Northern Territory's multi-million-dollar crocodile farming industry and fisheries. These national benefits cannot be realised without better understanding the biological relationships among animals, their skin microbes and the environment.							
DP210103227 Banks, Prof Sam C	This project aims to improve fire management for environmental outcomes in northern Australia. It will address a key knowledge gap in our understanding of the effects of fire on biodiversity, relating to the spatial pattern of fire in the landscape. This is important because changing patterns of fire are not only a risk to humans but have major effects on our environment. This project will involve researchers, environmental managers and indigenous land owners to design better fire management strategies for biodiversity. The key benefits include new knowledge and tools to better manage fire and address one of our major environmental challenges, the decline of native wildlife in northern Australia.	64,000.00	130,000.00	144,500.00	78,500.00	0.00	0.00	417,000.00

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement The management of fire is a priority environmental issue across Australia. In northern Australia, fire management is a major economic activity and a significant source of income for Indigenous communities through carbon emission abatement programs. Improved fire management also has much potential to halt the drastic, ongoing declines of northern Australian native wildlife. This project will provide a scientific basis for the development of fire management strategies for biodiversity conservation and assess how these align with other priorities. Outcomes for the Australian community include environmental benefits through improved wildlife conservation, potential development of alternative income streams for Indigenous savanna burning programs through 'biodiversity credits' and opportunities for training of new scientists in northern Australia in genetics and computational science for environmental management.							
DP210103369 Campbell, Dr Hamish A	This project aims to assess the ecological changes that have arisen due to the repatriation of estuarine crocodiles to Australian ecosystems. It is significant because the restoration provides a rare opportunity to empirically test changes in ecosystem processes under varying degrees of large carnivore predation pressure. Expected outcomes include improved understanding of the processes that govern the strength of predator-ecosystem interactions and an ability to quantify the biomass, social structure, and behaviours of predators required to influence these processes. Benefits should include improvements in how the ecological role of large carnivores is measured, and when and where carnivore populations should be culled or conserved.	45,000.00	120,500.00	150,500.00	75,000.00	0.00	0.00	391,000.00
	National Interest Test Statement While Australia's large carnivores pose a serious threat to humans and livelihoods, they also have significant economic and cultural value. There is a growing body of evidence that shows retaining or restoring large carnivores will counter environmental challenges such as biological invasions, disease, and climate change. The findings of this project will improve the way we measure the ecological role of large carnivores, enabling managers to harness the ecosystem services that predators provide, while informing government agencies where and when their populations should be hunted, culled, or conserved. The research is publicly engaging and will demonstrate to potential visitors that not all of Australia has been burnt and crocodile repatriation is a remarkable conservation success story. The project will also position Australia as an intellectual leader in the burgeoning field of trophic cascades and food-web dynamics and will see the development of low-cost, high quality biotelemetry technologies for Australian researchers and resource managers to enable broad scale monitoring of aquatic animals.							
	Charles Darwin University	241,750.00	519,167.50	570,502.50	293,085.00	0.00	0.00	1,624,505.00
	Northern Territory	241,750.00	519,167.50	570,502.50	293,085.00	0.00	0.00	1,624,505.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
Queensland								
Central Queensland University								
DP210100640 Verma, Prof Brijesh	This project aims to study feature extraction abilities of convolutional as well as traditional neural networks and develop a generic feature extractor which can be applied to wide variety of real-world image and non-image data. New concepts for automatic feature extraction, feature explanation, hybrid evolutionary algorithms and non-iterative ensemble learning will be introduced and evaluated. The expected outcomes are a generic feature extractor for automatically extracting features, an optimiser for finding optimal parameters and non-iterative ensemble learning technique for classification of features into classes. The impact of this project will be automatic feature extractors and classifiers for real-world applications.	73,352.00	143,154.00	139,604.00	69,802.00	0.00	0.00	425,912.00
	National Interest Test Statement Huge amounts of digital data are generated from video surveillance, drones, satellites and medical equipment but existing techniques have many problems with extracting appropriate features and interpreting them quickly and accurately. This research will develop advanced algorithms and techniques that can automatically process and interpret data quickly and accurately without using existing manual error-prone feature extraction and classification techniques. This will benefit Australian industry in developing fast and accurate vision systems for transport, agriculture and health. The project will have a huge impact on the Australian economy and society as it will advance the knowledge-base and research capability in neural networks that will produce new techniques for many Australian applications. The project builds on potential feed-forward and deep learning-based neural networks and will develop new automatic techniques for feature extraction, feature explanation, network optimisation and classification.							
	Central Queensland University	73,352.00	143,154.00	139,604.00	69,802.00	0.00	0.00	425,912.00
Griffith University								
DP210100658 Goddard, Prof Cliff W	This project will investigate how complex meanings are built up from more basic building blocks, and to what extent basic meanings differ between different languages, cultures, and geographical zones. The project is expected to lead to significant advances in the scientific knowledge of language. Nothing comparable has been attempted before. Expected outcomes include a rich harvest of new knowledge, digital tools to assist with analysing and translating complex meanings, and ongoing international collaborations. This will provide significant benefits such as enabling messaging and communication in education, health care, service delivery and international affairs to be clearer, more accessible and more translatable.	61,143.00	114,730.00	108,017.00	54,430.00	0.00	0.00	338,320.00
	National Interest Test Statement Words and meanings are central to people's understanding of the world and to successful communication between people from different language and cultural backgrounds. Using an innovative linguistic theory which has been pioneered by Australian researchers, this project will reveal how complex and difficult-to-translate meanings are built up from simpler building blocks of meaning that are shared between languages. This is basic research but it has an applied aspect which is an important part of the project. It will help meet a challenge that translators, educators, and outward-facing professionals face every day: namely, how to explain complex ideas and terminologies using maximally accessible language, i.e. words and phrases that everyone in Australia's diverse community can understand. By providing improved techniques and tools for more accessible messaging in health care, government service delivery, and early education this project will contribute social, cultural and educational benefits to the Australian community.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101600 Chen, Prof Chengrong	This project aims to reveal the continental pattern of soil carbon (C) response to warming in fire-affected ecosystems across Australia and to unravel the biogeochemical mechanisms underlying fire's role in shaping the temperature sensitivity of soil respiration. Fire has modified over 40% of the Earth's land surface and wildfire frequency is predicted to increase under global warming. This project expects to generate new knowledge on how fire influences soil-to-atmosphere C fluxes in a warmer climate using a multi-disciplinary approach. Expected outcomes include an enhanced capacity to predict the terrestrial ecosystem-to-atmosphere C fluxes and their feedbacks to climate under increasing frequency of fire using Earth-system models.	80,000.00	157,500.00	145,000.00	67,500.00	0.00	0.00	450,000.00
	National Interest Test Statement Australia is one of the most fire-affected countries. It is predicted that fire intensity and frequency will increase under a warming climate. The new knowledge generated from this project on a warming-induced increase in carbon (C) dioxide release from soils in fire-affected landscapes will contribute greatly to current soil C and Earth-system models for more accurate prediction of terrestrial ecosystem-to-atmosphere C fluxes and their impacts on climate change. The outcome of this project will provide scientific basis for developing sound climate change mitigation strategy and fire management regime, contributing to social-ecological resilience to wildfire and climate change. Moreover, this project will contribute to the science that underpins carbon sequestration, vegetation productivity and sustainability and conservation of biodiversity under a warming climate and increasing frequency of wildfire. This project is expected to boost international collaborative research links and will improve Australia's global reputation and prestige in this important and emerging field of science.							
DP210101651 Pryde, Prof Geoffrey J	This project aims to develop the science and tools behind device-independent quantum security for information networks. These gold-standard protocols rely on genuine quantum nonlocality but, to date, the strict performance requirements have been unachievable for general practical cases. Further, the theory of nonlocality in multiparty networks is almost completely undeveloped. The project's anticipated outcomes are novel experiment and theory to bypass barriers and open up nonlocal network protocols. It is also expected to rigorously establish that a single-photon wavefunction after a beamsplitter is truly nonlocal. Likely future benefits include secure random numbers, secure distributed information technology and world-best photon sources.	110,000.00	235,000.00	190,000.00	65,000.00	0.00	0.00	600,000.00
	National Interest Test Statement This project will position Australia to lead the world in the ultimate quantum-enhanced security for information networks. It will develop the theoretical and experimental science required to harness genuine quantum nonlocality, the extreme effect that enables gold-standard quantum-enhanced security. Specifically, the project will study quantum nonlocality in networks, and develop novel tools to generate this powerful resource, even in the presence of real-world imperfections. This will increase Australia's prominence and stake in the key internationally-competitive area of quantum science. It will provide world's-best training, preparing the next generation of researchers and quantum technology professionals to participate in nascent quantum industries. It will enable key technologies—for industry, government, and defence—in hardware security for information networks, and random number generation for computational and online security. It will hasten the coming of the quantum technology revolution and position Australia to capitalise on its economic, social, and quality-of-life benefits.							
DP210101875 Zhou, Prof Yaoqi	This project addresses the long-standing structure-folding problem of Ribonucleic acids (RNA) whose solution is essential for elucidating the roles of noncoding RNAs in living organisms. The proposed approach will detect hidden homologous sequences and enhance evolutionary covariation signals by developing new algorithms for search and smarter neural networks for deep learning. The project expects to generate new tools for structure-based probing of RNA evolutional and functional mechanisms. The outcomes should provide significant benefits by high-accuracy computational modelling of RNA structures that are difficult and costly to solve by current structural biology techniques but important for enabling biotech and clinical applications.	95,000.00	190,000.00	190,000.00	95,000.00	0.00	0.00	570,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	RNA plays an essential role in the biological processes of coding, decoding, regulation, and expression of genes, as well as in the regulation of many cellular processes. We know a lot about the 'components' (their sequences) in RNA, but very little about their static structures. Without structural clues, the entire field of RNA biology has stalled. Accurate prediction and modelling of RNA structures proposed in this project are expected to provide a new framework to enable future biotechnological applications such as gene regulations and structure-based drug discovery to disease-causing RNA targets. Other economic and social benefits to Australia will include enhancement of Australia's international reputation as a scientific leader in the field of RNA structure prediction, new capacity for provision of training of highly skilled staff in algorithm development and deep learning for the new knowledge-based economy with an international vision and network, and new computational technologies on RNA structure prediction to Australia and international biotech companies.							
DP210101913 Smith, Prof Tanya M	This project will build the requisite foundation to resolve whether variable climate change sparked the origins of humans and our great ape forebears. Scientists endeavor to recover ancient environmental records to examine this influential idea, but have lacked the means to do so at the scale of a human lifespan. This multidisciplinary effort will harness groundbreaking advances pioneered by our collaborative team to produce the first fine-scaled climate proxies from the teeth of humans' closest living relatives. Documenting climate variation across diverse landscapes promises to transform studies of prehistoric ecosystems and past behaviour from omnipresent fossilised teeth, providing further insight into humanity's unprecedented success.	91,943.00	171,543.00	79,600.00	0.00	0.00	0.00	343,086.00
	National Interest Test Statement							
	Increasing knowledge of human evolution is of considerable public benefit, as the foods we eat, environments we live in, and lifestyle choices we make have shaped our biology and will continue to do so. This project will empower a team of internationally-renowned scholars to improve accuracy and precision in predicting and measuring the impact of environmental changes caused by climate, National Science and Research Priority #8: Environmental Change. Our innovative interdisciplinary approach uses chemical analyses pioneered by Australian scholars and builds scientific workforce capacity and recognition of leadership in a field of growing international significance. This work pushes the boundaries of research on ancient life forms and modern endangered animals. Broader benefits may be realised by extending our approach to the abundant animal remains from rural Australia for insight into undocumented historic climate conditions, as well as prehistoric environmental changes that have shaped Australia's unique modern landscapes.							
DP210102247 Grootenboer, Prof Peter	This project aims to understand how middle leaders in schools can build teacher capacity to positively influence student learning. With Australian students falling behind their peers internationally, improving academic results is a national imperative. School-based professional learning for teachers is key to achieving that, and middle leaders are recognised as important facilitators of such learning. Using practice-based methodology, the project will study how their implementation of professional learning impacts on classroom teaching and student outcomes. The anticipated results will enable the development of practices to inform a charter of middle leadership best practice for improving teaching and learning in Australian schools.	49,343.00	95,780.50	91,638.00	90,436.00	45,235.50	0.00	372,433.00
	National Interest Test Statement							
	This project is in the national interest because it aims to enhance students' learning experiences and educational outcomes. It addresses two of Australia's national education priorities: i) effective curriculum development and teacher professional development, and ii) improving students' academic results. While middle leadership in schools is acknowledged as critical in this context, there is limited evidence on how it is effectively practised, as has been noted by peak educational leadership bodies. Moreover, key goals of the 2019-23 Australian National School Reform Agreement include undertaking research to establish 'what works in improving school and student outcomes', and 'translating research into practical resources to support schools and teachers'. The team will identify middle-leading practices that can transform teaching and educational outcomes, and this evidence will inform the development of professional learning and educational resources. Well-educated students help to make Australia more competitive, and are instigators of meaningful economic, social, environmental and cultural change.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102291 Paz-Silva, Dr Gerardo A	One of the key remaining obstacles to the successful deployment of quantum computers & sensors in science, industry, and society is the existence of noise sources that are themselves quantum, and thus have an unmatched potential for disruption. This project will attack this problem by providing (i) a detailed understanding of the impact of quantum noise sources, and developing protocols to (ii) characterize and (iii) overcome the negative effects such realistic noise entails. In taking this necessary step for the implementation of these breakthrough technologies, it will not only significantly advance knowledge but will have a direct impact in the development of a technology in which Australia and other leading nations are heavily invested.	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00
	National Interest Test Statement Australia and many nations and private companies around the world are heavily invested in the development of quantum-enhanced technologies, including quantum computing and quantum sensors. These technologies promise to radically change the way we process and acquire information, and have significant applications over an extremely wide range of areas of interest, including defence, securing data, medicine, drug discovery, mining, city planning, etc. In summary, in any area in which dramatically better sensors and exponentially more processing power are useful. Securing Australia's role as a leader in their development will ensure a technological edge for the country and its establishment as a niche for quantum-related research and development. This will translate in increased local and foreign investment to develop this technology. This proposal will provide the necessary tools to assess and overcome one of the key hurdles in the development of these breakthrough technologies, i.e., quantum noise, and is thus key to fulfilling their potential.							
DP210102373 Dioso-Villa, Dr Rachel	This is the first national study of its kind that investigates the trajectories of wrongful convictions as systems failures by examining decisions from investigation to exoneration. Wrongful conviction is a significant social and legal problem in Australia and other nations. It costs the Australian government millions in police, court and prison services and has health and psychological consequences for exonerees and their families. Expected outcomes for this project include an early warning detection tool to identify at-risk cases and overall improved accuracy in convictions. This will provide significant benefits, for criminal justice agencies, victims and accused individuals while positioning Australia as a world leader in the field.	31,292.50	91,283.00	97,427.50	37,437.00	0.00	0.00	257,440.00
	National Interest Test Statement This project addresses a significant problem for our criminal justice system and those directly affected by it. Wrongful convictions adversely impact the health and wellbeing of exonerees and their families; cost the Australian tax payer an estimated $39 million per annum in unnecessary prison expenses; and undermines our faith in the institutions of justice. This project is expected to pinpoint the case characteristics and different system pathways that lead to wrongful conviction and develop detection tools to help improve the accuracy of the Australian justice system. Project outcomes are expected to have direct benefits for those involved in the justice system as well as broader benefits such as better communication between criminal justice agencies and enhanced public confidence in the accuracy and fairness of the Australian criminal justice system. The project will generate an early detection tool for wrongful conviction, similar to the checklists used to reduce errors in medicine and aviation, and a national dataset of cases as a pubicly available resource to enhance research and comparative work.							
DP210102575 Hamilton, Prof David P	This project aims to conduct a global assessment of lake water quality and prioritise lakes for restoration. This project expects to generate new understanding of trends in lake condition based on application of geospatial frameworks and models for nutrient loads and in-lake trophic state. This information will help to quantify the magnitude of actions required to restore lakes at landscape scale. The intended outcome is a global atlas linking catchment hydrology, nutrient loads and lake attributes. Expected outcomes of this project include improved methods to predict effects of land use and climate change on lakes across the globe, and recommendations to water resource managers on investing in the restoration of lakes across the landscape.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Lakes and reservoirs are a strategic asset, critical for the water security of Australia. Their importance is emphasised now more than ever by the prevailing conditions of climate extremes, water shortages, bush fires and widespread landscape drying. Climate and land use change as well as human demographic factors are impacting on water quantity and quality in Australia. Our research will be the first to quantify the extent that natural lakes have departed from a pre-human reference state in Australia, allowing strategic planning for the scale of restoration efforts to arrest further degradation and improve functionality. Concurrently, we will use artificial reservoirs with comprehensive data sets to ensure our models are well calibrated to the unique variability of Australia. Our research will provide a basis to manage lakes as a vital economic and environmental asset underpinning water in the welfare and stability of citizens of Australia, as well as reinforcing intrinsic values. It will align with identification of Soil & Water by the Commonwealth Government as one of nine national research priorities.							
DP210102843 He, Prof Kai	This project aims to systematically examine the policy strategies that great powers can employ to challenge international institutions during a period of international order transition. This project expects to develop a new theoretical framework to shed light on how the United States and China compete and cooperate in the different issue areas of global governance. The outcomes of this project will be an in-depth understanding of revisionism in world politics and practical policy recommendations to cope with the dynamics of international order transition. This knowledge should provide significant benefits to Australia's policy community for making sensible policies against the background of US-China competition in the 21st century.	23,367.50	46,854.50	44,877.50	21,390.50	0.00	0.00	136,490.00
	National Interest Test Statement							
	This project serves Australia's national interest in three ways. First, this project focuses on the coming US-China competition in world politics, which is one of the most important foreign policy challenges for Australia in the 21st century. How Australia should act in order to maximize Australia's national interest is one of the toughest questions for policymakers in Canberra. Second, this project will provide a new theoretical framework to shed light on revisionist strategies in world politics, which will help Australia's policymakers to understand the dynamics of the international order transition against the background of US-China strategic competition. Third, it will offer some doable and practical policy recommendations for Australia's policy community to shape the future rules-based international order in global governance.							
DP210102981 Brumm, Prof Adam R	Archaeologists have long puzzled over the identity and origin of the 'Toalean' people from Sulawesi, Indonesia. These prehistoric hunter-gatherers produced a unique culture that emerged in the south of this island about 7500 years ago, and some scholars believe they introduced the dingo to Australia. Little is known about these early foragers despite a century of research. This project aims to investigate a significant new cave site in Sulawesi that is the richest, most well-dated Toalean locality yet uncovered. Through detailed archaeological excavations and analyses, this project expects to advance scientific knowledge of an important but poorly understood Indonesian culture that is often connected with the early human story in Australia.	105,518.00	202,017.50	193,124.00	96,624.50	0.00	0.00	597,284.00
	National Interest Test Statement							
	This project will bring together Australian and Indonesian scientists to advance our understanding of the origins and population history of one of Indonesia's most enigmatic, but poorly known, ancient cultures – one that may have played a role in shaping the Australian Aboriginal past. The research will aid in unravelling the intertwined and diverse histories of the indigenous peoples of Indonesia and Australia. It will benefit Australia through a key contribution to improving our nation's awareness of the shared history that underpins the pre-European world of Indonesia and Australia, and, in broader terms, our understanding of Southeast Asian populations (>590,000,000 people). By revealing the early roots of modern Indonesian society, the project will benefit Australia through both soft diplomacy and the long-term social stability of its most important neighbour. Uncovering Sulawesi's rich archaeological past will significantly contribute to the emerging cultural heritage-related businesses of local communities, thus aiding economic growth in an underdeveloped neighbour – to the benefit of the region.							
DP210103126 Yao, Prof Xiangdong	This project aims to fundamentally understand the catalytic mechanism at an atomic level through metal-metal and metal-metal/support interactions. The optimised configuration of active sites for a specific reaction is consequently identified, providing the design principles of novel catalysts. The precisely control of synthesis for such active sites and assembly of the target active sites into a catalyst will deliver a completely new methodology for catalyst development. The expected outcomes from this project include new science and knowledge of Chemistry, new design philosophy and strategies for catalysts, and the highly efficient catalysts for electrocatalytic reactions, benefiting Australian renewable energy research and industry.	50,000.00	100,000.00	100,000.00	50,000.00	0.00	0.00	300,000.00

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	With the introduction of fuel cell vehicles into the market, hydrogen energy is becoming a growth market. The market for fuel cells alone will exceed $100 billion by 2030. The outcomes of this project will lead to catalysts with sufficiently high activity to replace Platinum and Ruthenium in fuel cells; for hydrogen production from water; and for inclusion in metal-air batteries. The wide use of environmentally friendly, clean energy will significantly reduce the current dependence on fossil fuels, thus reduce air pollution and greenhouse emissions, improving quality of life and environmental sustainability. These catalysts and devices also have enormous commercialisation potential, benefiting the Australian hydrogen energy industry. It will also contribute to the hydrogen export chain, announced by the Australian government as one of the Australian economic priorities.							
DP210103266 Zhang, Prof Shanqing	This project aims to design a new generation recyclable and rechargeable all-solid-state sodium ion battery. We will use low cost and abundant sodium as a substitute for expensive and limited lithium to reduce material and environmental costs, and will develop ceramic/polymer composites as safe and environmentally friendly solid-state electrolytes to replace flammable and toxic organic liquid electrolytes. Furthermore, we design a recyclable battery configuration to allow rapid, low cost and green recycling of end-of-life batteries. The new battery will be a safe, low cost and sustainable energy storage technology for the multi-billion dollar electric vehicle and smart grid markets while simultaneously addressing battery recycling issues.	93,764.50	184,674.50	187,390.00	96,480.00	0.00	0.00	562,309.00
	National Interest Test Statement							
	This project aims to develop highly efficient, low cost, safe, sustainable, recyclable and rechargeable all-solid-state sodium ion batteries (ASSNIBs) that are beneficial for both electrical vehicles and smart grid applications. We will design a 3-D conductive network for electrodes enhances power density and stability and develop a ceramic/polymer composite as a non-flammable and highly ionic conductive solid electrolyte facilitates high energy density with zero risk of fire. Furthermore,our sustainability inspired design of conventional battery structure will enable low cost materials recycling and eliminates pollution from battery waste and recycling processes. The proposed ASSNIBs will help protect our environment by reducing consumption of our limited natural resources, decreasing the production of pollutants, and improving sustainable battery recycling processes. If successful, the resultant ASSNIBs can be manufactured and adopted at a commercial scale, driving Australia to the forefront of the energy storage industry and supporting sustainable, economic development in Australia.							
DP210103986 Waters, Prof Allison M	Exposure to adversity, such as violence, neglect and natural disasters, is common and a powerful risk factor for emotional maladjustment. Yet knowledge of the underlying mechanisms linking adversity with emotional maladjustment is remarkably limited. By drawing from theories of adversity and learning and utilising novel experimental methodology, this project aims to map how adverse experiences have different negative effects on daily emotional wellbeing by disrupting the mechanisms underlying how people learn to acquire and reduce reactivity to new threats. Expected benefits include new knowledge about the pathways linking adversity with psychopathology as well as the vital evidence-base for clear targets for behavioural interventions.	37,035.00	72,385.00	71,265.00	35,915.00	0.00	0.00	216,600.00
	National Interest Test Statement							
	Adverse life events are common, costly, and highly impairing for affected individuals, their families and the Australian health care and social welfare systems. In a world in which adverse experiences appear to be increasing, understanding the mechanisms for why some people develop different types of emotional problems following adversity and others do not will provide clear translational knowledge to inform behavioural interventions that could improve quality of life, reduce social burden and cut national health and welfare costs. With reported rates of violence and neglect on the increase, and recent natural disasters causing widespread devastation and loss, understanding how adversity leads to emotional maladjustment is crucial to our national interests of ensuring a healthy life for all Australians and economic stability.							
DP210104010 Zhao, Prof Huijun	Seawater is the most abundant aqueous resource on earth that is readily accessible at very low costs, but yet to be directly utilised for production of hydrogen fuel and commodity chemicals. This project aims to develop cheap and plentiful carbon-based high performance chlorine evolution electrocatalysts for seawater electrolysis powered by renewable electricity to realise the production of hydrogen, chlorine and sodium hydroxide directly from seawater. The electrolyser can also be used to treat desalination brine while produce hydrogen and chemicals. The success of the project will set a firm technological foundation for seawater utilisation, which will add to Australian capability to meet future energy and environment challenges.	84,779.50	173,134.50	178,780.00	90,425.00	0.00	0.00	527,119.00

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Australia is surrounded by oceans and has rich solar energy and wind power. Developing enabling technologies to collectively and coherently utilise Australia's abundant resources is vital for a green and sustainable future of Australia, but technologically highly challenging. This project takes the challenge to develop a seawater electrolysis system powered by renewable electricity generated from solar and wind and utilises seawater as feed to simultaneously produce hydrogen fuel and commodity chemicals such as chlorine and sodium hydroxide. This seawater electrolysis system can also be coupled with desalination plants to efficiently treat desalination brines while producing hydrogen and chemicals. The project addresses Australian Government Science and Research Priorities: Energy - New clean energy sources and storage technologies that are efficient, cost-effective and reliable and the outcome will lead to a new technology for producing hydrogen and chemicals from seawater and renewable electricity, which will bring considerable socioeconomic benefits to Australia.							
	Griffith University	1,038,186.00	2,084,902.50	1,927,119.00	925,638.00	45,235.50	0.00	6,021,081.00
James Cook University								
DP210100881 Bird, Prof Michael I	Pyrogenic Carbon ('charcoal') is a poorly understood component of the global carbon cycle, important because it is resistant to degradation and hence has potential soil carbon sequestration benefits. This project applies a new technique (hydrogen pyrolysis), in combination with spectroscopic techniques, to quantify charcoal in a pan-Australian soil sample set, collected using uniform stratified sampling and preparation protocols. This will enable the mapping of soil charcoal stocks in relation to environmental and soil variables across Australia. The results will enable understanding of the controls on charcoal sequestration potential in Australian soils and contribute to efforts to quantify soil charcoal stocks and dynamics globally.	102,500.00	200,500.00	98,000.00	0.00	0.00	0.00	401,000.00
	National Interest Test Statement							
	Australia is the most flammable continent on earth, clearly demonstrated by the bushfire disaster of this summer. Pyrogenic Carbon ('charcoal') is produced in bushfires and is important because, once formed, charcoal persists in soils and sediments for hundreds to thousands of years. This represents long-term carbon capture, which reduces atmospheric carbon dioxide. Most Australian soils contain some charcoal, some contain a lot. This project will use novel new techniques, developed in Australia to, for the first time, measure and map charcoal in Australian soils at the continental scale. Using this data we will uncover the environmental and soil factors that control charcoal abundance. This is important because we can then look for opportunities to increase charcoal in soils, and thereby opportunities to store more carbon in the soil. For example, potential opportunities exist to increase charcoal in soils in northern Australia across the very large savanna areas that burn naturally every year. Increasing soil carbon and reducing atmospheric carbon dioxide in the process is clearly in the national interest.							
	James Cook University	102,500.00	200,500.00	98,000.00	0.00	0.00	0.00	401,000.00
Queensland University of Technology								
DP210100331 Du, Prof Dr Aijun	Two dimensional (2D) ferromagnets have great promise for next generation electronics, but suffer from small magnetic anistropy and low Curie temperature for application at the ambient condition. This project aims not only to tackle this challenge by discovering and designing 2D ferromagnet with large anistropy and Curie temperature, but also to engineer 2D ferromagnet with highly mobile electron or extra ferroelectricity for novel nanoelectronic device. The technological outcomes will impact on the Australian economy through the potential for new knowledge-based electronics industry. Strong collaboration with leading expert will enable this Australian theoretical team to continue to establish itself as a leader in the field of 2D materials.	60,000.00	117,500.00	115,000.00	57,500.00	0.00	0.00	350,000.00

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement This project will utilize the power of high-performance computing to accelerate the discovery of highly stable two-dimensional (2D) magnetic materials. Smaller and smarter 2D magnets underpin emergent technology in low power nanoelectronics and would have direct economic impact on revolutionising multibillion-dollar electronic industry. New materials discovered will provide strong intellectual property positioning for potential commercialisation. New knowledges and breakthroughs achieved in this project can expand Australia's international competitiveness in the interdisciplinary fields of chemistry, physics, engineering, and technology. Additionally, the proposal fits in Australian Scientific and Research Priorities on advanced manufacturing associated with high performance materials and will also provide essential training environment for Australian researchers to foster future leadership and promote a long-term creative research culture in Australia.							
DP210100472 Ostrikov, Prof Kostya (Ken)	This project aims to discover how to catalyse the formation and control the structure of functional materials with atomic precision using plasmas. New mechanisms of ultra-fast, plasma-catalytic on-surface nanoasembly will translate into energy-efficient, scalable digital fabrication of subnano-cluster and single-atomic-site catalysts over large 3D surface areas, tailored for advanced electrocatalysis. The outcomes including new concepts and insights into synergistic action of plasmas and solid surfaces will bridge atomic-scale materials formation and digital fabrication at industrial scales. The benefits including the new nanofabrication platform and clean energy will go beyond the demands of digital manufacturing and hydrogen economy.	55,000.00	110,000.00	110,000.00	55,000.00	0.00	0.00	330,000.00
	National Interest Test Statement The outcomes may lead to versatile plasma-based nanotechnologies with new insights and methods for the scalable production of subnanometer-cluster and single-atom electrocatalysts of different composition tailored to specific applications, thus addressing at least two areas of Australia's priority national interests. The development of plasma-surface-catalytic processes will lead to new digital manufacturing technologies spanning from multipurpose surface coatings to custom-designed advanced energy materials with atomic precision. This could raise the value of Australia's natural resources by shifting the focus from crude ore exports to digital design and manufacture of products for high-value market segments. The focus on digital fabrication of next-generation catalysts using our proprietary plasma-enabled transformative platform technology would help place Australia as a world leader in the hydrogen export economy. Further benefits include zero-carbon-emissions, environment-friendly nanofabrication and training of highly-skilled workforce for the clean energy, digital manufacturing and sustainability age.							
DP210100546 Carrington, Prof Kerry L	Violence against women is twice the global average in Pacific Island Communities, yet most approaches about how to police it have come from the Global North. This project addresses this mismatch by discovering new ways to improve the policing of gender violence by testing unique models of women led policing. Expected outcomes include new evidence to improve the policing of gender violence, enhance victim's experiences, and to reform laws. Expected benefits include better outcomes for victims, improved policing practices and reductions in gender violence. The project will foster increased engagement, knowledge transfer and partnership between Australia and Pacific Island Communities in line with Australian Government strategic priorities.	19,903.00	53,537.50	57,071.00	41,494.50	18,058.00	0.00	190,064.00
	National Interest Test Statement The project expands Australia’s knowledge base and research capability to reduce harm and bring about positive change for the wellbeing of our regional neighbours in the Pacific, and Pacific Islander people who live in Australia.The Pacific Step-Up is one of Australia’s highest foreign policy priorities (Foreign Policy White Paper 2017). The Australian government has committed AU$320 million to improve the political, economic and social opportunities of Pacific women. The project will build and strengthen Australia’s capacity to direct aid investment and shape policies in context sensitive ways that enhance the security and prosperity of the region. The project will also foster increased engagement, knowledge transfer and partnership between Australia and PICs in line with these Australian Government strategic priorities of empowering women and girls in PICs (DFAT accessed 8 January 2020) and improving support for victims of gender violence while enhancing regional security and improving PICs as safe places for tourism, international travel and business (Pacific Women Support Unit, 2019).							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210100589 Miller, Prof Evonne A	The Royal Commission into Aged Care Quality and Safety is a singular opportunity to reform Australian aged care and redress the marginalisation of aged care residents—a vulnerable demographic whose voices too often go unheard. Using innovative arts-based forms of storytelling, this project explores how non-traditional approaches can provide older Australians with more visibility in aged care policy debates. Combining media analysis with poetic inquiry, participatory photography, citizen storytelling, and interactive art, this project amplifies the voices of residents and engages policy makers, providers, and the public in a reflexive, inclusive conversation about the past, present and future of aged care.	27,266.00	91,258.50	128,070.00	64,077.50	0.00	0.00	310,672.00
	National Interest Test Statement This boundary-pushing project generates new knowledge of international importance. It uses creative arts-based methods as an innovative, evocative and provocative way to reach and engage people in a critical conversation on aged care, helping ensure the findings of the Royal Commission are heard, remembered, and acted upon. This project produces substantial social, societal, and policy benefits for the Australian and international community: it determines what aged care narratives dominate traditional and social media; it explores how arts-based approaches might make older Australians more visible in policy debates about aged care, resonating with, engaging and educating stakeholders about critical issues in aged care; and it develops educational resources to facilitate professional development of the aged care workforce. This project will deliver a major public benefit, ensuring that the stories aged care residents and their advocates have so bravely shared in front of the Commission are heard during the critical policy-formation period following the RC's November 2020 final report.							
DP210100721 Du, Prof Dr Aijun	This project will develop innovative catalysts for the reduction of CO2 into carbon fuels via cost effective computational design. The approach aims at engineering catalytic surface and interface to modulate the coordination environment around catalytic active copper atom. The expected outcomes will be high performance catalyst materials that can significantly boost the conversion of CO2 into valuable fuels. The new knowledge achieved in this project will dramatically advance the development of sustainable carbon cycle, providing solutions to the global energy supply and environmental issues. The smarter energy and environmental technologies will potentially result in the enhancements to the quality of the everyday lives of Australian.	75,000.00	151,500.00	153,500.00	77,000.00	0.00	0.00	457,000.00
	National Interest Test Statement The success of this project will lead to innovative design of highly active and selective copper-based bimetallic alloy and hetero-interface catalysts for boosting the conversion of greenhouse gas CO2 into valuable carbon fuels. This cutting edge research will address three national research priorities on advanced manufacturing, energy and responding to environmental change. The expected outcome will be high performance catalytic materials for catalysing CO2 reduction. The smarter CO2 reduction technology will have significant economic and environmental impact on new knowledge-based environment and energy industries through the significant reduction of carbon emission and the production of valuable renewable energy source which can underpin the development of future green energy supply in Australia, potentially leading to the enhancements to the quality of the everyday lives of Australian. Additionally, the extensive training of PhD student and early career researchers is critical for Australian research and development in emergent energy and environmental technologies to be internationally competitive.							
DP210100849 Lotz, Prof Amanda D	Existing practices designed to enable Australian television to achieve national cultural and economic objectives have been deeply transformed by the impact of technological change and foreign ownership. This project investigates the intertwined implications of non-Australian ownership, technological adjustments, policy changes, and support adjustments enacted since the mid-00s that have challenged the making of 'Australian' television. The investigation will develop data and analysis relevant to policy debates, terms of trade, and collective agreements useful to national policymakers, producers, content providers, industry bodies, media and communication researchers, and audiences.	59,493.00	123,282.00	133,413.50	69,624.50	0.00	0.00	385,813.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement There is no longer any ambiguity around the national and international significance of media and its social, cultural, and political effects. Beyond our ability to 'tell Australian Stories', Australian drama is part of our soft power infrastructure. It provides means of identification, unification, national cohesion, and social inclusion. If left untended, it can achieve the opposite. The stories we tell about ourselves to ourselves and the world achieve economic goals by 'selling' ideas, values, attitudes, orientations, and products that are uniquely Australian. They add to our nation's value as an international destination and influence the perception of Australia on the international stage. This last is of critical importance in a world in which geopolitical dynamics are as unpredictable as at any time in history. This research will identify the most effective means of safeguarding Australian drama, including children's drama, in disrupted, digitised and increasingly globalised media markets.							
DP210101317 Fairfull-Smith, A/Prof Kathryn E	This project aims to develop new antimicrobials to address the rise of drug-resistant infections and resilient bacterial communities called biofilms. We aim to break new ground in our fundamental knowledge of antimicrobial mechanisms and exploit this understanding by fusing cellular/molecular microbiology and synthetic chemistry approaches. We seek to gain an in-depth understanding of how nitroxides induce bacterial biofilm dispersal, which is critical for the discovery of anti-biofilm molecules that do not fail due to resistance development. These breakthroughs should induce a step-change in our ability to reduce the occurrence of biofilm-related infection in fields ranging from medical and veterinary to biotechnology and agriculture.	41,000.00	113,500.00	147,500.00	115,500.00	40,500.00	0.00	458,000.00
	National Interest Test Statement The development of antimicrobials to address the vexed problem of drug-resistant infections driven by biofilm formation is a critical element in Australia's overall actions to combat antibiotic resistance, which has reached dangerously high levels worldwide. The OECD estimates that an average of 290 people die each year in Australia due to infections from resistant bacteria. By 2050, it is estimated that over 10,000 people will die due to antimicrobial resistance. Hospitals spend, on average, an additional AUD$14,000 to $56,000 to treat a patient infected by resistant bacteria.Social costs may be as high as healthcare costs, due to a loss of productivity and income. Thus, our in-depth approach taken herein to understand how to eradicate biofilms should lead to significant economic benefits for Australia by enabling effective treatment of antibiotic resistant infections. In addition, the fundamental knowledge and molecular design strategies pioneered herein will place Australia in a leading position to combat antibiotic resistant infections in medical, veterinary, biotechnological and agricultural fields.							
DP210102580 Wang, Prof Hongxia	Monolithic perovskite photocapacitor (MPPC) consisted of integrated energy harvesting perovskite solar cell and energy storage supercapacitor through an internally shared electrode can deliver stable electricity by harnessing solar energy. The performance of MPPC is dependent of properties of the shared electrode materials. This project aims to synthesis carbon materials with tailored surface, electrical and structure properties that are required to make a highly functioning shared electrode in MPPC. The goal is to fabricate stable, high performance MPPC. Successful achievement of the outcomes will enable cost-effective, reliable, solar electricity, placing Australia at the forefront of exploiting photovoltaics technologies.	62,500.00	122,500.00	122,500.00	62,500.00	0.00	0.00	370,000.00
	National Interest Test Statement One of the grand challenges in 21st century is how to make solar electricity more efficient, affordable and reliable to address the global issue of climate change and the increasing demand for energy in the society. Monolithic perovskite photocapacitor (MPPC) is a new technology that integrates cost-effective solar energy harvesting perovskite solar cells (PSCs) and energy storage supercapacitors (SC) through an internally shared electrode. The new technology can effectively address intermittent solar electricity generated by the PSCs and can deliver high areal energy density and power density. The main outcomes of high performance MPPCs enabled by highly functioning shared carbon electrode materials will place Australia at the forefront of exploitation of photovoltaics technologies for deployment of stable, cost-effective solar electricity. The outcomes of this research project align with the national Science and Technology Priority area of "Energy" through addressing Practical Research Challenge of "New clean sources and storage technologies that are efficient, cost-effective and reliable".							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103006 Sonar, A/Prof Prashant	The project aims to address the challenges of fabricating stretchable organic transistors for applications in wearable electronics and robotics through the development of new semiconducting polymers with stretchability and integrating them into novel, stretchable organic transistor configurations. The project will take a molecular engineering approach to the complex needs of this challenge by combining appropriate chemical functionality which provides high charge carrier mobility with judiciously placed flexible spacers and side chains to provide mechanical dexterity. These novel polymers will be integrated into transistor structures and their fabricated arrays deposited on stretchable substrates will be used for a real world applications.	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00
	National Interest Test Statement The global stretchable electronics market is expected to approximately reach USD 765 million by 2023, indicating rapid growth in smart wearable products and technologies. These technologies will drive innovation in smart medical technology, robotics, Internet of Things (IoT), automotive, smart manufacturing & consumer electronics. Australia is a global player in health and medical technologies, this projection only assists to boost the nation's strong continued assurance to advance smart electronics. This project aims to produce an innovative new class of stretchable transistors through the development of mechanically deformable new low cost printable conjugated semiconductors. Constructing a new class of stretchable transistors is critical in the existing electronics race & it holds a great potential in wearable technologies including health monitoring, sensors, human-machine interface, circuits, memories and robotics. Besides producing new intellectual property (IP), stretchable transistor technology will provide commercialisation opportunities to our local wearable technology manufacturers in Australia.							
DP210103284 Johnson, Dr Graham R	This project will improve our understanding of the role played by airborne particles in global climate, pollution and the transmission of influenza, corona virus and the common cold. It will do so by revealing the wider importance of "glassy states" of matter recently revealed in atmospheric aerosols. Glassy states are highly unpredictable quasi solids that abruptly form, interrupting the transition of a liquid to a solid. This interruption invalidates equilibrium assumptions of models of droplets as cloud nuclei and infection vectors. We will develop and validate a numerical tool for predicting glassy state formation and its impact in broad classes of aerosol that include particles critical to cloud formation and infection transmission.	56,500.00	115,500.00	119,000.00	60,000.00	0.00	0.00	351,000.00
	National Interest Test Statement Global climate change is widely acknowledged to be an imminent existential threat to our civilisation and the role of aerosols is the greatest source of uncertainty in modelling that threat. Viral respiratory infections cost communities tens of billions of dollars annually and global pandemic is an acknowledged existential threat with a demonstrated capacity to disrupt global trade. We have very little understanding of the factors controlling airborne transmission and in particular the impact of air temperature and humidity on rates of airborne infection spread. This project aims to improve the accuracy of both global climate modelling and our ability to predict and control airborne infection spread. The training of PhD students within this project prepares future scientists who will understand the physics of aerosol behaviour and its influence on climate and the propagation of disease.							
DP210103357 Zhu, Prof Dr Huai-Yong	This project aims to apply visible light photocatalysis to a wide range of chemical reactions by utilizing the intriguing effects of intense light absorption by plasmonic metal nanoparticles, such as generating energetic electrons, changing reactant adsorption and the chemical binding of reactant with the catalyst. These effects will promote catalysis at surface-bound metal complex reaction sites under mild reaction conditions. This is a part of our long-term effort to transform chemical production by heating into green photocatalytic process. This project expects to generate knowledge crucial for developing theories for catalysis, the design of efficient catalysts, green chemical synthesis methods, and enhance international collaboration.	57,500.00	105,500.00	84,500.00	36,500.00	0.00	0.00	284,000.00
	National Interest Test Statement The proposed research represents a versatile and advanced materials platform to convert homogeneous transition metal complex catalysts into efficient, heterogeneous photocatalysts. Beneficial outcomes are the generation of new knowledge and capabilities in synthetic catalysis and the conversion of solar energy to chemical energy. Significant impacts of this efficient photocatalyst concept on fine chemicals synthesis are the reduction of chemical waste and of energy consumption, made possible by these systems' capability for selection of specific reaction pathways and their efficient operation at mild reaction conditions that can be harnessed to generate new, value-added, chemical products by a green process. This work has far reaching significance in terms of both fundamental research and its applied, practical application.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103889 Turkay, Dr Selen	This project aims to help scientists communicate and collaborate in immersive environments. Fieldwork is more valuable to scientists than looking at abstract remote data, but expense, danger, or inaccessible locations often stand in the way. This project will address this issue by researching and designing immersive environments that combine remote data with visualisations and new interaction tools for science teams to make sense of spatial and temporal aspects of data. Outcomes will include new presentation and interaction methods, an evaluation with geoscientists, and a framework for designing interactive systems that enable situated interactions. Benefits will include helping Australian scientists overcome distance in their research.	93,000.00	168,500.00	157,500.00	82,000.00	0.00	0.00	501,000.00
	National Interest Test Statement This project will strengthen Australia's global standing working with remote sensing data and help overcome barriers that distance creates for Australian scientists and educators. In the context of distributed geoscience teams of multinational experts, it will develop new interaction tools and approaches that will improve scientific inquiry and explorations. Initial focus will be on determining how scientists conduct collaborative fieldwork, allowing them to perform in-situ collaborations remotely in an immersive environment using VR/AR technology. This will make geological research better, cheaper and more accessible for Australian stakeholders in business (eg mining, space exploration). In education, such “virtual field trips” will engage students in 21st century learning experiences that were previously inaccessible, preparing them for future scientific collaborations. Building on growing expertise and capacity in immersive technologies at a national and international level, this project will enhance Australia’s ability to become a global leader in developing immersive scientific technologies.							
DP210104020 Alexandrov, Prof Kirill	The genetic code programs biosynthesis of polypeptides with efficiency vastly superior to chemical engineering. As the chemical diversity of natural amino acids in proteins is limited, finding ways to include “unnatural” amino acids can supercharge biology with a range of new protein activities. While the genetic code can be expanded to make space for unnatural amino acids, the rarity of free codons and reliance on prokaryotic organisms limit the applicability of this approach. We will develop a new higher-organism cell-free protein production system that can incorporate multiple unnatural amino acids into defined points of proteins. This, enabling and broadly applicable technology, will be tested by constructing opioid biosensors.	95,000.00	190,000.00	190,000.00	95,000.00	0.00	0.00	570,000.00
	National Interest Test Statement The project explores new biochemical methods that allow combining of natural and synthetic chemistries in one protein. These have the potential to put Australia in the forefront of a broad range of areas of national interest such as development of novel industrial catalysts, bio-pesticides, pharmaceuticals and diagnostic agents. This will accelerate Australian economic growth while reducing its environmental and social cost. The power of the proposed technology will be tested by developing a new method for detection of synthetic opioids. Statistics for Australia show a constant increase in opioid-related poisonings, overdoses and deaths. At present there is no generic method for detecting these substances and the constant stream of new synthetic opioids overwhelms the ability of law enforcement and medical systems to adequately respond to their use. The proposed technology will create much needed analytical methods for detection of the constant stream of new synthetic opioids providing much needed tool for medical and law enforcement systems.							
	Queensland University of Technology	762,162.00	1,582,578.00	1,638,054.50	876,196.50	58,558.00	0.00	4,917,549.00
The University of Queensland								
DP210100137 Popkowski Leszczyc, Prof Peter T	Increased competition from over 57,000 registered charities and a recent 6% decrease in individual donations, have increased the need for charities to improve their fundraising strategies. This project aims to develop a comprehensive framework – based on theories from marketing, psychology, economics, sociology, and philanthropy— and develop novel methodologies to determine effective charitable fundraising strategies in a competitive marketplace. Key outcomes will include the theoretical model, and tests using conjoint choice-experiments, controlled field experiments and 10 years of giving data from 4 million Australian donors. These outcomes will enhance fundraising practice, ensuring charities can better serve the Australian public.	34,500.00	58,000.00	46,000.00	22,500.00	0.00	0.00	161,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Australian charities and not-for-profits fulfil essential missions in society, including caring for people in need, educating children, protecting animals and the environment, researching causes and cures of diseases, and disaster relief e.g. due to forest fires. These organisations rely on financial donations to support their essential work. The aim of this research is propose a theoretical framework and develop novel methodology that will help charities in developing better fundraising strategies to ensure that they can deliver their essential community services. With over 57,000 Australian charities competing for decreasing individual donations (ACNC, 2019), it is more than ever essential for charities to improve their fundraising strategies. Yet little is known about how donors choose which causes to support. The proposed research aims to study successful fundraising strategies in a competitive environment. Furthermore, novel research methods will be developed that will have important applications for big data, combining choice data with survey responses and text-based data.							
DP210100149 Stark, Dr Alastair	This project will analyse how changes in institutional memory inside government impact on the effectiveness of public policy processes. Institutional memory changes as ministers, public servants and public agencies come and go, but we don't know what effect these changes have over the quality of public policy. This project will therefore analyse how changes to institutional memory have influenced public services and policies in Australia and the UK. Expected outcomes include best practice recommendations for government - about how to address memory loss to improve public policy - and novel academic findings about how institutional memory influences the character of public service delivery, lesson-learning and long-term reform.	56,500.00	106,500.00	75,000.00	25,000.00	0.00	0.00	263,000.00
	National Interest Test Statement							
	Good government requires good memory. The national interest is served by ensuring that Australia's Public Service has a strong institutional memory that can be put to good use when ministers are deciding upon public policies and officials are implementing them. Institutional memory can help prevent failures from the past being repeated in the present, enhance the departmental advice given to ministers, help produce more consistent public service delivery, and ensure that long-term reforms stay on track. This research, quite simply, supports the national interest by supporting these outcomes. By exploring how institutional memory changes inside the public agencies of Australia and what effects this has over policy, and by benchmarking Australia against the UK in this regard, this research will be able to enhance the quality of public policy processes and outcomes in this country. This is our principal objective.							
DP210100341 Matook, A/Prof Sabine E	This project aims to gain a better understanding of discontinued use of social media. For businesses and governments, social media serves as a dynamic channel for engagement, value co-creation, and business analytics marketing that is lost when users choose to discontinue its use. This project will generate new knowledge of rational and emotional decision criteria, enabling design features of social media, and their complex effects on discontinued use of social media. The expected outcome of this project is an integrated theory of social media discontinuance. The project findings provide significant benefits, such as strategic capabilities and actionable knowledge for businesses and governments to mitigate social media discontinued use.	64,000.00	128,500.00	124,000.00	59,500.00	0.00	0.00	376,000.00
	National Interest Test Statement							
	Social media is a dynamic channel for governments and businesses to interact with the public, enabling communication, engagement, value co-creation, and business analytics marketing. When people leave social media, market understanding and innovation potential is lost. This project examines why people leave social media to understand their rational and emotional reasons for social media discontinuance. The outcome of the research will enable platforms, governments, and businesses to better design and use different features of the technologies to improve the complex interplay required to keep people engaged with social media. The project will result in commercial benefits by identifying digital capabilities for technology innovation. It will have economic benefits in the adaption of knowledge for companies to secure and grow their customer base. The project will also have positive social impacts; for example, Australian governments will be able to deploy this knowledge to support public connectedness with policy dissemination and crisis management.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210100614 Richardson, Dr Sandra R	Early in pregnancy, a handful of cells in the embryo become primordial germ cells (PGCs). These PGCs will eventually give rise to sperm or egg cells, representing a critical inter-generational genetic link. Mobile DNA sequences target PGCs to create new heritable genetic changes. This proposal aims to analyse the activity, regulation, and consequences of mobile DNA activity in PGCs. This project expects to generate significant knowledge about the origins of mammalian genetic diversity. Expected outcomes include enhanced national and international collaborations across disciplines and new experimental systems. The expected benefit is an enhanced understanding of the mutational processes underlying genetic diversity and disease in mammals.	90,818.00	158,286.00	142,436.00	74,968.00	0.00	0.00	466,508.00
	National Interest Test Statement The research outlined in this proposal will increase our understanding of the processes underpinning genetic diversity and harmful mutations in mammals. The program will raise Australia's reputation as a world leader in the germ cell biology, genomics, and mobile DNA fields. It will illuminate the spectrum of mutagenic threats during animal and human embryonic development, so that policy and practice around fertility interventions and care during pregnancy can be better informed. This initiative will bring to Australia innovative methodologies for creating “germ cells in a dish”. Building Australia’s research capacity in this area could allow eventual adaptation of this technology to multiple species beyond traditional model organisms. For example, the ability to create germ cells of Australian endangered species could revolutionise conservation efforts, helping to protect Australia’s unique natural heritage. Further economic benefits could arise through commercialisation of know-how and methodologies to Australian livestock breeding efforts to preserve and propagate commercially important bloodlines.							
DP210100703 Degnan, Prof Bernard M	This project seeks to understand how the environment influences the fate of cells over an animal's life, and how this influence originated in animal evolution. 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 global cell state changes that are induced through the interplay of environmental and endogenous signals at metamorphosis. Because of the evolutionary position of sponges, outcomes of this project expect to reveal the cardinal rules governing environmentally-induced cell state changes that are obligatory for most animals to complete their complex life cycles.	128,132.50	256,265.00	239,688.00	111,555.50	0.00	0.00	735,641.00
	National Interest Test Statement This project focuses on uncovering fundamental truths about the biology of cells, the building blocks of life that underlie the development and health of humans and all other animals, plants and microbes. Using a home-grown Australian model from the Great Barrier Reef - a sea sponge - this project will get to the heart of how healthy and stable animal cells can suddenly change (at metamorphosis) upon receiving an influential signal from the outside environment. Some of these signals are essential for animal survival (e.g. plant signals that induce beneficial insect metamorphosis), while others can lead cells down undesirable pathways (e.g. toxic environmental substances). By understanding how cells respond to different environmental situations, new technologies can be developed to promote healthy environments and humans. Ultimately this knowledge and understanding can translate into emerging regenerative technologies for mitigating threats to our natural environments, and thus create advanced manufacturing jobs for Australia.							
DP210100804 Pandolfi, Prof John M	Marine ecological communities are exhibiting rapid change in response to human actions. This project aims to apply a newly developed statistical framework, and expects to uncover historical patterns in the emergence and persistence of new community states of two sets of marine taxa: reef-building coral, and marine plankton. Understanding how often marine communities shifted into these novel states in the absence of human activities, as well as the relative contribution of environmental and biological factors, will provide significant foundational knowledge. In addition, this project aims to provide flow-on benefits to environmental management to ensure ecosystems continue to provide beneficial services, which include fisheries and tourism.	87,677.00	177,046.50	180,856.50	91,487.00	0.00	0.00	537,067.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Marine ecosystems provide valuable benefits to support human societies. Corals forming Australian reefs mitigate storm damage, support fisheries and are a key tourist attraction. Plankton communities are the foundation of open ocean food webs and sequester vast amounts of atmospheric carbon. Unprecedented changes to the composition of these communities has the potential to alter or reduce the value of these benefits, as well as how people enjoy the oceans. The research should provide information on the patterns, drivers and potential consequences of novel community emergence, providing clear benefits to understanding response to environmental change in the ocean. The results from the project will assist with tracking environmental impacts to Australian marine communities, as well as aiding ecosystem managers to better manage human-impacted systems and identify priority regions for assistance or conservation.							
DP210100832 Hardy, A/Prof Ian J	Globally, Australian school education is seen as under-performing. Consequently, attention to data, particularly numeric and standardised test data, in schools have become pervasive. This project aims to understand how teachers and educators in schools and school systems actually engage with a broader conception of data for enhanced learning, on a truly global scale, particularly in schools serving struggling communities. This project will reveal the myriad ways educators in diverse settings - England, Australia, Singapore and Bangladesh - engage with data. The project will re-conceptualise how data are understood globally, and will provide significant benefits including informing education policy-making and improving teaching practices.	36,146.00	101,239.50	130,247.00	65,153.50	0.00	0.00	332,786.00
	National Interest Test Statement							
	In Australia, national and international standardised measures of student performance are used to criticise lower performing schools, typically in marginalised communities. In the name of enhancing global competitiveness, school improvement is construed as premised on more and better engagement with student performance data. However, what such engagement looks like, especially for marginalised students, is an area for further inquiry. Through sharing detailed empirical stories about system and school-based use of data in different national, regional and local contexts, the research will benefit Australian educational policymakers and practitioners by informing them about the most effective ways system and school personnel work with a broad range of data in schools serving marginalised communities. At state and regional levels, the research will benefit systems by providing policymakers with information about the system levers that contribute to enhanced learning in schools. At the school level, the research will provide examples of productive ways teachers use data in classrooms to enhance student learning.							
DP210100913 Mayfield, Prof Margaret M	Though common in nature, the importance of plant-plant facilitation to coexistence and the maintenance of plant diversity at community scales is poorly understood. This project aims to advance understanding of how positive interactions (facilitation) impact on coexistence among plant species as well as local patterns of diversity. To achieve these aims the project will use a combination of field experiments and a comparative analysis of competition and facilitation in Australian, Californian and Spanish annual plant communities with a novel modelling approach for predicting coexistence across variable environments. Outcomes are expected to include an innovative predictive framework of use for plant conservation in Australia and beyond.	77,000.00	156,000.00	158,000.00	79,000.00	0.00	0.00	470,000.00
	National Interest Test Statement							
	This project aims to improve ecological models of local diversity in order to better predict the environmental conditions under which native plant communities can persist and when they are more and less susceptible to invasion by weeds. The study will focus on endangered wildflower communities in Western Australia with comparisons with similar systems in California and Spain. The models developed will be applicable to a wide range of systems across Australia and globally. The project involves using field and glasshouse studies of annual wildflower species to develop a predictive model of which plant species can live together and which cannot, using detailed information about positive, negative and indirect interactions among plant species. Project outcomes are expected to allow detection of environmental conditions and community types that are more and less vulnerable to environmental changes due to climate change and invasions by different types of exotic species. Results will allow for more accurate targeting of at-risk plant communities in Western Australia and around the world.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101280 Skwarczynski, Dr Mariusz	This project aims to develop nanoparticles built from natural hydrophobic amino acids as an immune stimulatory delivery system for peptide antigens. Currently available immune stimulants (adjuvants) are often toxic and/or are poorly chemically defined fragments of bacteria or toxins and vary from batch-to-batch. New adjuvants are in high demand; especially to facilitate the use of optimal, but weakly immunogenic, peptide antigens. It is expected that the proposed project will develop a novel efficient, safe and notably biodegradable self-adjuvanting delivery system that can be fully customised to match an antigen of choice. This foundational research should provide important advances for commercial immune stimulatory applications.	84,500.00	162,500.00	128,000.00	50,000.00	0.00	0.00	425,000.00
	National Interest Test Statement The newly developed chemical immune system stimulator (adjuvant), based on self-assembling and self-adjuvanting nanoparticles, is expected to be widely attractive to the pharmaceutical industry due to its efficacy, biocompatibility, simplicity, and cost-effective production. As such, it is expected to provide significant economic benefit, in addition to scientific repute, to Australia. The innovative new adjuvant will be utilised as a tool to investigate fundamental immunoreactions in mammalians, and has unmatched potential to underpin the development of effective veterinary and human vaccines. The novel adjuvant is expected to provide an antigen delivery system for future vaccine development that is easily modifiable to any antigen and notably safe for use in humans, with the end result of facilitating protection against debilitating and destructive infectious diseases.The created adjuvant will have positive socio/economic impact and will enable long-term outcomes of broad successful, safe vaccine development.							
DP210101434 Wilson, Prof Jill E	This project aims to develop a theoretical framework to assist health social workers to effectively assess and intervene in elder abuse. Social workers have responsibility in health settings to respond when abuse is noticed. Elder abuse damages trust, increases health costs and hastens death. Improving practice to assist older people who are abused relies on the knowledge, experiences and wishes of older people, social workers and international experts to provide an effective and efficient theoretical model to address elder abuse. A new framework will allow practitioners to assist vulnerable older people and improve the quality of their lives. Further, this information will assist the government to address elder abuse in Australia.	32,623.00	69,318.50	72,737.50	36,042.00	0.00	0.00	210,721.00
	National Interest Test Statement Elder abuse poses a significant social and economic burden on the community. Elder abuse increases the risk for hospitalisation, emergency presentations, nursing home placement, morbidity and death. In hospitals, social workers are the primary responders to concerns about elder abuse. Most social work literature focuses on caregiver education and providing referrals to services and does not take account of the context in which the abuse is identified and addressed. What goes on in a health setting has a significant impact on how this problem is identified and addressed. There is also a significant gap in understanding how to work with older people with cognitive impairment who are at risk of abuse. By engaging with older people and their experiences, social workers and published researchers, this research will provide guidelines for social workers in hospitals on how to address this problem. This can lead to significantly improved outcomes for older people, as well as improved efficiencies in the health system.							
DP210101496 Whittaker, Prof Andrew K	Low fouling polymers are important for moderating interactions of molecules and particles with cells. In pharmaceutical sciences they are essential tools for extending the pharmacokinetics of dissolved drugs. However, the widely-used low-fouling polymer, poly(ethylene glycol) (PEG) has been recently reported to induce formation of anti-PEG antibodies. Polymeric alternatives to PEG are thus desperately needed. We introduce in this project super-hydrophilic polymers incorporating sulfoxide groups, mimics of the polar solvent DMSO. The project aims to explore how polymer architecture can enhance biocompatibility and reduce biofouling. The outcome will be a new class of low-fouling polymeric materials with broad application in the biosciences.	85,000.00	166,500.00	151,000.00	69,500.00	0.00	0.00	472,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement When exposed to biological species, either cells or serum, molecules or particles are rapidly coated with a “corona” of adhered proteins. The protein shell results in the particles being recognised by the immune cells and either encapsulated, or excreted. This reduces effectiveness of drugs, and can lead to fouling of implanted devices. A class of polymer with low-fouling properties, primarily poly(ethylene glycol) (PEG), are routinely used to reduce protein adhesion and imbue the particle with stealth-like properties. However, over the past several years it has been recognised that PEG can indeed be recognised by the immune system leading to generation of anti-PEG antibodies and hence elimination by the immune cells. This project will develop a new class of polymers with substantially superior stealth properties to PEG, and with low immunogenicity. The polymer will have broad application in for example in pharmaceutics, bio-sensing device technologies and human-interface devices. The project thus has the potential to provide innovative solutions for the growing biotechnology industries in Australia.							
DP210101572 Suddendorf, Prof Thomas	Because humans can anticipate their limitations, they can act in the present to shape their future for the better. This project aims to chart four key developmental processes by which children gain this control over their future outcomes. It will use novel experimental paradigms to map children’s growing ability to compensate for their limits with strategic planning, and to improve their future capacities by acquiring new knowledge and innovating technical solutions. The cognitive underpinnings of these critical behaviours are still poorly understood. This project will therefore provide the essential empirical foundation for fostering the development of wiser, more skilled, and more innovative young people.	48,723.00	93,286.50	88,202.00	43,638.50	0.00	0.00	273,850.00
	National Interest Test Statement For children to flourish in the modern world, they must be able to think ahead. The proposed research will chart the development of foresight: a hallmark of adaptive human cognition that enables us to anticipate and plan for the future. This project will determine, for the first time, how children learn to anticipate their own future limitations and act to overcome them. Results from this project will provide the necessary foundation for understanding how children gain control over their future to become prudent and productive citizens. The resulting knowledge will benefit parents and educators via improved understanding of the emerging capabilities of children and potential strategies to support lapses in these crucial functions. This work has the potential to benefit society by fostering the development of more judicious and innovative citizens. This novel proposal emerges at an opportune time to elevate Australian research capacity in a rapidly growing area, and place Australian science at the forefront of supporting the next generation to thrive.							
DP210101698 Bhatia, Prof Suresh K	This project aims to transform the modelling of fluid transport in materials of nanoscale dimension by determining the coupled interfacial heat and mass-transfer barriers, which critically influence the transport. The outcome will not only be new knowledge on the effects of inherent structural distortion and of the barriers on the fluid flow, but also cutting-edge techniques to estimate system size-dependent transport coefficients in nanoscale systems. These will be achieved through a combination of targeted molecular dynamics simulations and experiment, and will have far-reaching implications for nanotechnology and emerging processes in catalysis, gas separation, human health and nanofluidics, and enable design of more efficient systems.	40,000.00	80,000.00	80,000.00	40,000.00	0.00	0.00	240,000.00
	National Interest Test Statement Gas separation and catalysis operations are ubiquitous in chemical, refining, and power generation industries. Nanotechnology, exploiting enhanced efficiency at small system size, is a rapidly emerging paradigm in the field, and nanoporous materials, which permit transport of molecules in their structure, are central to this craft. However, the effectiveness of nanoporous materials at nanoscales is governed by surface barriers and end effects, which are relatively insignificant at sizes prevalent in conventional processes. This project aims to address these concerns by developing a mechanistic understanding of interfacial effects through molecular scale simulation and experimentation, leading to cutting-edge techniques that enable design of more efficient processes. Enhancing process efficiency will benefit Australian chemical, refining and power industries, and establish Australia as a leader in nanotechnologies such as sensing and nanofluidics. It will also have positive impact on pollution control and manufacturing of value-added products, which is critical to Australia’s industrial and economic future.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101712 Richards, Prof Linda J	This project aims to investigate how the major connection between the two brain hemispheres (called the corpus callosum) is involved in higher cognitive functions such as decision making, learning, knowledge updating, and performance optimisation. New knowledge will be generated in the area of human cognition by combining computational theory with measures of cognition and brain MRI. Expected outcomes are to develop and advance computational models of human brain function and structure through interdisciplinary collaboration by combing theory and experimentation. Significant benefits will be to advance our understanding of the brain and enhance Australia's scientific capability through training and collaboration.	63,614.50	143,129.00	160,529.00	135,923.50	54,909.00	0.00	558,105.00
	National Interest Test Statement Humans engage in decision making in a variety of contexts from making purchases to behavioural and social choices. Theoretical modelling of decision making has found that the brain uses different strategies to make decisions and these have then been applied in the context of machine learning and artificial intelligence to build better machines. This project will discover the decision-making strategies used by people with major alterations to brain wiring (a condition called corpus callosum dysgenesis) where unknown strategies are used that can compensate for their altered wiring. These discoveries will advance Australia’s competitive position in the field of computational modelling and human behaviour. The findings could be applied to solving computationally complex tasks to advance the development of smarter machines, advancing the fields of machine learning and artificial intelligence, and bringing economic and commercial benefits to Australia.							
DP210101791 Asgari, Prof Sassan	Mosquitoes transmit a variety of viruses to humans and animals through blood feeding. This project aims to investigate one of the most common modifications of RNA molecules, known as N6-methyladenosine (m6A), in an important mosquito vector, Aedes aegypti, and its alterations upon infection with pathogenic as well as mosquito-specific viruses. In addition, m6A modification of viral genomic RNA and its importance in virus replication will be investigated. Expected outcomes of this project include fundamental understanding of RNA methylation in mosquitoes and their role in mosquito biology and virus replication.	68,468.00	138,209.50	112,999.00	43,257.50	0.00	0.00	362,934.00
	National Interest Test Statement This project aims to use genetics, bioinformatics and molecular biology analyses of the dengue mosquito, Aedes aegypti, to investigate global methylation of messenger RNAs and their modifications during virus replication in the mosquito. Significance: methylation of RNA is a conserved phenomenon in animals and plays a significant role in various biological processes, including regulation of gene expression, immunity and response to virus infection. Expected outcomes: We will determine global methylation of messenger RNAs and their changes during virus replication, including modifications to the genomes of RNA viruses, and if the methylation modifications are essential for virus replication in the mosquito. Benefits: In addition to generating new knowledge in an unexplored area of research in mosquito biology, this project will provide significant economic benefits by acquiring know-how of a novel approach in gene editing of insects through an international collaboration and training early career researchers.							
DP210101802 Schenk, Prof Gerhard	The sustainable production of high value chemicals (e.g. fuels, foods) from renewable materials is a cornerstone for the emerging global bioeconomy. We aim to harness the potential of protein engineering to develop a technology (EnzOnomy) to convert renewable raw material (e.g. sugar) into platform chemicals (e.g. isobutanol, a building block for jet fuels, fibers, plastics and antioxidants). Our multi-disciplinary and well established international team will link scientific progress to markets to enhance potential commercial impact in the bioeconomy. The project thus provides great benefit for our nation as it embeds Australia in technologies and global networks that will cement its leading position to safe-guard the future of our planet.	115,000.00	230,000.00	230,000.00	115,000.00	0.00	0.00	690,000.00
	National Interest Test Statement The development of sustainable production processes from renewable materials for essential commodities such as foods, energy and pharmaceuticals, and important materials such as plastics and fibres, is a major challenge for the global community to move to a healthier future trajectory. Australia can and should play a leading role in this emerging bioeconomy with its vast natural resources and highly developed technology sector. In this project, scientists, chemical engineers and economists from UQ and two European Universities (from Germany and Ireland) join forces to establish an innovative efficient production technology (EnzOnomy) to convert renewable materials (e.g. sugars, fats) into platform chemicals that underpin the synthesis of a wide range of high value products usable across multiple industrial sectors. Cutting edge engineering of biological catalysts (enzymes), informed by natural evolution, will be used to build this innovative cell-free technology. The ability to scale up the process to industrial dimensions enhances its impact on the Australian (bio)economy.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101934 Parker, Dr Stacey P	The aim of this project is to develop and test a computational model of work-related effort and recovery that explains how people recover from work demands moment-to-moment and day-to-day. Recovery is essential for well-being. Paradoxically, however, those who need to recover find it hard to put effort into recovery. The model will be tested in a series of naturalistic observational studies and controlled experiments. In each study, subjective and physiological experiences of well-being and recovery are measured as people regulate effort during work and recovery. The result will be a unifying and general model of work recovery, that can inform when and how to intervene to improve employee well-being.	66,645.00	108,388.00	80,538.50	38,795.50	0.00	0.00	294,367.00
	National Interest Test Statement The major intended benefit of this project is the development and validation of a computational model of recovery from work-related effort. Increasing work demands is a major problem for society. A computational model of work recovery will help us understand how people can regulate their energy during the work day as well as make the most of work breaks and off-the-job time to facilitate better quality recovery from day-to-day work demands. The model can be used to inform human resources, leadership, and management practices, as well as public policy on occupational health. If successful, this may have a range of benefits, including improvements to employee well-being, work engagement, and productivity. Lost productivity from work demands is estimated to cost Australia billions of dollars each year, equating to 2.7% of GDP (Medibank, 2011). New knowledge on how to improve recovery from work demands has the potential to benefit the Australian economy. Other benefits of the research include research training, capacity building, and international collaboration.							
DP210101977 Dux, Prof Paul E	This project aims to determine the cognitive and neurophysiological factors that predict an individual's response to non-invasive brain stimulation used to target learning and executive function processes. Stimulation methods show immense promise for elucidating the causal neural substrates of cognition, and for enhancing performance in a range of applied settings. However, there are large individual differences in response to such interventions. Using advanced imaging techniques, the project aims to provide comprehensive insights into the determinants of these individual differences. Outcomes and benefits include identifying brain characteristics that determine stimulation efficacy and informing the design of protocols for applied use.	87,621.50	193,123.00	191,565.50	86,064.00	0.00	0.00	558,374.00
	National Interest Test Statement Brain stimulation is used in a range of applied settings; for example, to enhance cognitive performance during learning and in the workplace. However, there are substantial differences in the efficacy of brain stimulation across individuals. These differences are not well understood and thus limit the utility of this promising technique. The project will identify neurophysiological and cognitive factors that predict individuals' responses to brain stimulation. This basic research will contribute to our understanding of the mechanisms of brain stimulation, focusing on core psychological functions including learning and executive control. The findings will support the development of targeted stimulation protocols. This will have application in industry environments to enhance concentration, focus and capacity to improve personnel productivity and efficiency which will result in increased economic return. The findings can also be integrated into educational programs to improve learning outcomes for Australia to create social benefit and invest in Australia's future smarter workforce.							
DP210102061 Huang, Prof Han	This project aims to address a timely bottleneck issue in the conventional lapping of difficult-to-machine optoelectronic brittle materials. An innovative chemically enhanced lapping technology for fabricating such materials is expected to reduce machined subsurface damage. This is significant because it would shorten the subsequent finishing process and minimise the manufacturing cost. Intended outcomes from this project also include an advanced machining theory and innovations in material removal characterisation. This breakthrough technology should benefit the design and fabrication of high performance electronic devices for energy, medicine and communication sectors with considerable impact on the Australian economy.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement The use of single crystals such as silicon carbide and gallium nitride in electronic devices can significantly improve the device performance and energy efficiency. However, such needs pose great challenges for the manufacturing sector as those materials are hard and brittle, thus difficult to machine. The development of a cost-effective lapping technology in this project will solve a longstanding issue, i.e. to simultaneously improve quality and efficiency in the machining of hard and brittle materials. Their low-cost production will promote the development of next generation light-emitting diodes, solar panels and high power devices and reduce energy losses of the resulting electrical systems, which is a key approach for solving the global, as well as Australia's, climate and energy crisis. This enhances the competitiveness of Australia's advanced manufacturing sectors by helping them integrate high value-add and transformative products into global supply chains. The outcome also includes the generation of a new machining concept, which can consolidate Australia's leading role in manufacturing science.							
DP210102150 Bernhardt, Prof Paul V	The stabilisation of highly reactive carbanions underpins advances in chemical synthesis of new compounds including polymers, agrichemicals and pharmaceuticals. This project aims to deliver an innovative chemical reactivity platform, underpinned by copper carbanion complexes accessed via synthetic electrochemistry. Carbanions are essential components of carbon-carbon bond forming reactions but their high reactivity can be problematic. Expected outcomes of this project are an understanding of why these novel copper compounds are stable and how they can be utilised as synthetic reagents. This should provide significant benefits in unlocking the synthetic potential of a new class of chemical compound that has until now remained unexplored.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement The pursuit of chemical technologies for the efficient preparation of pharmaceuticals, polymers and agrichemicals is demand-driven by society. Academia and industry rely on a toolbox of synthetic methods to produce new chemical compounds that feed commodity supply chains and Australia's economy. Carbanions play a fundamentally important role as building blocks in chemical synthesis as they lead to new carbon-carbon bonds, but they are highly reactive, difficult to stabilise and decompose in the presence of water which limits their application. Landmark preliminary research by the applicants has revealed an unprecedented way to overcome this stability problem using divalent copper as a partner. The proposed research pioneers a new frontier in copper catalysed synthesis, which offers not only novel routes to materials and bioactive molecules, but focuses on lowering energy consumption and limiting environmental impact, by circumventing traditional methods using existing reagents.							
DP210102192 Gentle, Prof Ian R	Organic light-emitting diodes (OLEDs) represent the next generation technology for displays and lighting. Despite their rapid uptake, one of the factors limiting their application in lighting is the efficiency roll-off at high brightness. This project aims to work towards solutions for this problem using an innovative combination of simulation studies and experimental work. Expected outcomes include improved theoretical and experimental approaches leading to new design rules for OLEDs. This should provide significant benefits such as a pathway for development of improved efficient, high brightness OLEDs for applications in low energy consumption lighting and long-lasting, bright displays.	75,000.00	145,000.00	130,000.00	85,000.00	25,000.00	0.00	460,000.00
	National Interest Test Statement This project is concerned with developing technology that has direct relevance to advanced manufacturing of devices that are already in commercial production (OLED displays and lighting) as well as technology that is highly promising and in the advanced stages of development (organic photovoltaics). As a result, it will lead to benefits that include, but extend beyond, new knowledge and understanding, to potential economic and commercial benefits for Australia. These benefits directly contribute to two of the Federal Government's National Science and Research Priorities, namely Advanced Manufacturing and Energy. There is great potential for the development of capabilities in high value-add areas of the market, where the results of this project can facilitate the development of Australian manufacture of premium display and lighting components. The wider uptake of efficient displays and lighting will lead to significant environmental benefits, lowering our dependence on fossil fuels. This work also has the potential for application in organic solar cells, contributing to the Energy research priority.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102224 Williams, Prof David J	Brittle rocks and concrete under extreme stresses fracture spontaneously and without pre-warning. In deep mining and tunnelling this causes fatalities, injuries and serious damage. Based on recent advances by the CIs in understanding the effect of biaxial loading and the free surface on catastrophic fracture propagation, the project aims to develop a new paradigm of monitoring, prediction and prevention of dangerous skin rock burst-type failures. A unique experimental methodology, measurements and analytical and numerical models will be employed to provide a better understanding of the fundamental processes in rock fracturing. This will lead to safer and more cost-effective deep rock engineering designs.	50,000.00	95,000.00	90,000.00	45,000.00	0.00	0.00	280,000.00
	National Interest Test Statement Australian society will not accept unsafe and dangerous engineering design and practice. Since all materials fail under excessive load, due to a limit to material strength, representative material samples are tested in a laboratory to measure their strengths under various design loading conditions. However, catastrophic failures of earthen and built structures and machineries occur due to the unreliable, inconsistent, overestimated, inaccurate and wrong measurements of the real material strength. This research aims to address one of the long-lasting and fundamental strength measurement issues related to failure in brittle solids used in Civil, Mining, Mineral Processing, Petroleum, Materials and Mechanical Engineering, such as glass, hard rock, concrete, ceramics, natural and artificial bones, and diamond composites. The outcomes will provide guidelines for the safer and optimal design of structures, automated machineries, excavations, foundations, rock breakage, testing and drilling equipment, cutting, tunnelling and mining industries, which are of critical importance to the growing Australian economy.							
DP210102277 Yu, Prof Chengzhong	High-performance adjuvants are essential components of vaccine technology. Aluminium-based adjuvants are widely used, but provide weak cellular immunity and possible risk of neurotoxicity. Combining state-of-the-art nanotechnology and classic coordination chemistry, this project aims to apply a new design principle to create novel mesoporous aluminosilicate nanoparticles with alkalinity, for use as nanoadjuvants. This project expects to advance knowledge of how immune systems respond to changes in chemistry and nanostructure of aluminosilicate materials and enable the design of nanoadjuvants with enhanced cellular immunity and reduced toxicity. Outcomes include a new family of functional materials with unprecedented adjuvant performance.	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00
	National Interest Test Statement This project will develop innovative materials for antigen delivery to overcome the limitations of conventional aluminium-based adjuvants. By advancing understanding of the interactions between nanoparticles and biosystems, a new generation of adjuvants will be developed with improved performance and safety. These adjuvants have the potential to enable the development of more efficient animal vaccines for improved productivity, animal healthcare and food safety. The new knowledge gained in this project will place Australian scientists at the forefront of an exciting interdisciplinary area. It will also train and mentor future research leaders to use the power of nanotechnology and multidisciplinary skillsets to solve problems in the biotech industry. On completion, the project is likely to generate IP and attract commercial interest, supporting and enhancing Australia's leading role in bionanotechnology. Innovation in advanced materials as adjuvants and their manufacturing will ultimately provide social and economic benefits to Australia by enhancing profitability in a number of livestock industries.							
DP210102292 Hornsey, Prof Matthew J	This project aims to provide new understandings of the psychology of believing conspiracy theories, a problem that promotes prejudice, undermines trust, and costs lives. This project will involve the first large-scale, multi-national survey of willingness to believe conspiracies, allowing us to identify how national and cultural factors influence conspiracist thinking around the world. It will also use innovative experimental techniques to test how group-based loyalties shape people's conspiracist thinking and their online behaviours. Doing so paves the way for us to test novel strategies for reducing the impact of conspiracy theories, with benefits in terms of reducing societal mistrust, prejudice, and political violence.	42,500.00	96,000.00	98,500.00	45,000.00	0.00	0.00	282,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement A surprisingly large percentage of the Australian population believe that it is common for networks of powerful elites – including scientists, bankers and politicians – to plot in secret for their own benefit against the common good. To the extent that official sources of knowledge are met with instinctive mistrust, it becomes increasingly difficult for governments and scientists to successfully communicate social messages that promote evidence-based change for individuals and societies (e.g., around climate change and vaccination). Furthermore, conspiracy theories have been designed and exploited by extreme ideological elements – both left and right – to promote intolerance, provoke violence, and distort democracy. As such, conspiracist thinking is a major problem, promoting prejudice, undermining science, and costing lives. By offering new ways of understanding and reducing the impact of conspiracist thinking, this project will have benefits for maintaining Australia's social harmony, reducing institutional mistrust, and protecting the role of science and facts in terms of guiding decisions.							
DP210102406 Fry, A/Prof Bryan G	This project aims to identify the selection pressures that shape snake venom neurotoxins and how they interact with nicotinic acetylcholine receptors, and to elucidate their biodiscovery potential. This project aims to test these important toxins on model systems that represent natural prey items in order to determine the molecular and functional evolution of neurotoxic peptides. Expected outcomes include substantial contributions to the body of evolutionary biology knowledge, while also having the applied benefit of discovering novel compounds with potential for use in drug design and discovery. These outcomes will benefit Australian science and society by elucidating fundamental processes while revealing biodisovery resources.	99,000.00	199,000.00	200,000.00	100,000.00	0.00	0.00	598,000.00
	National Interest Test Statement In recent years, snake venom compounds have been demonstrated as incredibly useful models for evolutionary studies and from which to synthesise therapeutic drugs to improve health and well-being. Neurotoxic snake venom peptides in particular have tremendous potential for use as investigational probes and lead compounds for the development of pain-killers. This project uses advanced technology established by a previous ARC infrastructure grant (LIEF) to advance Australian basic science while simultaneously having significant potential for applied outcomes with commercial benefit. The innovative approach will develop new techniques for use in advanced robotics and biomolecular interaction research. Real world potential benefits of this project include the discovery of novel lead compounds for use in the drug design pipeline. This could lead to economic and commercial benefits in Australia such as novel painkillers.							
DP210102425 Robinson, Dr Samuel D	Ants are diverse and ubiquitous and the ability of certain species to sting is familiar to many of us. Yet we know remarkably little about the chemistry underlying these stings. We recently discovered that the venoms of ants, including common Australian species, harbour a novel and unique class of sodium channel toxins. Building on this discovery, the aim of this project will be to perform an in-depth characterisation of the effects of these toxins on sodium channels and to uncover the diversity and breadth of this toxin class in ant venoms. The outcome of this project will be novel insights into the chemistry of ant venoms and new insights into sodium channel function.	66,028.00	159,264.50	130,596.00	37,359.50	0.00	0.00	393,248.00
	National Interest Test Statement Ants and their stings are things that many of us, particularly in Australia, are familiar with. Yet ant stings are still subject to much misunderstanding. The overarching objective of this project is to generate new knowledge in biology, which will be relevant not just in academia, but also in a practical sense to many Australians. Our discovery of a new class of neurotoxin in the venoms of ants, including Australian species, challenges the long-standing and popular misconception that ant venoms are "acid". The results of this project have the potential to attract commercial interest in the development of new, rational, sting treatments. Furthermore, they will shed new light on specific mechanisms by which sodium channels contribute to pain in humans, and could ultimately lead to the development of new treatments for some pathological pain states. This project will further advance Australia's reputation as a leader in venom research, and provide opportunities for students and postdoctoral trainees to develop high-level skills in proteomics, transcriptomics, peptide chemistry, and electrophysiology.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102473 Goodhill, Prof Geoffrey J	This project aims to use brain imaging and advanced computational analyses to investigate how early sensory experience affects brain development. It adopts the larval zebrafish as a model system, since they display sophisticated behaviours from an early age, and neural activity can be recorded at whole-brain scale with single neuron resolution. The project aims to generate new knowledge regarding environmental effects on brain development and behaviour. This will provide significant benefits including greater insight into normal brain development, and the formulation of new concepts potentially relevant for brain-inspired computing. The expected outcomes also include enhanced capacity at the interface between neuroscience and computation.	81,995.00	169,769.50	178,077.50	90,303.00	0.00	0.00	520,145.00
	National Interest Test Statement By better understanding how computations in the brain emerge during normal development we will be able to design improved artificial intelligence (AI) algorithms, and be in a better position to understand the underlying causes of neurological dysfunction. The huge current economic impact of AI depends on algorithms inspired by relatively old concepts for how biological brains work. By developing our understanding of brain computation using the very latest experimental and theoretical tools, this project has the potential to inspire new AI algorithms which could have significant economic impact. Furthermore, by expanding our knowledge of the mechanisms driving normal neural development, in the longer term it could inspire an improved understanding of what might be going wrong in neurodevelopmental disorders, which have a significant social and economic impact.							
DP210102521 Zalucki, Prof Myron P	Microscopic, detachable hairs on processionary caterpillars cause clinical reactions when they enter the skin or internal tissues of humans and animals. There is a time delay between exposure and the most serious effects, inferring an action more complex than simple irritation. The project aims to test a novel mechanism – how the hairs form a perimeter defence around caterpillars that primes the immune system of potential predators, how these hairs function within the layered caterpillar defensive system and how far setae can disperse. The research will inform relevant authorities and in particular veterinarians of the risks being exposed to processionary caterpillar hairs and add to the theory of predator-prey interaction.	41,316.50	97,013.00	112,443.50	81,555.00	24,808.00	0.00	357,136.00
	National Interest Test Statement Australia's processionary caterpillar species have been shown to cause illness in humans and other animals following accidental exposure, including abortions in mares. Foetal loss is a major economic cost and source of anxiety in the Thoroughbred horse breeding industry and among recreational horse owners alike. We aim to provide an understanding of the caterpillars layered defensive systems and behaviour and how it interacts with vertebrate and invertebrate predators. Our characterisation and distribution maps of different nesting forms in this species complex will show regions where processionary caterpillar activity is likely to impact communities, and our models of effective exposure will show how caterpillar activity is likely to impact individual farms and premises. This project will provide the scientific basis for health and veterinarian professionals to make evidence-based decisions, and to take the appropriate action to effectively reduce or even eliminate the health, economic and social costs associated with this insect.							
DP210102531 Rudolph, Prof Victor	The project will address a key objection to geological carbon dioxide (CO2) sequestration by removing the risk of long-term leakage to drinking water aquifers or to atmosphere. By injecting a nano-emulsion of CO2-in-water, the project seeks to show complete reaction to permanently stable solid carbonate occurs within weeks, eliminating the need for secure caprock or extended seal integrity monitoring. New knowledge will be generated using innovative approaches to create and stabilise CO2-in-water nano-emulsions and demonstrate the fast conversion of CO2 into stable minerals. The benefits are significant in opening potential sequestration targets to include areas without secure caps, reduced cost and elimination of long-term leakage risk	95,000.00	150,000.00	105,000.00	50,000.00	0.00	0.00	400,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Geologic sequestration is one of the immediate practical methods to stabilise the atmospheric concentration of carbon dioxide in order to address climate change. This provides a method for permanent disposal of carbon dioxide captured from fossil-fueled power stations, cement and steel processing, or directly scrubbed from the atmosphere. Subsurface sequestration faces public concerns regarding the long-term integrity of the storage repository and the risk of the injected carbon dioxide subsequently leaking into drinking water aquifers or back to the atmosphere. This project aims to develop and demonstrate a new low-cost method in which the carbon dioxide is injected as a nano-emulsion in water, which accelerates its conversion into inert solid carbonate rock. The project aims to show that this transformation reaction can be accomplished within weeks, when nano-emulsions are used, thereby eliminating objections regarding potential future damage to fresh water aquifers - an Australian National Science Priority, or leakage back into the atmosphere.							
DP210102595 van Swinderen, A/Prof Bruno	All animal brains are prediction machines, which allows even tiny flies to effectively navigate complex environments. To predict what will happen next is important for guiding attention, but also for detecting anything surprising. This project aims to understand how prediction is optimized by sleep in Drosophila flies. We aim to use electrophysiology and calcium imaging to map visual prediction error signals across the fly brain, and then determine how genetically controlled delivery of sleep regulates the quality and distribution of these signals. This knowledge will benefit our understanding of how brains balance a capacity for prediction versus surprise, by examining how evolution has solved this difficult problem in the smallest brains.	62,500.00	129,000.00	136,000.00	69,500.00	0.00	0.00	397,000.00
	National Interest Test Statement							
	Although sleep is a subject of great general interest, there is surprisingly little understanding of what sleep does for the brain. This is especially true for REM sleep, when the brain seems awake but remains disconnected from the world. Our lack of understanding here is evidenced by the growing use of sleeping pills, which mostly promote deep sleep at the expense of REM sleep. This modern trend ignores the fact that sleep is not just one phenomenon, but that it instead comprises distinct stages that are tightly regulated even in the smallest animal brains. There is therefore an acute need to understand the fundamental neurobiology underlying the link between sleep stages and cognitive functions, and it is only very recently that efficient genetic models such as Drosophila melanogaster have been made accessible to this necessary research direction. While knowing how to achieve better sleep is of crucial national interest, it is just as important to know what different sleep stages are doing for the brain. This project proposal focusses on one function, prediction, that has relevance to any animal brain.							
DP210102663 Slaughter, Prof Virginia P	We copy others all the time, to learn new skills and to connect socially and emotionally with those around us. But where does this ability to imitate come from? This is a long-standing question in developmental psychology that the proposed project aims to answer. Using a unique combination of EMG and behavioural observations, this project will chart infants' imitation skills from birth through the first year of life, and test whether infants learn to imitate from watching themselves and being imitated by others. The new knowledge arising from this research will clarify the origins of our uniquely human sociality. The outcomes should also enable earlier identification of developmental problems and provide novel avenues for intervention.	93,487.50	175,477.50	160,640.50	78,650.50	0.00	0.00	508,256.00
	National Interest Test Statement							
	Imitation is fundamental to being human; it is one of ways that people connect with and learn from each other. Where does this ability come from? Currently there is no clear answer to that question. This project will provide a definitive answer and in so doing, clear up 40 years of controversy that has stymied theories of development, blocked progress on early intervention and confused parents of newborns. With innovative and sensitive new ways of testing imitation in young infants, this project will identify when imitation first occurs in typical infants, and how it arises. The new knowledge generated by this project will showcase Australia's world-leading paediatric research. It will also clear up parents' confusion about what newborns actually do, alleviating potential anxiety about what they can expect from their babies. In the long run, this project will generate new early detection and intervention tools for children with social learning problems, thereby improving quality of life for many Australian children and their parents.							
DP210102704 Jones, Dr Mathew	DNA replication is the fundamental mechanism of genetic inheritance and essential for all cellular life. This project aims to inform our understanding of how human cells coordinate the DNA replication machinery in time and space to accurately copy the human genome. By applying multiple innovative approaches and employing an interdisciplinary research team, this project is anticipated to generate new knowledge that explains how the human genome is replicated. This knowledge is expected to generate research publications of high quality and provide economic benefits, such as unlocking new potentially patentable DNA technologies.	78,000.00	157,000.00	158,000.00	79,000.00	0.00	0.00	472,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement This proposal will provide critical information about the control of DNA replication in humans. Since DNA replication is the cornerstone of molecular biology, advances in this field can unlock new DNA technologies with commercial applications and patentable processes that will provide economic benefits to the Australian community. For example, our research will provide information that can be used to copy large amounts of DNA accurately and rapidly, which can be used in ultra-low-cost DNA based data storage. This technology harnesses the extreme information-storage density of DNA, which is several orders of magnitude higher than any other known storage technology. Moreover, our research can be used for high-efficient, low-cost whole genome synthesis and assembly technologies. Synthetic genomics is an emerging discipline and will make it commonplace to engineer entire pathways and genomes beyond what is possible with current editing strategies.							
DP210102970 Zheng, A/Prof Zuduo	This project aims to balance road safety and efficiency as conflicting goals of transport systems mixed with connected and automated vehicles (CAVs). This project is expected to generate fundamental knowledge on operational algorithms and analytics for CAVs and develop innovative tools for operating them. Expected outcomes include ground-breaking models capable of the co-estimation of efficiency and safety impacts of CAVs, and control strategies to safely and efficiently integrate CAVs into existing transport systems. This should provide significant safety and efficiency benefits that currently cost about 1160 lives and 1.25 billion hours of congestion per year, and make Australia better prepared for the connected and automated vehicle era.	74,978.00	125,401.00	109,266.00	58,843.00	0.00	0.00	368,488.00
	National Interest Test Statement This project will provide not only scientific breakthroughs in modelling safety, operation, and dynamics of traffic flow mixed with connected and automated vehicles (CAVs), but also efficient transport solutions that will significantly contribute to fully utilise the well-acknowledged benefits arising from CAVs, including safety benefits by reducing fatalities and injuries, mobility benefits by reducing congestion, and environment benefits by reducing greenhouse gas emissions. Findings from this pioneering, ground-breaking research will help researchers, policy makers and transport authorities in Australia to plan for optimal integration of CAVs in the transport systems and identify appropriate transport management strategies that maximise the productivity of its transport network without compromising safety. These models will also help government town planning and road design. As the first of its kind in Australia, the unprecedented data yielded will pave the way for the exploration of new operational and control strategies to better manage CAVs on Australian roads.							
DP210102998 Hume, Prof David A	The immediate postnatal period in mammals is crucial for survival, long term health and productivity. This project is an international collaboration that aims to investigate how cells of the innate immune system called macrophages control somatic growth and development of mature organ function in the early postnatal period. The project aims to build upon investment in new animals models and a novel discovery to generate significant new knowledge that will challenge current concepts of mammalian growth control. The outcomes will enhance Australia's international reputation in the fields of physiology, immunology and developmental biology.	90,493.50	185,760.50	191,807.00	96,540.00	0.00	0.00	564,601.00
	National Interest Test Statement This project addresses the genetic control of mammalian postnatal development in order to understand survival, resilience and long-term health and productivity in humans and animals. The discoveries will inform the basis of key production traits in livestock animals and will benefit Australia’s international competitiveness in livestock farming by improving individual animal productivity, increased outputs and reduced inputs and losses. The project also has commercialisation potential to develop breeding strategies and animal health products for improved performance and development in livestock. As the first weeks of life are the key period that better determine lifelong well-being in humans, this work will, with time, benefit Australian society as findings could be used to inform the environmental frameworks that support the normal healthy development of human infants.							
DP210103017 Teasdale, A/Prof Rohan D	This project aims to investigate the cellular components which generate carriers that transport material between compartments within the cell. The process of sorting proteins and sending them to the right place is a fundamental mechanism critical to understand how individual proteins function as the move around within cells. The generated knowledge about how cells organise themselves through the movement of proteins between endosomal intracellular compartments will provide significant benefits by enhancing our capacity to understand this conserved cellular pathway which ensures the integrity of all cellular processes including signalling, communication, homeostasis and development.	89,500.00	183,000.00	185,000.00	91,500.00	0.00	0.00	549,000.00

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	The proposed research will generate fundamental knowledge that will lead to an increased understanding of a key cellular pathway underpinning numerous critical cellular systems. The outcomes from this project will deepen our understanding of how cells organise the thousands of distinct components with each needing to be precisely located within defined regions of the cell. This will include defining the details of the vessels which move material between compartments inside the cell that ultimately controls the functional levels of individual proteins. Dysfunction in this pathway is directly associated with human metabolic disorders and neurodegenerative states and the knowledge generated from this project may ultimately feed into understanding these diseases which represents a significant social and economic burden in Australia.							
DP210103079 Zhao, A/Prof Chun-Xia	Mechanical forces play critical roles in many biological processes, but how particle mechanical properties modulate particle-cell interactions remains elusive. This project aims to develop new design principles for engineering nano/micromaterials with tunable mechanical properties for improved cell activation and expansion, and to advance knowledge of the role of particle stiffness in modulating receptor-mediated particle-cell interactions. Expected outcomes and benefits include new fundamental understanding of the effect of particle mechanical properties on cell function, new insights into T cell activation and expansion, and new classes of stiffness-tunable fit-for-purpose materials for various applications in cell manufacturing.	91,391.00	182,153.50	181,262.50	90,500.00	0.00	0.00	545,307.00
	National Interest Test Statement							
	Nano/microtechnology and material engineering hold enormous promise for Australia’s multibillion-dollar pharmaceutical industry. The convergence of nano/microtechnology, material engineering and cell manufacturing offers unique opportunities to develop novel particle-based artificial cell systems for activating immune cells (T cells) for cell production. Building on a recent breakthrough in engineering core-shell materials using designed biomolecules, the project aims to develop novel nano/micro particles with tunable stiffness, contribute new knowledge to the optimum design of artificial cells for various biological applications, and provide new design rules for engineering materials for cell production, shifting the paradigm of cell engineering. The new class of stiffness- tunable particle system will provide technologically advanced materials for future applications in cell engineering and manufacturing. Project outcomes will expand Australia’s knowledge base in the area of bioengineering and biotechnology, and position Australia at the forefront of bionanotechnology.							
DP210103151 Trau, Prof Matt	This project aims to develop an entirely new nanotechnology to visualise dynamic molecular circuits in real time, and within any biological sample as small as a single cell. This project expects to generate new knowledge in the field of cell biology and sensor technology, using innovative nanofabrication and nanoscopic fluid flows to advance understanding of the emerging field of single protein molecule interactions in cellular pathways. Expected outcomes include a universal technology platform to detect single molecules in single cells, with potential to deliver valuable intellectual property of commercial interest and economic benefit through technological advancements.	61,174.50	116,118.50	108,854.00	53,910.00	0.00	0.00	340,057.00
	National Interest Test Statement							
	This project will develop a new nanotechnology to visualise dynamic molecular circuits in real time and in single cells. This will benefit Australia by advancing knowledge in cell biology, material science, and technology development with potential to be commercialised to deliver economic benefits, and be used by materials scientists to develop further technologies to study cellular processes. The expected outcomes will likely be translated into a new sensing platform that in the longer term will enable personalised diagnostics and contribute towards development of next-generation bio-sensing instrumentation. Given the enormous size of the global diagnostics and research instrument market (greater than B$100 per annum), this project also has the potential to lead to significant financial benefits to Australia through potential commercialisation of the novel single molecule technology that will be developed. As such, the proposed research falls directly under the strategic research priority of ‘Health and Economic Growth'.							
DP210103162 Zhang, Prof Ming-Xing	As the current materials that can be additively processed are still very limited, this project aims to increase the additive manufacturing processability of commercial engineering materials through developing effective and practical grain refinement technology so that more engineering parts can be additively fabricated. The project expects to widen the applications of this advanced manufacturing technology in industry productions. Expected outcomes include commercialisation ready grain refinement technologies and breakthrough fundamental understanding of the physical metallurgy of melt pools. This should enhance Australia’s capability to establish world-leading additive manufacturing activities serving to various other industry sectors.	85,000.00	165,000.00	160,000.00	80,000.00	0.00	0.00	490,000.00

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Additive manufacturing is a technology that allows 3D printing of complex shapes from metals and ceramics. Currently, only a very limited number of alloys and ceramics are capable of being printed, limiting applications of this technology and restricts growth of Australia's manufacturing capacity. This research will develop new grain refinement techniques to improve the printability of materials, significantly increasing the range of materials that can be 3D printed. The approach used in this research will also improve the mechanical performance of 3D printed parts to expand their usability into the defence, aerospace, shipbuilding and biomedical industries. It will therefore increase Australia's high-value manufacturing capacity, and provides Australia with a competitive advantage and material science know-how to make economic benefit through advanced manufacturing in critical Australian investment areas.							
DP210103342 Rakic, Prof Aleksandar D	This project aims to address an important problem of noncontact assessment of tissue including skin and cartilage. By using extremely wide spectrum – between the terahertz and the near infrared – the effects of scattering and absorption arising from the variation of tissue properties from macro- to nano-scale will be explored. Spatial variations of tissue properties will be addressed in model and experiment by combining spectroscopy with the novel terahertz and mid-infrared Scanning Near field Optical Microscopy. The outcomes will advance fundamental understanding of light interaction with multi-layered tissues. This will provide a tool for advancing bioengineering research, terahertz technology, and development in biomedical devices.	98,902.00	164,157.50	137,954.00	72,698.50	0.00	0.00	473,712.00
	National Interest Test Statement							
	This project will advance knowledge of light-tissue interaction, with potential applications in biomedical engineering. The outcomes could lead to significant socio-economic benefits to Australia in areas where optical techniques are gaining increasing application, such as medical device innovation and wearable technologies. For example, knowledge created in this project will support Australia's manufacturing industries to develop and optimise spectroscopy-based medical devices for early detection of diseases. Optical heart rate monitors, present in most smart wearable devices, are based on using light (photopletysmography) to measure blood flow. The technology suffers from poor accuracy with measurements through photodamaged or tattooed skin. This project will contribute to addressing this problem. Australian market for wearable technology is approximately $1 billion, thus a breakthrough solution for addressing the shortcomings of present technology could result in economic benefits to Australia.							
DP210103352 Sun, Dr Ya-Yen	With over 6 billion vacation trips annually, tourism is a major and fast-growing contributor to climate change. To support a climate-centred tourism policy, this Project aims to construct a world's first global database that answers three key questions: 1) if tourism carbon footprint increases in direct proportion to its consumption, 2) how quickly tourism can decarbonise emissions, and 3) can tourism deliver better carbon performance than other sectors? The outcomes include new theoretical and empirical knowledge about the impacts, drivers, and trade-offs of tourism's carbon emissions. A significant benefit of this Project is to identify mitigation policies that can better balance tourism economic yield and emissions stabilisation.	63,230.50	128,484.50	137,531.00	72,277.00	0.00	0.00	401,523.00
	National Interest Test Statement							
	Tourism has grown 5% annually, faster than the Australian economy in the past 5 years and is one of the largest economic contributors and employers. At the same time, tourism is the sector most vulnerable to climate change risks, evidenced in the recent devastating bush fires and flood events. Thus, it is of regional and national significance to safeguard Australia's tourism system through effective carbon management. This Project provides insights to inform the future outlook of tourism's economic outputs and consequences for the Australian carbon mitigation objective based on the current tourism expansion path. This Project will advise an environmental policy to stabilise and later decrease tourism carbon emissions for Australia without reducing tourism's contribution to employment and economic yields. This will result in a saving of at least 3.4 million tonnes of carbon emissions, thus achieving sustainable economic growth—an ultimate goal stressed by the National Science and Research Priorities.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103401 Wolvetang, Prof Ernst J	Editing the genome of an organism in an efficient and safe fashion is critical for the livestock and biotechnology industries. While CRISPR-Cas9 has become the method of choice for genome editing, it is known to introduce unwanted "on-target" and "off-target" mutations, limiting its utility. To address this the CI team created a novel genome editing platform technology termed Crackling-CAST that is almost 100% accurate, while retaining the efficiency of the classical Cas9 system. This project will exemplify the capabilities of the novel gene targeting platform in cell types used by the biotechnology and livestock sectors, ensuring its global uptake by these industries and delivering significant economic benefits for Australia.	75,516.00	153,681.00	161,515.50	83,350.50	0.00	0.00	474,063.00
	National Interest Test Statement Gene editing is increasingly used to change the genomes of a range of livestock species, as it can both rapidly achieve the same goals as traditional crossbreeding AND enable the introduction of desired or entirely novel traits.The global gene editing market is conservatively expected to grow to a value of 7.5 Billion (USD) in 2024 and with its new legislative regulatory framework Australia is well placed to capture a substantial slice of this market. Despite its promise there remain intrinsic reservations towards genome editing in both the public and industry sectors alike that are largely and justifyably based on the unknown consequences of introducing unwanted mutations during genome editing. The new Crackling-CAST methodology at the heart of this project directly addresses this concern, as it permits virtually error-free genome targeting. In this project we aim to exemplify the power and safety of the Crackling-CAST platform in a range of cell types that are important for Australia's biotechnology and livestock industries to the benefit of these sectors as well as Australian society.							
DP210103430 Becker, Dr Stefanie I	This project aims to investigate an important, newly discovered dissociation between early visual selection and perceptual decision-making. Contrary to current theories, attentional and perceptual processes are tuned to different stimulus attributes described in the relational vs. optimal account, which implies that current theories of attention do not describe early attention but later, decisional processes. This project will provide an accurate description of these processes, which promises important theoretical breakthroughs. Work on this project will also significantly advance methods to detect and describe early attentional processes, by identifying error-prone methods of Psychophysics and Neuroscience studies, and proposing remedies.	15,974.50	34,856.50	60,826.00	85,240.00	43,296.00	0.00	240,193.00
	National Interest Test Statement The study is of broad public interest, as it promises new insights into visual search, which is one of the most frequent activities in everyday life. Moreover, our discovery that early vs. late selection processes are dissociated opens new ways to study these processes in a more systematic manner, and can be expected to have a large impact on research, which will help maintain Australia's leading role in research. The results of this project will also yield a more accurate description of the factors causing distraction and errors in decision-making. As these are still the most frequent causes for mishaps and accidents, the project can also help to inform policy-makers to create safer environments. In addition, the project may help create more effective interventions, for instance, by aiding the development of more effective brain-training apps, and allowing more accurate models of clinical disorders such as ADHD, autism and schizophrenia. Work on this project will also provide excellent opportunities for graduate and post-graduate students which will aid Australia to maintain its leading role in education.							
DP210103808 Bredy, A/Prof Timothy W	Activity-induced gene expression is central to neural plasticity, learning, and memory; however, the underlying mechanisms of these processes in the brain have yet to be fully resolved. The aim of this proposal is to obtain a deeper understanding of the functional relationship between genes and brain function. By elucidating the full repertoire of epigenetic mechanisms in the brain during learning and the formation of memory, it is hoped that the true nature of brain adaptation across the lifespan will be revealed. Findings which may then provide new opportunities to strengthen, maintain and optimise cognitive function.	73,662.50	151,575.00	158,625.00	80,712.50	0.00	0.00	464,575.00
	National Interest Test Statement New state of the art approaches will be used in this research project to obtain a deeper understanding of learning and memory and how the brain changes across the lifespan. The mechanisms described represent an entirely new way of thinking about experience-dependent plasticity in the brain, and will impact many fields beyond neuroscience. Conceptual and technical advances will provide Australia a competitive edge in applying and commercialising the discoveries from this project. For example, the design of new tools to manipulate the genome and enhance memory may find broad applicability in the area of cognitive enhancement in the healthy brain, benefitting complex learning and skills acquisition in schools and in Australia's workforce. It will also enable the design and application of DNA storage devices, representing a new frontier in synthetic biology and DNA computing for Australia's technological industries.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103827 Cooper-White, Prof Justin J	Printing mixtures of live cells and biomaterials (or 'BioInks') to make bespoke engineered tissues has the potential to enable personalised platforms for therapeutic discovery and organ replacement. Using a novel high throughput approach to materials synthesis, BioInk design and process optimisation, this project aims to discover new biomaterials and printing nozzles to help realise this potential. It will produce new insights in colloid science, cell-laden biomaterials design, and BioInk processing. Structure-property-function guides for colloid-based BioInks and quality-assured bioprinting as outcomes represent significant benefits for researchers and industries alike engaged in biofabrication, cell therapy and biotherapeutics.	70,118.00	151,859.50	166,006.00	84,264.50	0.00	0.00	472,248.00
	National Interest Test Statement The new polymeric biomaterials, printing nozzle designs and processing methodologies produced in this project represent new commercial opportunities for our rapidly growing Biotechnology, Biofabrication and Nozzle Manufacturing sectors. Once translated to these industries and the clinic, there will be flow on benefits for cellular therapy, biotherapeutics and aligned life sciences R&D industries, along with substantial potential to impact and improve the quality of life of people suffering from injury or disease. This research thus has the potential to enable Australia to realise substantial economic benefit, with the global cell therapy and tissue engineering market valued to be ~$170 billion by 2028 (annual growth rate ~26%). These new materials have potential for uptake in other industrial sectors, including as surface coatings and sprays, personal care products (creams, conditioners) or agrochemical spray improvers. The international linkages created in this project will significantly benefit our scientific and industrial communities by stimulating local expertise and enhancing international reputation.							
DP210103970 De Voss, Prof James J	This project aims to understand the use of the steroid cholesterol as a source of essential metabolic building blocks by bacteria. Cholesterol utilisation is a key feature of many bacterial pathogens which have evolved to survive in niche environments. By understanding the initial step in cholesterol degradation and the bioinorganic and bioorganic chemistry of the metalloenzymes that catalyse it, this work aims to develop strategies to block this activity. This will turn a key strength of these bacteria into a potent weakness and will generate the proof of principle and knowledge required for the future development of effective strategies to combat pathogenic bacteria.	86,500.00	166,000.00	162,500.00	83,000.00	0.00	0.00	498,000.00
	National Interest Test Statement This project will explore the role of a set of enzymes in the first key step of the cholesterol degradation pathways in bacteria. These metalloenzymes are widely viewed, and often employed, as excellent biocatalysts for use in fine chemical production; for example, in industrial steroid synthesis. Understanding the bioinorganic and bioorganic chemistry and the inhibition of these enzymes is crucial to the development of new chemicals to prevent infection of humans or crops. Several of the bacteria to be studied are potent human pathogens causing Buruli ulcer, a serious skin disease on the rise in Australia, and the global pandemic tuberculosis. Increasing occurrences of drug resistant strains hinders progress in the treatment and eradication of these diseases. Due to the critical role of cholesterol in bacterial growth and the potential for inhibition using analogs of this steroid, the increased understanding of the cholesterol degradation pathway revealed by this project may have far reaching consequences for medical and biotechnology researchers and companies developing applications in the future.							
DP210103991 Morrison, Prof Mark	The aim of this project is to provide deep functional understanding of our recent discovery of novel microbes from the Domain Archaea that inhabit the digestive tracts of native Australian herbivores. These animals are unique natural resources of great cultural, environmental, and economic significance, but increasingly susceptible to habitat change and degradation. Very little is currently known about the microbes that have co-evolved with these animals, to support their nutrition and health. The project will address these knowledge gaps, and the ensuing discoveries are expected to deliver products and services relevant to environmental health assessment and sustaining the "low methane carbon economy" attributed to these iconic species.	80,000.00	162,500.00	153,500.00	71,000.00	0.00	0.00	467,000.00
	National Interest Test Statement Australia’s native herbivores are among its iconic natural resources, which must be protected for the cultural, environmental, and economic well-being of all Australians. A key feature of these animals is their "clean and green" image because of their low methane emissions (per kg of food intake) compared to ruminant livestock. This project explores and characterises newly discovered microbes representing the third Domain of Life (Archaea) from these animals and a critical control point in methane emissions from animals. The project tackles knowledge gaps in understanding how changes in their environment might affect their nutrition and methane emissions from these animals, and how to monitor and correct it. It may also improve how we manage animals after natural disasters (e.g. fires) or relocation for population dispersal and conservation. The knowledge gains from this project can also support new and improved (bio)technologies elevant to minimising the carbon footprint and environmental impacts of our traditional industries, including agriculture. The project's national benefits are both timely and broad.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210104043 Zuccon, Dr Guido	This project aims to develop novel AI-based search engine methods to make the creation of systematic reviews cheaper, faster and unbiased. Systematic reviews are the cornerstone for evidence-based decisions in clinical practice and government policy making. Given the pace new research is published at, it is unsustainable to manually conduct systematic reviews in the traditional manner, taking on average 2 years and $350K and becoming already outdated when published. The outcomes of this project will lead to systematic reviews of higher quality, while reducing their financial and temporal costs, providing significant benefits to organisations performing reviews and their funders, and to people impacted by decisions made from the reviews. **National Interest Test Statement** This project will contribute AI-based search engine technology to reduce the time and costs of completing systematic reviews, while increasing the quality. This will translate into high quality and up-to-date evidence to support accurate clinical and policy decision making, thus improving health decision-making and increasing efficiency. More timely and precise systematic reviews will have a direct and profound effect on healthcare delivery in Australia. In its aims, this project directly tackles two important societal challenges: (1) the promotion of population health and wellbeing -- by providing methods and tools for researchers, clinicians and decision makers that would be able to identify high quality, up-to-date evidence, reliably and efficiently; and (2) the lifting of productivity, by reducing the financial and temporal costs required for producing systematic reviews.	31,328.50	65,557.00	70,557.00	36,328.50	0.00	0.00	203,771.00
	The University of Queensland	3,329,564.50	6,614,920.50	6,416,260.50	3,278,917.50	148,013.00	0.00	19,787,676.00
University of Southern Queensland								
DP210101220 Chen, Prof Dr Zhi-Gang	Thermoelectric materials, directly converting thermal energy into electrical energy, offer a green and sustainable solution for the global energy dilemma. This project aims to develop cost-effective metal selenide materials for high-efficiency solid-state devices using a novel industry-level approach, coupled with nanostructure and band engineering strategies. The key breakthrough is to design high-performance metal selenide thermoelectric materials with engineered chemistry and unique structures for new generation thermoelectrics. The expected outcomes will lead to an innovative technology for harvesting electricity from waste heat or sunlight, which will place Australia at the forefront of energy and manufacturing technologies. **National Interest Test Statement** Cost-effective and high-performance metal selenide thermoelectrics can efficiently convert heat or sunlight into useful electricity, which will bring tremendous economic and environmental benefits to our society. The outcomes of this project will be utilised in the power industry and automobile industry for harvesting electricity from waste heat and sun light. In this case, the consequence of this project will help to create new employment opportunities in the manufacturing, energy recovery, and power generation sectors, and will provide international recognition and wealth generation for Australia. Such expected outcomes will significantly release our dependence on fossil fuels and will ultimately contribute to the reduction of greenhouse gas emissions. The success of this project will provide novel technology for waste heat recovery and provide the technological solution to enhance the sustainability and wellbeing for Australian Society, which will significantly enhance the international impact of Australia in the area of development of renewable energy for addressing climate change.	73,153.00	140,771.00	135,136.00	67,518.00	0.00	0.00	416,578.00
DP210103869 Kiss, Prof Levente	Fungi are devastating agents of crop diseases. These plant pathogens, in turn, are often parasitized by other fungi in the field. The project will focus on such interactions between powdery mildews, important pathogens of many crops and wild plants, and their common fungal parasites (Ampelomyces spp.) that have already been utilised as biocontrol agents in crop protection. Genetic and genomic tools will be used to determine if these parasites evolved by switching host from plants to plant pathogens. The project has the potential to make a ground-breaking discovery in this field, and also establish the starting point for new innovative methods to protect a wide diversity of crops using these fungi or specific compounds derived from them.	90,000.00	177,500.00	172,500.00	85,000.00	0.00	0.00	525,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Agriculture is a major contributor to the Australian economy, and while Australia is one of the most urbanised countries, the land and its farmers are a quintessential feature of the Australian identity. Our crops are attacked by a large number of fungal pathogens, which threaten the economic return to farmers and the stability of rural communities. Targeting crop pathogens with synthetic pesticides may lead to the evolution of pesticide resistance with the concurrent concern for the off-target impact of large scale use of chemicals. New solutions are urgently needed. Biocontrol, a sound alternative based on antagonistic microbes, has become economically successful in only a few specific crop protection areas to date. This project has the potential to make a ground-breaking discovery in this field, and also establish the starting point for the development of new innovative methods to protect a wide diversity of crops using biocontrol microbes, or specific compounds derived from them. The project thereby has economic, commercial, environmental, social and cultural benefits to the Australian community.							
	University of Southern Queensland	163,153.00	318,271.00	307,636.00	152,518.00	0.00	0.00	941,578.00
University of the Sunshine Coast								
DP210100647 Manathunga, Prof Catherine E	This project aims to apply Indigenous knowledge approaches (agency of Country; power of stories and iterative, intergenerational and intercultural knowledge production) to Australian doctoral education. This project expects to generate new knowledge in the area of Indigenous and transcultural (migrant, refugee and international) doctoral education. Expected outcomes of the project include multimedia portal/app and policy recommendations for doctoral supervision, language and examination protocols that place Indigenous and transcultural knowledges at the forefront of Australian research. This should provide significant benefits to Australian higher education, enabling Australia to become a world leader in global knowledge production.	46,745.00	96,169.50	91,984.50	42,560.00	0.00	0.00	277,459.00
	National Interest Test Statement							
	Australian research could be greatly enriched if the knowledge, histories, languages and cultural practices of Indigenous and migrant, refugee and international student communities received greater recognition. This research project works in respectful partnership with Indigenous and transcultural doctoral candidates and their supervisors to foreground and accredit Indigenous and transcultural knowledge systems. It is based upon Indigenous knowledge approaches including the agency of Country, the power of Stories and iterative, inter-generational and intercultural knowledge production. The project will deliver significant benefits to Australian society, culture and the environment by ensuring that unique First Nations and transcultural knowledge is actively incorporated into doctoral research projects. This project aims to harness the power of the multiple cultures in Australia in order to address some of the challenging ecological and social issues Australia is now experiencing, such as the unprecedented bushfires of this Australian summer. The project will improve doctoral candidates' experiences.							
	University of the Sunshine Coast	46,745.00	96,169.50	91,984.50	42,560.00	0.00	0.00	277,459.00
	Queensland	5,515,662.50	11,040,495.50	10,618,658.50	5,345,632.00	251,806.50	0.00	32,772,255.00

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
South Australia								
Flinders University								
DP210100740 Nordstrom, Prof Karin	This project aims to understand how hoverflies and honey bees, with tiny brains and sensory systems, excel at making fast and accurate decisions while on the fly in a complex world. The project will combine brain recordings with flight analyses and computational modelling to generate new knowledge on how animals may utilize movements to simplify information sampling. Expected outcomes are a novel, comprehensive understanding of how animal movements could enhance decision speed and accuracy. This should provide substantial benefits for neuroscience, and for enhancing performance of autonomous robotic systems operating in challenging environments, such as disaster relief, mining and remote exploration.	100,140.50	200,772.00	166,254.00	65,622.50	0.00	0.00	532,789.00
	National Interest Test Statement Our project will provide a comprehensive understanding of how biological systems use movements to enhance decision speed and accuracy. The speed and accuracy of movements is a performance issue in a range of important activities, such as in autonomous robotic systems. This project will provide a basis for improved performance in autonomous robotic systems especially those operating in challenging Australian environments, such as those encountered during disaster relief, mining and remote exploration. In addition, the project will directly promote international collaboration with the UK, India and Sweden, including with one of the top biorobotics groups in the world, as well as enhancing Australia's standing in neuroscience. Finally, by furthering our understanding of the biology of two of our most important pollinators, our project could have a direct impact on Australian agriculture.							
DP210101214 Wendt, Prof Sarah C	This project aims to generate an evidence base on the nature of domestic and family violence (DFV) work and the implications for the DFV workforce across victim, perpetrator and Aboriginal specialist services. Using the innovative method of rapid ethnography, this project expects to provide a comparative understanding of DFV work and workforce practices and requirements. Expected outcomes include workforce development strategies that are responsive to the context and needs of DFV work. Given the high social, health and economic costs of DFV, investing in the DFV workforce has national benefits including improved services and better client and worker wellbeing.	39,433.00	91,983.00	98,075.50	45,525.50	0.00	0.00	275,017.00
	National Interest Test Statement The Victorian Royal Commission into Family Violence and the Fourth National Action Plan have identified the domestic and family violence (DFV) workforce as pivotal in solving Australia's DFV crisis. However, the nature of DFV work and workforce remains largely invisible. There is currently no comprehensive analysis of the inter-relationship between DFV work, workers' capacities, needs and experiences, and workplace structures, cultures and conditions. Without detailed and contextualised data and related theorising of the work and workforce, policy makers, educators, managers and practitioners will continue to struggle to address the complexity of DFV. Strengthening the capacity of the workforce to respond to DFV will improve the immediate and longer-term health and wellbeing of victims and perpetrators, and those who work with them, and reduce costs to health, welfare and criminal justice systems. Investing in responses to DFV reinforces Australia's cultural shift towards taking seriously the interpersonal and social harms of DFV.							
DP210101243 Andersson, Prof Mats R	Biofilms grow on all surfaces and environments posing environmental threats and economic issues globally, costing billions each year to those attempting to eradicate them. To date, biofilm's detailed response to variations in electrochemically generated redox stress and shear is unknown in marine environments. The project aims at (i) developing novel electrically conducting carbon based paints that are stable in marine environments and (ii) investigating how marine biofilms respond to these coatings. The expected outcome of this project is the development of a green alternative antifouling technology that can be used on demand in marine applications. This provides a new solution for controlling the biofouling of surfaces immersed in oceans.	83,900.50	147,925.00	138,825.00	74,800.50	0.00	0.00	445,451.00

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement The research proposed here contributes to Australia's national interest through its potential benefits to various Australian industry sectors. The benefits will be (i) commercial: the fabrication of innovative electrically conducting carbon-based coating technology, (ii) environmental: these coatings will be stable in marine environments and provide a green alternative antifouling method and (iii) economic: these coatings can be used on demand in the maritime, defence and water industries to reduce the costs of controlling biofilm formation. They can also be the basis for the development of antifouling coatings in many other industry sectors. This research thus sits within the Australian science and research priorities for food, water, transport and advanced manufacturing.							
DP210103065 Meech, A/Prof Robyn M	The gut is the most rapidly renewing tissue in the body, driven by a highly active stem cell niche. Bile acids are emerging as critical regulators of this stem cell niche and disruption of bile acid homeostasis has profoundly adverse effects on intestinal renewal and hence gut health. We are addressing a critical gap in our understanding of how bile acids are controlled within stem cell niche. The aim of the project is to define the critical role of a novel enzyme called UGT8 in controlling intestinal stem cell response to bile acids; this is achieved by modulating UGT8 activity in intestinal stem cell models and determining the effects on stem cell function and the key signalling pathways that control intestinal homeostasis and renewal.	83,706.00	162,552.00	152,542.00	73,696.00	0.00	0.00	472,496.00
	National Interest Test Statement This project will build on a timely alliance between researchers in Australia and the USA who will bring a cross-disciplinary approach to understanding the factors that control the normal process of intestinal turnover, which is essential to gut health. This team recently made major inroads into understanding how intestinal turnover is controlled by critical chemical regulators known as bile acids. In doing so, they identified a major gap in our understanding of how the intestinal stem cell modulates the bile acid signal. This team will now combine extensive expertise in stem cell biology, metabolism, and mouse genetics, to fill this gap by defining a new pathway for bile acid metabolism within the stem cell. This should enable the development of novel approaches to intervene where bile acid metabolism, and hence gut turnover, is dysregulated, for example by dietary factors or disruption of the microbiome. The team's extensive research commercialization experience supports development of such interventions within the biotechnology space, ultimately benefiting Australian industry.							
	Flinders University	307,180.00	603,232.00	555,696.50	259,644.50	0.00	0.00	1,725,753.00
The University of Adelaide								
DP210100462 Farkas, Dr Juraj	This project aims to constrain the timing and speed of the Cambrian radiation of complex animals, and to test potential environmental triggers of this milestone bioevent. New laser mass spectrometry and mineral mapping technology will be integrated to precisely date glauconite – a silicate mineral commonly formed in Cambrian shallow marine animal habitats. This innovative and cost-effective approach will produce the first high-resolution timeline of early animal evolution, where the glauconite-based marine isotope record identifies the most likely environmental trigger for the Cambrian Radiation. Outcomes of this study include improved understanding of the drivers of animal evolution, and a new dating tool for basic and applied research.	35,000.00	115,000.00	160,000.00	80,000.00	0.00	0.00	390,000.00
	National Interest Test Statement In addition to fundamental science discoveries on the evolution of life, the project has potential immediate and longer-term benefits for the Australian resources sector, particularly in relation to exploration and use of sediment-hosted energy resources. In the short-term, the project will develop and validate a world-first, rapid, and cost-effective method for sediment dating. By going beyond current, traditional methods, this new technique could help identify previously undiscovered deposits. In the longer-term, routine application of this novel method could help de-risk and lower costs of complex resource exploration of prospective basins in Australia, by enhancing profitability and job creation. The industry-linked research training embedded in the project will also contribute to providing a future skilled workforce for the Australian resources industry.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210100508 McInerney, Dr Francesca A	This project aims to investigate the influence of bushfires and shifting rainfall patterns on the development of Australia's dominant ecosystems. By combining a range of novel geochemical, isotopic and palaeontological techniques, this research seeks to reveal the causes and consequences of Australia's transformation from a forested to mainly open landscape of grassland, shrubland and savannah. The expected outcome is detailed knowledge of how changes in fire and rain shaped the ecology and evolution of plants and animals. This knowledge is key to understanding how Australian ecosystems function and to protecting their cultural, economic and environmental values, especially as climate and fire regimes continue to change into the future.	89,500.00	178,000.00	148,500.00	60,000.00	0.00	0.00	476,000.00
	National Interest Test Statement Australia's wide-open landscapes are central to our cultural identity, environmental health, and economic prosperity. The grasslands, shrublands and savannahs that cover 70% of the continent support a vast diversity of plants and animals found nowhere else on Earth. These natural wonders attract international tourists that contribute over $40 billion to the economy, while our rangelands support a $17-billion beef industry. Anticipating how these ecosystems will respond to changes in bushfire and climate is difficult because of complex ecological feedbacks and the unprecedented scale of change. By combining a novel array of techniques, this project will document how Australia's dominant ecosystems were shaped by changes in rainfall and bushfire over the last 15 million years. By using both local and regional environmental archives, it will identify what drove the evolution of Australia's unique vegetation and fauna. The outcomes of the project will provide crucial knowledge about Australia's past to aid in better managing our iconic and valued landscapes into the future.							
DP210100858 Conduit, Prof Jodie L	This project aims to develop knowledge on how to engender collective engagement for a social purpose, such that the collective actions of the group facilitate well-being of the broader community. The project expects to generate new knowledge of how to drive the emergence of engagement from an individual to a collective level, and understand the benefits that can be gained by focusing this engagement on social purpose. Expected outcomes include measurement tools, an intervention framework for facilitating collective engagement, and mechanisms for leveraging this engagement for community well-being. This should provide significant benefits within organisations, by enhancing their social impact and facilitating economic growth and job creation	45,000.00	92,000.00	102,500.00	55,500.00	0.00	0.00	295,000.00
	National Interest Test Statement This research will generate economic, commercial and social impacts to Australia by developing academic knowledge and practical pathways to move private corporations' purposes away from pure profit maximisation to a more holistic purpose; where firms can provide greater social benefit while still optimising shareholder return. While the significant potential for facilitating economic growth and job creation in Australia by enhancing social purpose within organisations and markets has been recognised, we lack knowledge on how to generate the collective action that is required to drive a purpose economy. This research is the first to not only develop tools to measure collective engagement and facilitate its emergence within and across organisations, it will also demonstrate the process through which collectively engaged actors will drive a highly robust economy; that is one that achieves the highest level of social, cultural, environmental and economic impact.							
DP210100936 Perry, Dr Conrad	Aims: This project aims to understand how people read. We will use novel mathematical methods, experimentation, brain imaging and computational modelling to adjudicate between model predictions. Significance: This project expects to develop methods to understand and test important aspects of reading. Expected outcomes: Expected outcomes are the development of novel methods for understanding complex models and the collection of data that can extend and falsify current models of reading. Benefits: These developments will significantly increase our understanding of how people read and what causes dyslexia. This work will also provide new ways to evaluate complex computational psychological models.	45,000.00	75,000.00	60,000.00	30,000.00	0.00	0.00	210,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement People who have difficulty reading tend to have poor social and economic outcomes. This is not only a problem for them, but represents a significant risk for Australia's economic development, especially because the level of literacy in Australia has declined compared to other countries in the last 10 years. A key problem in helping people with poor literacy is understanding the heterogeneity of possible problems they have and how the underlying mechanisms involved in reading could cause them. We will examine this problem using computational models, big data, informational geometry, brain imaging, behavioural experimentation and other novel methods. Using a cross-disciplinary approach will provide exceptional insights into this process that no single method could. The outcomes of this research will enable new methods that target the specific reading difficulties people have to be developed.							
DP210101849 Drew, Dr Georgina R	This project aims to understand how Australian farmers adapt to water resource limitations and governance constraints. We will address this significant challenge by identifying how social and cultural perceptions of water risk inspire farmers to create resilient management solutions in line with policy guidelines. Through ethnographic fieldwork and the analysis of historical patterns of water use, the research seeks identify the hydrosocial adaptations that enable farmers to effectively respond to change. The new knowledge will foster water risk management via the culturally appropriate tailoring of interventions. Outcomes will support the long-term viability of Australian agriculture, with relevant lessons for managing drought globally.	29,660.00	63,474.00	79,168.00	45,354.00	0.00	0.00	217,656.00
	National Interest Test Statement The mitigation of water stress is one of Australia's greatest challenges. Our research contributes to the national interest by identifying how farmers can work proactively within water governance constraints. By generating culturally appropriate strategies for water risk management to guide policy in Australia and internationally, we aim to inform long-lasting solutions that support the nation's water resilience. This project employs an innovative framework for understanding how farmers respond to water risks, with case studies drawn from viticulture and horticulture. Without the tailoring of water use to specific socio-cultural understandings and practices, policy interventions remain unacceptable for users, leading to governance risks. We will research socio-cultural water management practices and innovations—which we conceptualise as hydrosocial adaptations—to illuminate how farmers respond to water limitations and water use policies in the nation's driest state. The project provides significant benefit because failing hydrological systems cost Australia environmentally, economically and socially.							
DP210102148 Harris, Prof Hugh H	The goal of this project is to deliver a new toolkit for imaging cells at an unprecedented resolution and level of chemical detail. We will expand the capabilities of two existing, but complementary, methods: optical fluorescence microscopy with responsive probes and X-ray fluorescence imaging. Expected outcomes include improved techniques and benchmarks for visualising bacterial and mammalian cells; development of new molecules for elucidating cellular chemistry; better utilisation of valuable synchrotron resources; and greater understanding of the strengths and limitations of current microscopy workflows. Results should benefit the biotechnology sector, and may lead to improved medical, diagnostic, and bioremediation capacity.	75,000.00	150,000.00	137,500.00	62,500.00	0.00	0.00	425,000.00
	National Interest Test Statement Microscopic imaging is a cornerstone of biological research. However current methods for providing chemical data from cells are not as advanced as those providing structural information. This project will concurrently develop new tools, methods and benchmarks to provide a step-change improvement in the depth and fidelity of chemical information that can be derived from within cells and tissues. These cutting edge developments will enable Australian and international researchers to develop new understandings of biochemical processes that differ in normal vs disease physiology. The research will strengthen and expand multi-disciplinary collaborations in Adelaide, Sydney and internationally to provide an exceptional environment in which to train the next generation of researchers, and to pioneer new methods for examining complex biochemical questions. In the long term, these improved techniques may lead to patentable imaging agents, and more broadly, better diagnostic and therapeutic agents for medical and environmental problems that have a significant impact in our society.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102155 Huang, A/Prof David M	This project aims to achieve a predictive understanding of liquid transport through two-dimensional (2D) membranes driven by concentration gradients by using a combination of novel theory and computation. Membranes made from 2D nanomaterials hold great promise for many applications from desalination to power generation to chemical sensing, but the concentration-gradient-driven transport processes that underlie these applications are not well understood. The expected outcome of this project is an unprecedented quantitative understanding of the parameters that control these transport processes. This will enable predictive optimisation of 2D membranes, which will reduce the time and cost of membrane development for diverse applications.	50,000.00	115,000.00	115,000.00	50,000.00	0.00	0.00	330,000.00
	National Interest Test Statement The movement of liquid mixtures through porous membranes is fundamental to many processes with key roles in the Australian economy and society, including energy generation, energy storage, and water desalination, and to novel devices with significant medical and environmental applications, such as chemical and biological sensors. Current membranes suffer from deficiencies that new so-called 2D membranes made from atom-thick sheets of materials promise to tackle. But the performance of 2D membranes for many applications is hard to predict from their physical properties. This project aims to develop new methods to predict flows of liquid mixtures through 2D membranes, which also has important general implications for fluid flow at the surface of thicker membranes. This will benefit society and the economy by accelerating and reducing the cost of development of more effective membranes, which could lead to considerable financial and energy savings given the ubiquity of membrane applications.							
DP210102670 Yarom, Dr Yuval	This project aims to improve cybersecurity by automating the process of generating cryptographic software for smart devices. The expected outcomes are tools that automatically produce efficient cryptographic software that resists attacks. The main benefit of this project is to reduce the amount of expert labour required when developing secure software.	80,000.00	160,000.00	160,000.00	80,000.00	0.00	0.00	480,000.00
	National Interest Test Statement Smart devices are a key enabler of the smart society we live in. They are the building block which constructs smart homes, smart cars, smart grids, smart cities, and even smart governments. Due to their key roles in the society, security is of paramount importance for smart devices. Cryptography underlies the security of smart devices. It is the basic tool that ensures that data is only accessible by the legitimate parties to the communication, preventing attackers such as hackers, commercial competitors, and adversarial foreign government agencies from intercepting or modifying the information as it transits. Our proposal, "Intelligent Technologies for Smart Cryptography" will provide tools to develop secure and efficient cryptography for smart devices that will help maintain Australia's lead as an enabler and a consumer of online services, and will help us lead our modern, free, and prosperous society towards a smart future.							
DP210102828 Gilliham, Prof Matthew	This project will dissect a newly identified signalling pathway in plants that regulates plant water use and carbon gain. It will deploy multiple techniques, including novel biosensors, to understand the links between the metabolism of plants and their environmental responses. The project will build partnerships with scientists at leading international institutions for enhanced outcomes, including access to specialised equipment and upskilling of our scientists. The generation of barley with the latest gene editing techniques aims to produce a non-GM crop with the potential for enhanced root C sequestration, lower water use and improved yield, three key goals for agricultural sustainability in the face of a drying Australian climate.	99,500.00	177,000.00	155,000.00	77,500.00	0.00	0.00	509,000.00
	National Interest Test Statement Australian agriculture constitutes ~1/5 of our GDP and contributes up to 60% of our nation’s exports. In Australia, water is a major agricultural limitation, it is estimated to decrease the yield of ~30% of our crops by ~50%, with major economic ramifications. Reducing plant water use while maximising carbon gain has been proven to improve cereal yields in water-limited environments. This project will build new international linkages, train new students and create new intellectual capital in order to understand how a recently discovered signalling pathway in plants functions to alter plant water use and carbon gain. By exploiting this pathway, and the latest gene editing techniques, this project aims to create non-GM barley that uses less water and sequesters more carbon via the roots as a test of concept. Barley is Australia’s second largest cereal crop by area and underpins the Australian beer industry worth $16.5bn, nearly 1% of GDP. If successful, this technology will be transferred to our other major crops, providing a new tool for improving Australian agricultural sustainability in a drying climate.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103050 Cassey, A/Prof Phillip	This project aims to understand the complex trade in live Australian reptiles. The global pet trade is a major threat to biodiversity. This project expects to generate critical new knowledge for combatting the current and future illegal trade in Australian wildlife. Using surveillance of domestic and overseas online markets, and innovative statistical and simulation-based approaches to inform conservation decision-making, the expected outcomes of this project include an enhanced capacity to conserve native species and to monitor and disrupt the complex illegal wildlife trade. This should provide significant benefits in terms of biodiversity conservation and safeguarding Australia's unique and ecologically important native reptile species.	62,212.50	130,425.50	148,213.00	80,000.00	0.00	0.00	420,851.00
	National Interest Test Statement This project will generate new knowledge about the conservation threats to Australian reptiles from wildlife trade. The project will benefit the Australian community, who are invested in the long-term protection of Australia's unique native wildlife. Specifically, the project will inform conservation decision-makers charged with protecting at-risk species, and aid Government wildlife agencies to prioritise surveillance and enforcement actions. The project will provide critical scientific support to on-ground conservation activities for tackling illegal wildlife trade and driving behaviour change. The research will directly address Australia's 'Environmental Change' Science and Research priority, and the practical challenges of 'improved accuracy and precision in predicting and measuring the impact of environmental changes'. Key project outcomes will include: (i) sharing unique data on the conservation risk of Australian reptiles; (ii) developing innovative statistical approaches to analyse the role of wildlife trade in biodiversity decline; and (iii) improving precision in conservation action planning.							
DP210103307 Ng, A/Prof Ching Tai	This project aims to develop a novel approach for early damage detection. It relies on a systematic experimental investigation of nonlinear ultrasonic interaction between different input wave modes in the presence of damage, so as to identify optimal mode selections and operating parameters that will maximise the sensitivity to particular forms of structural damage. The effects of in-service loading on wave-mixing response, and non-contact detection suitable for hard-to-inspect surface conditions, will also be investigated. The new developments will help transform existing schedule-based maintenance practice to a condition-based maintenance paradigm, to achieve significant cost savings in maintenance.	76,135.50	147,237.00	144,176.50	73,075.00	0.00	0.00	440,624.00
	National Interest Test Statement The successful demonstration of early damage detection and diagnosis achieved in this project will provide the scientific basis for a quantum leap forward in structural integrity management of high-value assets and ageing infrastructure. The new technology will enable engineers to transition from the current practice of costly scheduled inspections to the more cost-effective approach of condition-based maintenance, thereby resulting in cost savings for Australian operators of high-value assets such as power plants and rail transport infrastructure, as well as increased competitiveness for Australian manufacturing industry. The outcomes will contribute directly to the Science and Research Priorities of Environmental Change, through "resilient urban, rural and regional infrastructure" and Advanced Manufacturing through "specialised high value-add areas such as high-performance materials, composites, alloys and polymers."							
DP210103491 Tucker, A/Prof Matthew R	This project aims to investigate how barley flowers produce cells that deliver nutrients into developing seeds. This project expects to generate new knowledge through international collaboration and technical improvements in cell biology and genetics, overcoming current methodological limitations to precisely influence seed size, shape and quality, which are traits of agricultural relevance to the Australian cereal industry. Expected outcomes include strengthened international partnerships, leveraged funding and increased knowledge of plant reproduction. This should provide significant benefits, including upskilled researchers, improved research capacity and genetic targets to optimise seed production in challenging climatic conditions.	87,566.00	183,907.50	182,518.00	86,176.50	0.00	0.00	540,168.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement Cereal crops are one of the pillars upon which Australia is built. Seed development in these crops is dependent upon coordinated inputs from multiple plant organs, tissues and the surrounding environment. This project will decode the complexity of these inputs by capitalising on unique methods and tissue-specific datasets from species such as barley, to determine how plants feed their seeds and translate resources into improved grain characters. The ability to customise grain quality impacts the food, feed and fibre sectors, and aligns with the Australian science and research priority area of “Enhanced food production”. Understanding how different inputs are translated into seeds of different sizes, shapes and quality will provide avenues to sustain and grow the $10 billion Australian seed industry, support regional communities and secure lucrative export markets, particularly in the face of variable climatic conditions.							
DP210103512 Gruetzner, Prof Frank S	Research on iconic Australian mammals has profoundly reshaped our understanding of reproductive biology and sex chromosome evolution. In this project we combine unique expertise, international collaboration and novel genetic information about Australia's unique egg-laying mammals (echidna and platypus) to investigate major aspects of reproduction. This work will address fundamental aspects of sex chromosome biology and advance our understanding of mammalian reproduction. The knowledge gained will have application in captive breeding and conservation of these extraordinary Australian mammals. The project also provides opportunity to train research students in cutting edge molecular biology and informatics.	129,969.00	266,225.00	276,201.00	139,945.00	0.00	0.00	812,340.00
	National Interest Test Statement The echidna and platypus are iconic Australian species, even featured on our coins. They are the only egg-laying mammals on our planet and have captivated scientists, artists and the general public worldwide for more than 200 years. As the oldest surviving mammal they provide unique insight into mammalian biology and evolution. In this project, we utilise resources and new genetic data that we have generated to address fundamental questions about the genetics of these extraordinary Australian species. This research will provide a better understanding of platypus and echidna biology and reproduction, which is important for conservation of these species. Both platypus and echidna are vulnerable to environmental change, including weather extremes such as drought and floods, and have been identified as priority species in the context of the recovery from this season’s devastating bushfires. New knowledge gained from this work will benefit conservation efforts and assist captive breeding programs, ensuring that these much-loved Australian mammals survive into the future.							
DP210103565 Lambert, Prof Martin F	The project aims to develop an urgently needed smart pipe fault diagnosis, characterisation and prognosis system. Analysis techniques will be used for the detailed mapping of buried pipe condition between access points using micro-sized transient pressure waves. Water assets are critical infrastructure and they consist of a network of pipes that are often old and deteriorating. The annual maintenance cost exceeds $1b per year in Australia. The outcome will be a next-generation tool that allows water utilities to move from reactive emergency repairs to proactive repair and predictive replacement. This will enable performance-driven asset management, extending asset life and replacing deteriorated high-risk pipe sections in a timely manner.	90,000.00	155,000.00	133,500.00	68,500.00	0.00	0.00	447,000.00
	National Interest Test Statement Australia’s public health and economic prosperity rely on over 162,000 km water mains. Current water asset management is reactive and buried pipe renewal programs are not adequately guided by actual detailed pipe health information. This unsustainable practice brings a major challenge: almost half of the assets, with a total value over $80b, need to be replaced in the coming three decades. The next-generation smart pipe fault diagnosis system will enable rapid assessment of the actual health of complex water networks. The proposed machine learning based pipe failure predictor will use the unprecedented pipe condition information to achieve accurate and reliable risk assessment. This will allow risk-based asset management and “just-in-time” pipe replacement. Enabling extended asset life, delayed capital investment and deliver economic benefits to water utilities and customers. Cities will see less pipe breaks, which means less interruptions 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.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103638 Burton, Prof Rachel A	This project aims to investigate the role of recently discovered plant cellulose synthase-like CslM genes and to define the polysaccharide product associated with them. Successful identification of the polysaccharide is highly likely to increase our fundamental understanding of how cell walls are made, how cells stick together or fall apart as well as facilitating the training of the next generation of cell wall biologists in challenging molecular and biochemical techniques. This new knowledge could increase our understanding of fruit ripening, and how it might be manipulated. This could have significant downstream commercial benefits if applied to breeding programs of economically important fruit such as grapes, tomatoes and strawberries.	97,500.00	197,500.00	180,000.00	80,000.00	0.00	0.00	555,000.00
	National Interest Test Statement Australian agriculture is a major sector of the economy and the production of fruit for domestic consumption and export is worth over $10 billion a year. Fruit is a highly perishable commodity and getting it to market at the perfect stage of ripeness is difficult. It is estimated that half the fruit and vegetables produced in Australia every year are wasted – at a $20 billion cost to the economy. This research aims to provide a better understanding of a major component of the cell wall in fruit, a polysaccharide called pectin, which undergoes extensive changes as fruit ripens. A better understanding of how pectin is made and broken down will provide new targets for manipulation, influencing fruit ripening and benefiting growers and processors to make Australia more globally competitive and ultimately reducing waste. This knowledge can be applied to a range of fruit including grapes, tomatoes, citrus and strawberries. But pectins are important in all plant tissues so new knowledge could also enhance plant productivity in a changing Australian climate and increase use of plant biomass as a renewable resource.							
DP210103700 Mitchell, Dr Lewis	This proposal aims to develop new mathematical and statistical methods to understand information flow in social networks. By using novel information theoretic techniques, it will create new methods to characterise social information flow in social networks. These tools will allow derivation of fundamental limits of predictability for AI methods applied to digital data. New mathematics of information flow will produce insights into social influence in online social networks. Benefits include: better understanding of how echo chambers may form in social networks, predictive models for how misinformation can spread online such as during an emergency, and a framework for intercomparison of AI methods applied to digital data on individuals.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement Modelling how social networks drive population-level change is a major challenge for understanding critically important phenomena such as viral information spread and political discourse. A critical contemporary example is the spread of misinformation in online social networks, such as during emergencies (e.g., the 2019-20 Australian bushfire season). This project will build mathematical models to enhance understanding of the connection between individual interactions and global change within social networks, including understanding how "echo chambers" might form. It will support the predictions made by these mathematical models by quantitative studies of actual information flow in the Australian online social media space. This project will improve Australia's capacity for research and ability to create impact in the emerging international field of computational social science, and develop expertise in big data analysis.							
DP210103706 Leinweber, Prof Derek B	This project aims to explore the finite-matter-density features of the relativistic field theory of the strong interactions, Quantum Chromodynamics (QCD). Drawing on national supercomputing resources, this project will undertake QCD calculations of unprecedented complexity to discover emergent phenomena in the ground-state quantum fields that form the foundation of matter. By studying their evolution under temperature and matter density and exploring their contribution to the structure of the nucleon and its excitations, the research will advance theoretical understanding and challenge experimental programs. Benefits include transferable skills in advanced analytical techniques, high-performance computing, and scientific data visualisation.	92,500.00	180,000.00	175,000.00	87,500.00	0.00	0.00	535,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement This research program in nuclear science will not only exploit the latest developments in high-performance computing (HPC) and large data-set visualisation, but will also advance capability in both fields. Industries leverage HPC and data visualisation to conduct advanced modelling, simulation, and data analytics that help optimise processes, improve quality, predict performance, accelerate innovation and even eliminate prototyping and testing. Improving 'big data' visualisation can reveal novel insights faster and more easily, and inform strategic commercial decisions. The Australian Government has recognised the importance of HPC projects such as this to Australia by their recent commitment of $70M to upgrade the National Computational Infrastructure (NCI) platform. This project will ensure Australian leadership in global initiatives to understand nuclear matter at high densities and temperatures, informing the energy-generation and defence/national-security sectors. In doing so, the project will deliver highly-skilled personnel ready to contribute to the future of Australian high-tech industries.							
DP210103744 Langridge, Prof Peter	Genetic diversity underpins crop improvement but has become increasingly narrow in our major crops. Strategies exist for mobilising simple traits (e.g. disease resistance) from wild accessions or landraces into cultivars, but there are no effective approaches for introducing complex traits, including stress tolerance or components of yield. Using barley as an important crop and a genetic model, the project aims to address this problem by applying a novel approach; partial redomestication of wild accessions by introgressing genes required for modern farming, then evaluating the resulting partially adapted germplasm in hybrids with elite cultivars. The project expects to generate new and diverse germplasm pools for breeding.	80,658.50	163,518.50	167,770.50	118,038.00	66,244.50	33,117.00	629,347.00
	National Interest Test Statement Wheat and barley represent Australia's 1st and 6th most important crops, respectively, with a gross production value of over A$5 billion. Australia has a difficult production environment due to low soil fertility, extensive land degradation and highly variable climate. These stresses are predicted to become more severe due to increasing climate extremes. There are good examples of where the introduction of new genetic variability has led to major improvements in productivity, but these have come about more through chance than the result of systematic exploration of the available genetic diversity for these crops. Revitalising the genepools available to breeders will provide new opportunities for breeding and adapting our crops to changing production environments. Easy access to new genetic diversity – the engine that drives crop improvement - will help keep our commercial breeding programs internationally competitive, deliver farmers resilient varieties and support a highly valuable rural industry.							
DP210103779 Bulone, Prof Vincent	This project aims to define mechanisms that control cell wall composition and stability in Rhizopus oryzae, a zygomycete fungus responsible for life-threatening human infections. The biochemical properties and function of vital enzymes involved in a newly discovered cell wall polysaccharide biosynthetic pathway will be determined using innovative approaches at the interface of biochemistry, microbiology, cell biology and structural biology. Expected outcomes include new knowledge on the enzymes that synthesise major fucose-based carbohydrates, to guide the future development of novel strategies for antifungal therapies. The data will also be applicable to animal protection from related zygomycete pathogens.	84,848.50	169,253.00	166,809.00	82,404.50	0.00	0.00	503,315.00
	National Interest Test Statement Fungi can cause severe and costly infections in humans, especially in immunocompromised patients and those with underlying conditions, such as diabetes. Life-threatening mycoses caused by pathogenic zygomycete fungi have limited treatment options, and often result in protracted hospital stays costing in excess of $150,000 per episode. This project will exploit our recent discovery of unusual carbohydrate polymers that constitute the major part of the fungal cell wall, essential for infection and fungal stability. Cutting-edge techniques will deliver a complete characterisation of these polymers and the enzymes that synthesise them, providing advanced fundamental knowledge that, beyond high academic impact (publications, training of researchers), will inform novel targets and strategies for improved disease control. The research addresses the Practical Challenge within the Australian Government's Health Priority by having high potential for the prevention and cure of fungal infections in humans and animals, with social and economic benefits for the health and veterinary sectors, both nationally and globally.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103919 Bayer, Prof Ralph C	This project aims to investigate under which circumstances restrictions on how often firms can change prices increase competition in an oligopoly and bring down prices. For this, we propose the use of laboratory experiments with a novel design followed by field experiments and a real price-data analysis for external validation. This study will result in both the advancement of theory describing how firms compete in dynamic oligopolies and practical policy advice on how price setting rules can be used to improve consumer welfare. This project has the potential to generate sizable benefits to Australian consumers, as the resulting policy advice would be applicable to large markets such as those for petrol, groceries and online retail.	22,437.50	48,628.00	50,883.00	24,692.50	0.00	0.00	146,641.00
	National Interest Test Statement This research project will inform policy makers in Australia about the circumstances under which regulating how often retailers can change prices can reduce consumer prices and therefore increase competitiveness and efficiency in an industry. Moreover, the insights gained from this project allow policy makers to predict in which industries technological advances that increase the ability of market participants to quickly react to competitors is likely to increase or decrease competition and with it consumer welfare. This knowledge will allow policy makers to appropriately develop rules on price-setting frequencies that improve competitiveness in Australian retail markets. More competitive markets increase total surplus through lower prices and put pressure on market participants to become more efficient.							
DP210104031 Hill, A/Prof Gary C	The project aims to use the high energy neutrinos observed by the IceCube detector at the South Pole to uncover the nature of the most energetic objects in the Universe. This project expects to find out what distant objects made the neutrinos, understand their distribution through the Universe, and see if they are also cosmic and gamma ray acceleration and production sites. Expected outcomes of this project include solving this long-standing mystery in high-energy astrophysics, development of new data analysis techniques, training new scientists, and educating the public. These should provide significant benefits to science and society, through a better educated and critical thinking workforce and public, ready to face future challenges.	77,500.00	157,500.00	160,000.00	80,000.00	0.00	0.00	475,000.00
	National Interest Test Statement This project will enhance Australia's reputation as an international leader in astrophysics, and help lead young generations into science careers, particularly in space science. By leveraging Australia's involvement in international projects in Antarctica worth over $300M, this project enables Australia to tap into global-scale teams in high energy astrophysics to study Nature's extreme phenomena in the Universe. In addition to astrophysics applications, the novel ‘big data’ analysis, simulation and statistical techniques developed and validated in this project will provide longer-term application in data-heavy Australian industry sectors such as cybersecurity, earth observation, and emerging efforts in space exploration. The project will further enhance the long record in Adelaide of providing students a diverse training environment in areas of complex data analysis, statistical methods and machine learning skills, leading to rewarding careers in high-tech industries such as defence and security, information technology, and space science - particularly important in the new era of Australia's Space Agency.							
	The University of Adelaide	1,514,987.50	3,054,668.50	3,032,739.00	1,526,185.50	66,244.50	33,117.00	9,227,942.00
University of South Australia								
DP210100116 Sullivan, A/Prof Anna S	This project aims to investigate how and why Australian schools use exclusionary practices to manage disorderly students. This project expects to generate new knowledge in the area of school discipline about the extent and impact of these practices. It will provide a detailed analysis of the political, legislative and policy frameworks that impact on exclusion rates. Expected outcomes of this project include alternative policy and practice recommendations for legislatures and education systems. This should provide significant benefits, such as reducing youth alienation from schooling; creating inclusive schools; reducing the financial burden of exclusion on individuals and governments; and improving the health and wellbeing of young people.	40,500.00	104,500.00	121,500.00	57,500.00	0.00	0.00	324,000.00

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement This project directly addresses a major social, economic and health issue across Australia, namely, the escalating number of young people being excluded from the benefits of education because of behavioural and disruptive conduct. The implications are profound not only in terms of poor educational outcomes for those concerned but associated problems of youth alienation, mental health and well-being, unemployment, crime and welfare dependency. The research seeks to create a comprehensive analysis of existing policies, legislation and regulations framing exclusionary practices and its effects. In the process, it draws on primary and secondary data sources to map the nature and extent of the problem and create an alternative set of policy and practice settings to enhance the life chances of all students.							
DP210100665 Kumar, Prof Sharad	This project aims to elucidate novel mechanisms that regulate autophagy-depdendent cell death during animal development. It will combine the power of Drosophila genetics with multidisciplinary approaches, such as proteomics, bioinformatics and cell biology. Given the conserved nature of autophagy the oucomes will provide highly topical and exciting new knowledge of broad biological significance. The project will help establishing international collaborations, enhancing Australia's competitiveness and reputation in an important area of research, and provide training of HDR students in skills across a range of areas. In the long-term the research findings may translate into improved agriculture, food production and human health outcomes.	78,500.00	162,500.00	172,500.00	88,500.00	0.00	0.00	502,000.00
	National Interest Test Statement Fundamental biological research generates essential knowledge about the physiology of plants and animals. Such knowledge is vital to societal needs, from food production to biotechnology and human well-being, as attested by several Nobel Prizes awarded to scientists who contributed to basic biological research. Among the critical cellular processes, cell survival and death are essential for organismal homeostasis. This application focuses on understanding of a new type of cell death process. Successful completion of this project will result in high-impact publications, invited presentations at international meetings, training of HDR students in cutting edge scientific research, and capability building in a highly topical research field. The outcomes have the potential to bring significant economic benefit, as defective cell death underpins many human and livestock ailments, which are an economic strain on food production and healthy ageing. This project will also generate knowledge potentially useful for insecticide development for limiting the spread of insect-transmitted diseases and pest control.							
DP210100710 Moulding, Prof Nicole T	This project will generate new knowledge about the social dimensions of childhood emotional abuse. Experiences of childhood emotional abuse are extremely common, with many affected individuals going on to face long term health problems, social marginalisation, intergenerational family violence and re-victimisation. This project will investigate how different social contexts influence childhood emotional abuse itself and the interconnected problems flowing from it that often persist over the life course. The findings of this project will increase the evidence base and inform the future development of policy and practice that aims to prevent the intergenerational transmission of violence and abuse, and improve health and social outcomes.	54,821.50	109,248.50	100,082.00	45,655.00	0.00	0.00	309,807.00
	National Interest Test Statement Childhood emotional abuse is the least researched form of child abuse and can have a devastating impact on health and increase the risks of social marginalisation, intergenerational family violence and re-victimisation. Many individuals go on to struggle with physical and mental health problems with an estimated cost of $7.6 billion annually, while lost productivity costs employers $10.9 billion per year. Better understanding of the contextual aspects of childhood emotional abuse and its impact on different groups in the community will provide an evidence base to inform future preventive, trauma-informed policy and practice targeting at risk groups. The project contributes in a cost-effective way to maximising health and social participation across the community, and to reducing the socio-economic impact of family violence and child abuse.							
DP210101226 Nichols, A/Prof Sue M	This project aims to: identify forms of digital exclusion and inclusion impacting on parents' ability to support their children's education; produce a new conceptual model of technologically mediated school-home relationships; and provide a comprehensive map of school-home connected digital tools and services. Combining a detailed survey of 500 school leaders with innovative networked case studies across three schools and 18 families, this will be the first national study to comprehensively describe and analyse home-school partnerships in the digital age. It will provide policy and educational leadership with a roadmap for addressing barriers to digital inclusion, as schools advance their integration of digital platforms.	42,357.50	86,479.50	83,230.50	39,108.50	0.00	0.00	251,176.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement This project will fill a critical gap in knowledge about how Australian parents are experiencing digitally mediated interactivity in their children's education at a time of rapid change in digital platforms and tools used by schools and marketed by enterprises. In 2019 the Alice Springs Declaration committed all state education systems to the nation's children becoming "productive and informed users of technology … able to adapt to emerging technologies into the future". Australian parents are expected to support children's engagement in digital learning; providing digital tools and access and interpret digital data on their children's progress and outcomes. Yet, Australia has a serious problem with inequity in families' digital resourcing and capabilities according to the Digital Inclusion Index report (Thomas et al, 2019). This project, in revealing how parents in different social circumstances, served by differently resourced schools, manage their digital engagement, will provide the basis for guidance on combatting inequities and building on strengths.							
DP210102246 Hajek, Dr Bronwyn H	This project aims to develop a new mathematical model to predict the pattern formation of a new class of permanent lubricants. Ionic liquids are conductive and do not evaporate, creating a unique opportunity to develop such coatings. These thin films form patterns where the pattern type (patches, stripes or holes) depends on the liquid/surface interaction. Only some patterns result in good lubrication; current limited understanding of the pattern formation process hampers selection of a good lubricant for a chosen material. Current mathematical approaches are computationally expensive and time consuming. The new model expected from this project would provide a cheap, fast and reliable alternative for screening suitable liquid/surface pairs.	35,000.00	77,500.00	77,500.00	35,000.00	0.00	0.00	225,000.00
	National Interest Test Statement The new mathematical model expected from this project will aid our understanding and prediction of the behaviour of novel smart lubricants, composed of permanent ultrathin films. The outcome will be a simple, cost-effective, fast and reliable mathematical tool to identify new candidates for lubrication of challenging mechanical contacts. This will reduce the need for expensive and time-consuming experiments. These application specific lubricating layers will have particular impact in the fields of advanced manufacturing, smart coatings and aerospace applications, by increasing energy recovery from renewable resources, preventing mechanical failures, reducing maintenance costs and decreasing energy consumption. This represents real economic benefits to Australia, with potential cost savings due to proper lubrication estimated at 1% of Gross National Product, as well as environmental benefits due to increased energy efficiency and decreased material wastage.							
DP210103351 Harvey, Prof Natasha L	Aims: This project aims to investigate how molecular switches known as transcription factors, work together to turn genes on or off to program cell identity during development. Significance: This project expects to generate new knowledge in the area of genetics and developmental biology using collaborative, cutting edge technologies. Outcomes: Expected outcomes of this project include the identification of new genes important for programming the identity of cells that comprise our blood vessels, lymphatic vessels and circulating blood cells. Benefits: Data generated will underpin the development of approaches to program/reprogram stem cells to produce mature cells for transplantation or tissue engineering purposes ex vivo.	93,065.00	201,699.00	213,452.50	104,818.50	0.00	0.00	613,035.00
	National Interest Test Statement This project will generate new knowledge crucial to understanding how the identity of each cell type within an organism is programmed during the development of the embryo, filling a fundamental knowledge gap. This project builds upon our exciting discovery of a part of the genetic code that binds specific molecular switches, turning genes on or off. Disruption of these switches results in a change in cell identity, from cells that normally build our vessel walls to cells that circulate in our blood. These insights will inform the development of novel stem cell biology and tissue engineering technologies, ultimately yielding economic benefits for Australia. Additionally, new, interdisciplinary, national and international collaborative partnerships will be forged, building Australia's research capacity and international profile. Furthermore, this project will enable the world class training of postgraduate students and research fellows in state-of-the-art technologies, building Australia's skill base and international research standing.							
	University of South Australia	344,244.00	741,927.00	768,265.00	370,582.00	0.00	0.00	2,225,018.00
	South Australia	2,166,411.50	4,399,827.50	4,356,700.50	2,156,412.00	66,244.50	33,117.00	13,178,713.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
Tasmania								
University of Tasmania								
DP210100025 Bissember, Dr Alexander C	This project aims to develop new catalytic synthetic reactions for the rapid and more direct functionalisation of organic compounds under mild conditions with the use of visible light. An integrated experimental and computational approach will be used to design potent visible-light photocatalysts that retain the advantages of standard photoredox catalysis but with the added ability to intercept and, thus control, reactive intermediates in situ. This will enable the control of stereochemistry in photoredox reactions – not possible with standard catalysts - and establish other useful synthetic transformations. These strategies will make it easier to prepare valuable classes of organic molecules – efficiently, safely, and cost-effectively.	85,000.00	170,000.00	170,000.00	110,000.00	25,000.00	0.00	560,000.00
	National Interest Test Statement Environmental sustainability is a major concern in the modern world and developing more sustainable processes represents a continuing challenge for the chemical industry and indeed for the global economy. The limited availability (and increased costs) of raw materials combined with environmental concerns, demands that chemists rethink traditional synthetic strategies and this adjustment has, in part, led to the advent of more sophisticated and efficient catalytic processes that feature reduced waste streams. This project will establish new catalytic reactions for the more efficient and environmentally-benign synthesis of valuable organic compounds using an abundant, greenhouse-friendly and renewable resource – light. Original methods will be established that allow for the direct and selective preparation of important organic molecules with relevance to the pharmaceutical and agrochemical industries. This research aligns with the Australian Government's Science and Research Priority: Advanced Manufacturing.							
DP210100604 Lea, A/Prof Mary-Anne	The ecosystem of the Southern Ocean is extremely complex, and understanding its response to rapid climate change is challenging. The aim of the project is to use changes in the behaviour of marine predators to provide new measures of integrated changes in eastern Antarctic ecosystems throughout the winter. With novel combinations of electronic tagging, natural biogeochemical markers, and simulation modelling, the project expects to reconstruct changes in animal behaviour in response to changes in the environment. The data is anticipated to explain ongoing large-scale shifts in Southern Ocean ecosystems, providing information needed to underpin future management and adaptation strategies.	97,000.00	187,000.00	151,500.00	61,500.00	0.00	0.00	497,000.00
	National Interest Test Statement The outcomes will reinforce Australia's position as a key contributor to the science-based management of Antarctic waters. Our advances will enable observation and mapping of animal behaviour and changes to the Southern Ocean environment, allowing us to detect large-scale changes in the ecosystem, and to better understand how food webs respond to these changes. This will help to guide the selection of precautionary catch limits for international fisheries – research-based findings that are urgently needed for the rapidly expanding commercial fisheries in the region. Australia's finfish catches in the region are currently estimated to be worth > $75M per annum. By integrating unique data streams and new predictive modelling methods, the project will enable greater precision in predicting the influence of environmental variability on Southern Ocean food web structure. This will enhance our capacity to fish these regions sustainably while maintaining ecosystem resilience.							
DP210100643 Phillips, Dr Helen E	This project aims to collect unprecedented observations and develop high resolution model simulations to examine changes in the Indonesian Throughflow (ITF) north of Australia. This project expects to develop new knowledge of ocean-atmosphere interactions along the path of the ITF from the Pacific to the Indian Ocean, which are the powerhouse that drives changes in winds and rainfall around Australia and the entire Indo-Pacific region. Expected outcomes include a 1000-fold increase in the observations of mixing in the Indonesian seas and new understanding of the ocean-atmosphere processes that control water property change along the ITF. This should lead to strong improvement in the skill of climate forecast models in the Australian region.	133,989.50	244,153.50	191,329.50	137,943.50	56,778.00	0.00	764,194.00

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement The Indonesian Seas are known to influence Australian weather and climate variability, yet regional and global climate models struggle to simulate this complex region. Seasonal-to-decadal prediction and longer term projection models exhibit persistent systematic biases there, limiting provision of reliable forecasts. This project will enhance our understanding of ocean-atmosphere coupling, to be incorporated into coupled models to improve weather and climate predictions to Australia and the region. We address identified science and research priorities for Australia, including Soil and Water, and Environmental Change research priorities. We also address key recommendations of the National Marine Science Plan (2015-2025): provide baseline and long-term monitoring to comprehensively assess the Australian marine estate; facilitate coordinated national studies to enable understanding of development and climate change impacts; provide data to improve reliability of marine forecasts; provide data to support decision-making; and provide training opportunities to the next generation of marine scientists.							
DP210100834 Reading, Prof Anya M	This work aims to establish a way of detecting change in the great outlet glaciers of East Antarctica by analysing the small vibrations made by moving water or by cracking and sliding ice. Change in these glaciers is very significant because they hold back over 10 m of potential future sea level rise, but many melt and movement processes are hidden from satellite view. Expected outcomes include a semi-automated approach for remote area glacier monitoring using seismic signals, and recommendations for cost-effective future instrument deployments in key areas of East Antarctica. The new capability will be world-leading and pragmatic, enabling the risks of accelerated future coastal inundation affecting Australia to be better anticipated.	101,281.50	207,757.00	209,853.50	103,378.00	0.00	0.00	622,270.00
	National Interest Test Statement The proposed method development will have the medium- and long-term benefit (5 years and ongoing) of better predicting episodes of sea level rise, and possible sudden accelerations in sea level rise, impacting Australia. It will thus inform better preparedness for global change. In the 1-3 year time frame, through this project, a new world-leading capability will be developed that uses data-driven computational techniques to detect active processes, and pivotal process change, in Antarctic glaciers. Small seismic noise signals caused by running melt water or ice moving over rock (akin to the 'snickometer' waves seen on televised cricket matches when the ball grazes the edge of the bat) will be analysed to reveal hidden motion that couldn't otherwise be detected. The project will also result in pragmatic recommendations for cost-effective glacier monitoring in areas of Australian operation in East Antarctica. The new methods could also be applied to end-use cases such as monitoring landslips or geotechnical applications.							
DP210101466 Breadmore, Prof Michael	This proposal aims to understand the chemical and physical properties governing the transport of ions into and within advanced extracting polymeric materials, known as polymer inclusion membranes, under the influence of an applied voltage. These membranes are dry-to-touch and represent a new and potentially powerful analytical platform for environmental, medical and industry sample preparation. By understanding the transport mechanism, new membranes will be developed, capable of purifying and concentrating diverse targets chemicals from liquid and solid samples. These processes can take place during sample transportation to a centralised laboratory thus simplifying and streamlining analysis upon arrival to decrease drastically its costs.	68,500.00	163,500.00	190,000.00	95,000.00	0.00	0.00	517,000.00
	National Interest Test Statement Australia is a large and sparse country and it takes time to collect water, food and clinical samples and to send them to a laboratory for analysis - time that is not effectively utilised delaying the speed with which chemical information can be obtained. We have demonstrated the efficient use of this transport time by purifying an alkaloid from a single drop of blood over 36 hr while being sent to the laboratory through the post. The proposed sample pretreatment platform exploits the dry-to-touch state of a new type of membrane - a polymer inclusion membrane - meaning that there is no risk at spilling fluids, no need of sophisticated engineering to avoid spills and we can directly sample surfaces and solid samples. This unprecedented capability may underpin a new generation of high throughput cost effective screening of hundreds and thousands of samples collected from around Australia to allow us to understand the chemicals that are around us. This would impact beneficially on the country's health and well-being and the protection of our environment.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102296 McDonald, Prof Jan	This project will expand Australia's climate response options by developing a governance framework for research, development and deployment of solar radiation management. These emerging technologies seek to reflect part of the sun's energy from the earth to reduce climate change impacts. Through case studies of key proposals, marine cloud brightening and stratospheric aerosol injection, the project aims to develop national laws and research policies to responsibly govern research, development and deployment in Australia. This will deliver benefits for Australian governments, civil society, communities and researchers by managing risks and building public confidence in these technologies and provide a best practice model for other countries.	33,502.50	82,902.50	89,900.00	40,500.00	0.00	0.00	246,805.00
	National Interest Test Statement This project will give Australian governments and civil society a new strategy for dealing with the heatwaves,drought, bushfires and other climate change impacts experienced this summer. Reducing national emissions is essential but cannot prevent locked-in climate impacts; adaptation is also important but is costly and less effective as temperatures rise. Research on Solar Radiation Management expands Australia's options in responding to climate change over the next decade. This can provide Australian governments with local or regional actions to lessen the effects of climate change. But solar radiation management is controversial. Experience from the United States and United Kingdom shows that specific governance of research and development is needed to manage risks and build public confidence ahead of deployment. This project will provide a blueprint for governance of solar radiation management research, development and deployment, enable Australia to contribute to the development of governance arrangements in our region and internationally.							
DP210102493 Bolch, A/Prof Christopher J	Current phytoplankton ecological theory is derived primarily from lab cultures, but in nature phytoplankton have unique microbiomes that support their growth and ongoing ocean primary production. This project aims to establish the structure and function of these natural microbiomes, and how they contribute to seafood poisoning caused by bacteria and algal biotoxins. Using advanced flow cytometry with single-cell microbial profiling, we will sample nano-scale plankton microbiomes and synthetic microbiome phylogenomics to the link between microbiomes and seafood poisoning outbreaks. The outcomes will underpin enhanced predictive modelling of seafood risk to ensure the safety and export security of Australia's $2 billion seafood industry.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
	National Interest Test Statement Phytoplankton are the base of all marine ecosystems and contribute >50% of global photosynthesis and carbon cycling that stabilizes global climate. Both lab and field studies show phytoplankton rely on healthy microbiomes for growth and that imbalanced microbiomes result in death/disease, lead to human illness caused by marine bacteria or harmful algal blooms that poison seafood consumers. We know almost nothing about the bacteria performing this critical role in the ocean because microbiomes on microscopic plankton cells are difficult to sample at their nano-litre scale. This research combines advanced flow cytometry, single-cell molecular profiling and synthetic microbiomes to determine which maintain a productive, safe plankton community, and which lead to seafood poisoning from marine bacteria and biotoxins costing >$1 billion in global impact on public health and seafood production. Project outcomes will support better prediction and management of seafood poisoning outbreaks, improve seafood safety for consumers, and ensure on-going export security of Australia's $2 billion seafood industry.							
DP210102928 Breadmore, Prof Michael	This project aims to address the barriers faced by 3D printing in chemistry. 3D printing can create bespoke 3D structures within a fraction of time and cost compared to traditional fabrication. However, its scope in chemistry has been limited by the poor chemical robustness, biotoxicity and low resolution of the 3D printed components. Hence, this project will develop novel gold coating techniques and explore high-resolution 3D printing to overcome these challenges. The project should generate commercially significant products (analytical platforms), technology (gold coating) and patents. The developed systems and technologies will address Australian research challenges in advanced manufacturing and enable on-site environmental monitoring.	80,000.00	105,000.00	50,000.00	45,000.00	20,000.00	0.00	300,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	3D printing is a fast growing and disruptive technology that has the potential to impact across all areas of society. This proposal will develop a new approach to coat 3D printed parts with a solvent and biocompatible layer that will broaden the applications of these parts in chemistry and may facilitate the fabrication of new point-of-collection devices for measuring environmental pollutants in water. Our approach is highly scalable, making it suitable for large volume manufacturing addressing one of the major impediments to the commercial development of microfluidic portable chemical analysis technology. We have the potential to provide commercial opportunity to Australian industry through commercialisation of this unique and patent-able approach, through to environmental and social benefits from the application of this chemical analysis systems created with our unique coating system to protect the environment and to maintain the highest possible quality of our precious water resources.							
	University of Tasmania	674,273.50	1,310,313.00	1,202,583.00	668,321.50	101,778.00	0.00	3,957,269.00
	Tasmania	674,273.50	1,310,313.00	1,202,583.00	668,321.50	101,778.00	0.00	3,957,269.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
Victoria								
Deakin University								
DP210100227 Beliakov, Prof Gleb	This project addresses a key issue in automated decision making: explaining how a decision was reached by a computer system to its users. Its aim is to progress towards a new generation of explainable decision models, which would match the performance of current black-box systems while at the same time allow for transparency and detailed interpretation of the underlying logic. This project expects to generate new knowledge in modelling interdependencies of decision criteria using recent advances in the theory of capacities. The expected outcomes are sophisticated but tractable models in which mutual dependencies of decision rules and criteria are treated explicitly and can be thoroughly evaluated.	57,643.50	117,097.00	121,224.00	61,770.50	0.00	0.00	357,735.00
	National Interest Test Statement The protection of citizens' data privacy and strengthening their rights for detailed explanations of automated decisions affecting their daily lives has been already legislated in the European Union and will soon be part of the Australian legislative framework. Explainable artificial intelligence aims at providing decision models that can be examined, understood and trusted by people. This project will facilitate progress towards explainable artificial intelligence by producing understandable and sophisticated decision models that can match the performance of black-box systems. It will provide the mathematical fundamentals to handle interactions between decision criteria and decision rules, and explicitly quantify them to enhance systems' interpretability. It will benefit society by enhancing the transparency and trustworthiness of many computerised decision tools employed in manufacturing, banking, insurance, welfare, education and defense.							
DP210100256 Gomis Porqueras, Prof Pedro	In response to the global financial crisis, the world's major central banks cut their rates to near zero and implemented untested unconventional monetary policies, significantly expanding the size and composition of their balance sheets. More than a decade later, the Reserve Bank of Australia is considering similar balance sheet policies. This proposal aims to develop various frameworks that can be used to simulate and evaluate when and how to eventually undo unconventional monetary policies in order to prevent a prolonged recession. Thus this research proposal will contribute to the current Australian monetary policy debate while providing some insights on how best to implement such policies, improving the living standards of Australians.	25,518.50	49,181.50	48,560.50	24,897.50	0.00	0.00	148,158.00
	National Interest Test Statement To stimulate the Australian economy, the Reserve Bank cut the cash rate three times in 2019, reaching to a record low of 0.75%. These measures have not delivered the desired effects. As a result, the Governor has hinted the possibility of considering quantitative easing as a way to reactivate the economy. Given the current Australian fiscal challenges, being able to identify the intended financial and macroeconomic effects of changing the composition and size of the central bank's balance and highlight the potential unintended consequences of implementing quantitative easing is critically important. By providing theoretical frameworks where different central bank's balance sheet policies can be simulated and assessed, this research proposal will contribute to the current Australian monetary policy debate. This proposal can shed some light on the timeliness of such policy response, when negative shocks hit the economy (such as the coronavirus), as to prevent a prolonged recession so that education, investment, and economic opportunities are less likely to suffer.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210100278 Slaveski, Dr Filip	This project aims to increase our understanding of the relationship between drought and famine by analysing the most recent, though least understood famine in Soviet and Modern European History. This famine followed a massive drought in the summer of 1946 across the western Soviet Union and led to the deaths of at least one million people. This research is timely given the growing threats to food security, markets and trade posed by the increasing incidence of severe and enduring drought in Australia and globally. The expected outcome of this research is to produce new historical knowledge with contemporary application to better inform policy approaches with the expected benefit of reducing the threat of food crises emerging from drought.	52,961.00	93,551.00	69,805.00	29,215.00	0.00	0.00	245,532.00
	National Interest Test Statement This project will produce new historical knowledge on how droughts potentially develop into food crises and famines and what roles might be played by natural conditions along with human decision making in this process. This project is timely because the growing threats to food security, markets and trade posed by the increasing incidence of severe and enduring drought in Australia and globally underscore the urgency of its research into the most important and recent, though least well-known, nexus between drought and famine in European history. The new historical knowledge produced by this project will have contemporary application in informing current policy making responses to the growing challenges that drought poses to food supply and trade in Australia, its region, and globally. This improved understanding will help position Australia at the cutting edge of drought and famine research to adopt and advise on policy responses with the expected benefit to the Australian taxpayer of reaping the significant economic, commercial and environmental advantages of better managing drought.							
DP210100476 Peng, Dr Bin	This project aims to tackle important challenges in time trend modelling by taking advantage of panel data structures. This project expects to propose flexible models in time trend modelling to retrieve reliable inference. The expected outcomes include innovative econometric models and methods that have a wide range of applications, and are particularly suited for empirical problems within large and complex systems. This will provide significant benefits to all fields in which data displays any form of trending behaviour. The proposed model is used to evaluate the economic consequences of climate change and global housing market contagion, which provide strong evidence-based insights to the environmental and economic policies in Australia.	57,500.00	121,000.00	99,000.00	35,500.00	0.00	0.00	313,000.00
	National Interest Test Statement Time trends are widely observed in many time series data from different fields. This project aims to develop flexible and innovative econometric models and methodologies that can be used to identify and analyse the impacts of time trends in a variety of data sets, particularly in data with a panel structure. This project expects to advance economic knowledge in time trend modelling using new and innovative techniques. These new econometric models and methods have a wide range of applications, and are particularly suited for empirical problems within large and complex economic and social systems. The proposed modelling framework will be applied to two empirical questions: (1) the economic consequences of climate change; and (2) the macro-financial implications of global housing market contagion. These two applications will provide strong evidence-based insights to improve environmental and economic policies in Australia.							
DP210100482 Li, A/Prof Jingliang	This project aims to create nano-fibrous active thin films with high charge mobility for organic photovoltaic (OPV) devices, using a method inspired by molecular gelation. The significance of this project is that it addresses a major bottleneck, i.e. poor charge generation and transport, that limits the efficiency of OPV devices. The outcomes will provide insights into the crucial factors that affect the self-assembly of organic semiconducting materials, and the influences of nano-fibrous structure on the charge mobility and efficiency of an OPV device. The outcomes will greatly facilitate the development of highly efficient, lightweight and low-cost solar energy harvesting devices to reduce our carbon footprint.	60,000.00	120,000.00	110,000.00	50,000.00	0.00	0.00	340,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Increasing the use of green energy is urgently needed to address the global energy crisis and global warming.The latter has led to more frequent occurrence of extreme weather that brought disasters such as the recent severe bushfires to Australia. Organic solar cells (OSCs) have the advantage of being lightweight, low cost and having greater physical flexibility, compared to its inorganic counterparts. However, their low efficiency limits their applications. This project brings together scientists in materials science, organic synthesis and device physics to address this problem.The outcomes of this project will provide significant knowledge base to facilitate the manufacturing of high efficiency organic solar cells to meet the huge market demand for flexible solar energy harvesting devices, which will bring about significant economic benefits to Australia. It will also have significant environmental benefits, as the increase in use of green energy reduces our carbon footprint.							
DP210100838 Lin, Prof Tong	This project aims to acquire new knowledge about the preparation of flexible polymer membranes that can convert mechanical energy into electricity (“piezoelectric” conversion) stably at high temperature (e.g. 200-500 °C). This will solve the current problem where only inorganic ceramic materials can be used for high-temperature piezoelectric conversion. The expected outcomes include a new approach to prepare polymer membranes capable of high-temperature piezoelectric conversion using an electrostatic spinning technology. The new breakthrough materials will not only enhance performance and reliability at high temperature, but also offer novel applications in diverse fields such as “smart” protective clothing for firefighters.	49,489.00	96,028.00	89,448.00	42,909.00	0.00	0.00	277,874.00
	National Interest Test Statement							
	The new knowledge generated by this project will be very useful for designing advanced piezoelectric polymer materials (polymers that can convert mechanical energy into electricity). It will lead to new technology to produce high-performance piezoelectric polymers that have excellent mechanical flexibility, high-temperature resistance, and strong piezoelectricity. These breakthrough materials will boost the development of next-generation high-temperature piezoelectric devices for a broad range of applications, such as “smart” protective clothing to enhance personal protection for firefighters and peoples whose works involve hot temperature heat, advanced energy harvesters to convert high-speed mechanical vibrations and noise pollution into electrical power, and acoustic imaging for geological/marine exploration, non-destructive testing of industrial materials and medical diagnosis. These will promote the development of local industry and scientific research, bringing economic and social benefit.							
DP210101172 Forsyth, Prof Maria	This project aims to deliver a high specific energy, ambient temperature sodium metal battery that is more sustainable, safer and better performing than existing technologies. Innovative chemistry will be used to replace the current flammable and toxic organic solvent-based systems, while novel tools and capabilities will be forged to retain Australian leadership in this sector. These advances will provide a technology and materials platform to generate and support emerging energy storage industries in Australia. It will strengthen international collaborations with leading research teams and provide opportunities and training for the next generation of energy storage research leaders in both academia and industry.	93,126.50	206,614.00	232,454.50	118,967.00	0.00	0.00	651,162.00
	National Interest Test Statement							
	This project directly addresses the "Energy" research priority and the research challenge "New clean energy sources and storage technologies that are efficient, cost-effective and reliable." In the context of global concerns about the depletion of fossil energy resources and climate change, the Australian Government introduced a Mandatory Renewable Energy Target (MERT) program with the goal of increasing uptake of renewable energy. The proposed project addresses the nationally and internationally pressing need for clean and sustainable energy by developing battery technologies based on sodium, a safer, more sustainable and greener alternative technology. This project will provide the fundamental knowledge, training and intellectual property that will foster an emerging sodium battery sector in Australia and will ensure that Australian researchers remain in the driving seat of this growing market. Such technologies will also bolster our battery materials resource sector through adding value to nickel, manganese and vanadium-based minerals.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101238 Buchanan, Prof Katherine L	It has long been recognised that animals perceive environmental information before they are born. This project will test for the first time whether such avian communication systems rely on vibrations. We will test the hypothesis that cryptic communication using rhythmic vibration, is essential for embryonic birds to sense parental cues regarding rising temperatures, by measuring neural control in adults, as well as embryonic perception and response. By experimentally manipulating family communication we will demonstrate the potential for prenatal vibrations to alter developmental outcomes, enriching our understanding of avian sensory development.These data are important for the commercial poultry industry and for captive breeding programs.	128,319.50	213,241.50	84,922.00	0.00	0.00	0.00	426,483.00
	National Interest Test Statement On our warming planet, it is essential to develop an understanding of how Australian fauna may adapt rapidly to the thermal extremes which are predicted to become more intense. Our project seeks to determine the mechanisms Australian birds may use to develop embryonic resilience to thermal stress. Understanding how embryonic birds perceive signals relating the thermal stress and in particular their ability to perceive rhythmic vibrations, will enrich our understanding of the processes underlying the development of the brain and sensory systems. But, such demonstration would also have important practical implications for assessing the impacts of environmental noise on developing wild birds. This is particularly relevant for future environmental impact assessments which address whether wild animals are detrimentally affected by vibration pollution, through anthropogenic noise (e.g. construction, mining). Demonstrating that vibrational communication is important for avian embryos also has important ramifications for the commercial poultry industry, as well as for captive threatened species breeding programs.							
DP210101269 Pringle, Prof Jennifer M	This project aims to develop new materials designed to possess optimum properties for targeted clean energy technologies. By the design of specific ion chemistries, we aim to produce materials that absorb large amounts of thermal energy, as needed in energy storage and refrigeration applications. Their large internal free volume will offer unique properties for energy-consuming gas separation applications. Expected outcomes from the project include (i) fundamental understanding of ion design, (ii) a suite of new materials with advantageous properties for energy application. The expected benefits include advancement of technologies that support renewable energy storage and a reduction in energy costs and harmful emissions from refrigeration.	77,500.00	158,000.00	157,500.00	77,000.00	0.00	0.00	470,000.00
	National Interest Test Statement Australia is very vulnerable to the effects of climate change and therefore it is crucial to find cleaner and more efficient methods for storing energy from renewable sources. It would also be of great benefit to develop more environmentally friendly ways to meet the demand for power-hungry processes such as refrigeration and air conditioning. The project aims to benefit Australia by producing new materials with optimum performance in clean energy technologies, specifically: for thermal energy storage, for environmentally friendly refrigeration and for the reduction of CO2 emissions. Environmental benefits include developing an inexpensive way to store renewable energy from the sun and wind, thereby reducing Australia's carbon emissions. Commercial benefits include the development of new technologies for energy storage and refrigeration (which has a massive environmental footprint) that would allow new Australian businesses to be at the forefront of these substantial emerging markets. The project will also provide training in the important area of materials development and sustainable energy.							
DP210101465 Nahavandi, Prof Saeid	This research project aims to propose a novel framework for developing uncertainty-aware autonomous systems using deep learning. There are fundamental gaps in our knowledge of deep uncertainty quantification and its application for risk-aware decision making. Novel algorithms will be proposed to reliably generate deep uncertainty estimates with low computational overhead. These estimates will be then exploited by safety-critical systems such as autonomous robots to identify risky actions and avoid catastrophise. Developed algorithms will be implemented on an autonomous robotic system to make it averse to uncertainties. The outcomes will greatly increase reliable telerobotic applications in mining, manufacturing, defence, and health.	72,500.00	148,500.00	154,000.00	78,000.00	0.00	0.00	453,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement The project aims to provide novel approaches to address fundamental shortcomings to quantify and manage risks associated with applications of artificial intelligence techniques in safety-critical applications. The innovative algorithms developed in this project can be applied across the advanced manufacturing sector including that of telerobotics. Such cutting-edge technology will place Australia at the forefront of autonomous telerobotic system design, benefitting a number of sectors involving safety critical applications such as mining, undersea exploration, material handling, medical procedures and search and rescue operations. Australia will be well placed to lead the world in the design and manufacture of autonomous telerobotic systems, an industry estimated to be worth $18 billion in the next four years. This research project will thus benefit Australia in both a commercial and economic sense, and enhancing Australia's positon as a leading advanced manufacturing economy.							
DP210101983 Thomas, Prof Samantha L	This project aims to provide new and informative qualitative data aimed at preventing and reducing children's exposure to gambling advertising, promotion and sponsorship (GAPS) in sport. It uses a Commercial Determinants of Health Framework which investigates the impact of industry mechanisms on health outcomes. It explores this issue from three perspectives - children; sporting organisations; and policy makers. The project will have significant policy benefits by providing important evidence about the impact of gambling industry marketing strategies within sport, the decision making processes associated with gambling policy, and identifying leverage points for improving strategies to prevent GAPS from having a negative impact on children.	61,000.00	122,000.00	81,000.00	20,000.00	0.00	0.00	284,000.00
	National Interest Test Statement Harmful gambling is linked to Australia's most pressing social problems, including financial difficulties, homelessness, relationship breakdown, criminality, and family violence. While there have been efforts to strengthen consumer protection frameworks for adults who engage in gambling, there has been very limited focus on prevention strategies that may significantly reduce children's intentions to gamble. Research from Tobacco Control demonstrated that comprehensive policies addressing advertising, promotion, and sponsorship were instrumental in preventing young people from taking up smoking and denomalising tobacco use. Given recent research suggesting that three quarters of young sport fans perceive that gambling is a normal or common part of sport because of the marketing they see, this project contributes to Australia's national interest by identifying strategies aimed at preventing and monitoring this emerging threat for children.							
DP210102254 Lowe, Prof David M	This project aims to determine what the concept of national security has meant to Australians since 1901, and how its meanings have changed over time. Rather than relying exclusively on the role of speeches, policy statements and crisis moments, it enhances our understanding of national security in the Australian setting by considering how broader popular understandings were formed and interacted with political and policy prescriptions. This history takes into account the roles of changing federal bureaucracies and agencies, and the practices of security. Outcomes of the project will benefit national security policy by better connecting the Canberra policy-making community with the security concerns of the broader Australian public.	27,862.00	74,415.00	83,814.50	37,261.50	0.00	0.00	223,353.00
	National Interest Test Statement This project will result in social and economic benefits from strengthened national security policy. It will improve social cohesion by providing greater context to important debates over the balance between government regulation in the name of national security and individual freedoms. Democratic processes will be strengthened by greater understanding of how shifting conceptions of national security have determined the allocation of state resources and elevated certain concerns and priorities over others. There are dangers in an approach to national security that is too shaped by the aftermath of 9/11 or beholden to specific interests, at the expense of understanding the broader conceptions and concerns about security in Australia. By revealing the deeper roots of national security, this history will provide a basis for more informed and holistic policy making. It will offer insights into the rising challenge of cyber security and the ongoing social, cultural and economic ways in which policy makers and the wider population can work constructively in order for Australians to feel collectively secure.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102791 Backholer, A/Prof Kathryn	We aim to generate evidence on the influence of price promotions on foods and beverages considered to be of concern for human and planetary health. We further aim to identify if, and how, policies can be designed to reduce these types of price promotions and understand the feasibility and acceptability of doing so, from a range of perspectives.The significance of this project is substantial - unhealthy diets are the leading cause of disease and death and unhealthy foods account for >30% of the food-related environmental footprint. By understanding if, and how, this novel policy target can be designed to improve population food choices, this project will ultimately deliver benefits for human and planetary through improved dietary choices.	49,000.00	127,500.00	128,500.00	50,000.00	0.00	0.00	355,000.00
	National Interest Test Statement Dietary factors are the leading contributor to the healthcare burden in Australia and globally, and are key drivers of environmental degradation. The social and economic implications for individuals, families, communities and societies are substantial, with obesity alone (a key consequence of sub-optimal dietary intake) estimated at costing >$8 billion/year. Food and beverage price promotions are a powerful but neglected potential driver of dietary choices across the population. In this project, we will generate evidence on the influence of, and behavioural response to, price promotions on foods and beverages considered to be of concern for human and planetary health. We will identify if, and how, policies can be used to reduce these types of price promotions and understand the feasibility and acceptability of doing so from a range of perspectives. In doing so, this project will support effective and equitable policy action that leads to improved population food choices. Through a reduced diet-related healthcare burden the project will ultimately lead to cost-savings for individuals, families and societies.							
DP210102798 Venkatesh, Prof Svetha	This project aims to discover new ways to verify whether decisions made by Artificial Intelligence and Machine Learning algorithms are as per the specifications set by their designers and/or regulatory bodies. The project also provides new methods to align algorithm decisions when they are found to be non-abiding. The outcomes will include new machine learning theories and frameworks for algorithmic assurance. The significance of the project is that it will offer a crucial platform for certifying algorithms and thus benefit society and businesses in deciding the right Artificial Intelligence algorithms.	59,000.00	119,000.00	121,500.00	61,500.00	0.00	0.00	361,000.00
	National Interest Test Statement The use of Artificial Intelligence (AI) algorithms is widespread in Australia e.g. risk prediction in healthcare, portfolio management, and product recommendations in e-commerce. AI algorithms are black-box in nature and we do not know if they behave as intended. Our project takes an important step towards verifying AI algorithms. The specific benefits are: Economic: Australian organisations already use AI algorithms to manage/grow their businesses. Our project will benefit the Australian economy by assuring businesses are indeed getting the intended benefits from AI Algorithms. Commercial: Our methods have potential to become a foundation for a start-up that certifies algorithms and creates a trusted marketplace for buying and selling algorithms. Australia can be a world leader in this still nascent but an important sector. Social/Cultural: The algorithms trained from data acquired internationally may be biased by non-Australian policies, values and cultures. Our methods can align them better in an Australian context and thus improve the confidence in using AI algorithms for social matters.							
	Deakin University	871,420.00	1,766,128.00	1,581,728.50	687,020.50	0.00	0.00	4,906,297.00
La Trobe University								
DP210100673 Heras, A/Prof Begoña	This research aims to use interdisciplinary approaches to advance fundamental knowledge on bacterial aggregates and biofilms. These bacterial clusters are a significant problem as they have extraordinary resistance to disinfectants and antibiotics, and currently no effective methods are available to disrupt them. The expected outcomes of this project are to dissect how autotransporters, the most common group of bacterial cell-surface proteins, promote aggregation and biofilm formation, and to develop inhibitors that prevent the formation of these damaging bacterial clusters. Ultimately, this new knowledge will help address the increasing economic and social burden of industrial, environmental and biomedical biofilms.	73,325.50	148,151.00	149,651.00	74,825.50	0.00	0.00	445,953.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Bacterial aggregates and biofilms are a global problem. These bacterial clusters cause corrosion and biofouling in plumbing, heating and ventilation systems, equipment and machinery, and result in important economic losses to many industries (biocorrosion alone costs over US$440 billion worldwide, 0.6% of the world's GDP). Biofilms are also of great importance in biomedicine. Approximately 80% of human infections are biofilm-associated, which contributes to significant morbidity and healthcare expenditure (the annual cost for biofilm infections in the US alone is ~$94 billion, with an equivalent cost in Australia with respect to population size). No effective approaches are currently available to disrupt and eliminate biofilms. This study will define the molecular mechanisms underlying aggregation and biofilm formation and provide the basis for the development of approaches to block these processes, which will have future economic, social and health benefits. Other short-term benefits include building capacity; training students; building international collaborations and generating high impact papers.							
DP210100775 Tang, Prof Caixian	Australian farmers will be producing crops under elevated CO2 in the future. However, it is unknown how the increased CO2 level will affect agricultural production and soil health. This project aims to understand the effect of high atmospheric CO2 on carbon and nitrogen cycles in major cropping soils. It will examine how combinations of crop and soil types lead to differences in loss of soil organic carbon. Soil microorganisms that link to carbon and nitrogen cycling in soils will be examined in the long-term field trials. The project intends to provide fundamental information that is essential to evaluate the future impact of climate change on the fertility and productivity of our poor, already infertile soils in semi-arid regions.	68,000.00	135,000.00	134,000.00	67,000.00	0.00	0.00	404,000.00
	National Interest Test Statement							
	This research will explore the impacts of climate change on soil carbon management and food production. It will provide new knowledge that addresses a key component of the climate threat to rural social communities, and engages farmers to implement strategies to sustain food production, profitability, and security. The findings on the elevated CO2-induced nitrogen transformation, associated with soil organic carbon decomposition, will assist Australia to gain the economic benefits through effective management of nitrogen fertilisers and soil fertility in response to climate changes. This proposal directly responds to three key Science and Research Priorities through 1) improving understanding of sustainable limits for productive use of soil; 2) developing solution for restoring soil carbon for a resilient, sustainable and productive future; and 3) providing fundamental data to devise a model to predict soil carbon stocks in the future. It also aligns closely with the research priority of La Trobe University "Securing Food, Water and the Environment".							
DP210100951 Nikolayevsky, Dr Yuri	Mathematical models of many processes in science (physics, engineering) and in the real world (nature, economics) are governed by complicated systems of differential equations. An important, distinguished class of such models is described by integrable systems, the systems for which one can provide a comprehensive qualitative picture, and in many cases, a complete solution. Using recently developed, powerful methods of integrable systems and differential geometry, this project will focus on a range of important, interconnected theoretical problems in both disciplines. The expected outcomes will provide new, deep, mathematically and physically significant results which will lead to applications and developments across a range of fields.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement							
	This project provides deep contributions to higher mathematical concepts in geometry and dynamics that underly a diverse range of current and future technologies such as quantum computing, nano-optics and applied hydrodynamics, all important to Australia's modern digital and industrial directions. The project investigates the behaviour of a wide class of mathematical models, from very classical ones (like the harmonic motion of a spring or planetary motions), to highly complex systems which govern processes in modern physics, biology and industry (for example, power transmission in the electricity grid, or the spread of bushfires). New mathematical techniques developed in this project will establish effective ways to understand and predict the behaviour of such systems. Wider cultural importance in the development of novel methods in the mathematical sciences is pivotal to the advancement of new scientific outcomes in Australia and to providing research training to highly skilled graduates.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101630 Gibb, A/Prof Heloise G	This project aims to bridge the gap in understanding of ecological strategies between plant and animal ecology, globally, using ants. It will test how environmental change influences the success of species, based on ecological strategies, and the consequences for ecosystem function. This project is expected to make a significant contribution to generality and prediction in ecology. Expected outcomes of this project include theory development and application and enhanced global networks of trait researchers. Intended benefits include improved ecological theory, an enhanced capacity to predict how global change will affect organisms and increased understanding of the cascading effects of changes for ecosystem function.	110,163.50	209,543.50	161,880.00	62,500.00	0.00	0.00	544,087.00
	National Interest Test Statement Environmental benefits for Australia and internationally: We will contribute to the priority area of “Environmental Change” in the subcategory of: “Improved accuracy and precision in predicting and measuring the impact of environmental changes caused by climate and local factors”. By combining a new understanding of ecological strategies and functional traits and their distribution among ant species, we will, firstly, enhance our ability to predict the responses of species to environmental change, based on their ecological strategies. Secondly, by linking ecological strategies with effects on ecosystems, we will be able to predict the effect of changes in species abundances on ecosystem function, thus improving our ability to predict ecosystem change following climate change and other anthropogenic disturbances. Understanding ecological strategies is critical to this benefit because different traits underlying response to and effects on ecosystem function may be linked if they are part of the same ecological strategy. Importantly, this broad approach means that findings are globally applicable.							
DP210102225 Doblin, Dr Monika S	This Project aims to define the molecular mechanisms that control the processes involved in the biosynthesis and regulation of mixed linkage glucan, a major soluble dietary fibre in the cell walls of cereal grains. Plant cell walls determine the quality of most plant-based products used in modern human societies, yet the regulatory mechanisms responsible for their modulation are not well understood. Key distinguishing features of the Project will be the international, integrative, and multidisciplinary approach towards addressing this major challenge in plant biology and the potential of the fundamental scientific discoveries to benefit end-users in the food, feed and beverage industries.	80,474.00	165,239.50	165,371.50	80,606.00	0.00	0.00	491,691.00
	National Interest Test Statement This project is a step in the pathway towards developing fit-for-purpose cereal grains to increase Australia’s agricultural productivity, profitability, wealth and health through higher production (grower benefits) and improved nutritional quality (consumer and community benefits). For Australia, the cost of obesity and lifestyle-related diseases is $70 B, greater than our entire agricultural output of $65 B. Grain with enhanced levels of soluble dietary fibre provides a means of commodity differentiation and added value to growers and aligns with the strategic ambition of the National Farmers’ Federation to expand the Australian agricultural industry to $100 B by 2030. Producing raw food ingredients of greater nutritional quality is an alternative approach to changing dietary habits to tackle the rising incidence of food-related diseases and the unsustainable burden on our health budget. Healthier communities and a more productive labour force are also predicted outcomes of this work.							
DP210102250 Edwards, A/Prof Phillip C	This project aims to investigate the shift to sedentary life by excavating one of the earliest villages, founded by hunter-gatherers around 12,500 BCE. Of key interest are foundational burials at Wadi Hammeh 27 in Jordan and their role in the establishment of this new kind of settlement. Well-preserved deposits present a rare opportunity to track a community in the act of settling down so significant knowledge about the transition to sedentism should be generated. An interdisciplinary approach combining archaeology, bioanthropology and archaeogenetics may provide new explanations of early social organisation. Potential benefits include the building of international collaborations and the development of Australia’s role in the Middle East.	32,606.50	55,970.50	46,728.00	23,364.00	0.00	0.00	158,669.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	To understand recent claims for the pre-colonial occurrence of Indigenous Australian village life and farming it is crucial to provide comparative data from early global settlements and farming practices at the dawn of the transition from hunter-gatherer life to agriculture. Our project site of Wadi Hammeh 27 in Jordan is one of the earliest villages in the world, dating from 14,500 years ago. Its unusually well-preserved sequence of layers provides a rare opportunity to study the origins of modern settlement practices and the initial move to farming that is critical for understanding the nature of the Australian record, where archaeological traces of such activity are often ephemeral. The project will reveal the sources of our modern lifeways; ancient DNA analyses on foundational burials at our site will clarify the diversity of human communities in the Middle East, a seminal region for ancient human dispersal, and the ancestral origin point for many Australians.							
DP210102314 Brown, Dr Graham E	This study aims to investigate why, when and how inter-organisational networks adapt or remain resistant to change. Responding to complex social problems and technological change requires inter-organisational networks to be adaptable. Through a combination of longitudinal network analysis, survey research and qualitative interviews, this project plans to study the Victorian HIV and hepatitis C sector as it responds to major advances in prevention and treatment, requiring community, health, policy and research organisations to adapt their roles and relationships. This timely and novel study aims to improve our knowledge of how to enable inter-organisational networks to adapt and improve organisational responsiveness to complex issues.	62,500.00	126,000.00	127,000.00	127,000.00	63,500.00	0.00	506,000.00
	National Interest Test Statement							
	Inter-organisational networks are common where collaboration is required to effectively address complex, dynamic problems, such as in the public health and social services sectors. Understanding how these networks adapt to change, and the factors that enable or limit organisations' capacity to change, are important steps in developing more suitable governance and support systems. This study examines the Victorian HIV/HCV sector as an exemplar, charting its response to the largest changes in treatments and prevention strategies in 20 years. In doing so, it will unlock more of the potential of inter-organisational networks to improve the health and well-being of the clients they serve, promote health and reduce inequity. We build upon the baseline data collected and work conducted with the Victorian health sector in 2018. The results will be useful to inform any complex policy challenge where understanding, enabling and guiding organisational network structures plays an important role in achieving successful health and social outcomes.							
DP210102658 Poon, A/Prof Ivan K	This project aims to investigate how dying cells rearrange their cellular contents to aid their removal. More than 200 billions cells die daily in the human body. It is critical that dying cells are rapidly cleared as their buildup can interfere with normal tissue functions. This project will use a suite of contemporary molecular/cell biological approaches to study a newly identified process that occurs during cell death. Expected outcomes include a paradigm-shift in understanding the process of cell clearance. This project is expected to generate fundamental new knowledge of the mechanisms by which dying cells are efficiently removed from tissues. This should provide significant benefits to the cell death and general cell biology fields.	86,848.50	172,087.00	162,025.50	76,787.00	0.00	0.00	497,748.00
	National Interest Test Statement							
	In adult humans, billions of cells die daily as part of normal turnover. It is vital that dying cells are rapidly removed, otherwise their accumulation can interfere with organ functions. To aid efficient clearance of dead cells, dying cells can disassemble into fragments for neighbouring cells to remove. This project aims to elucidate the molecular machinery that controls how cellular contents are partitioned during the disassembly of dying cells, and the role of this process in cell clearance. Understanding the mechanistic basis and function of dying cell disassembly will generate fundamental new knowledge of the downstream consequences of cell death, continuing Australia's world leading research in this field. This breakthrough will yield high impact academic outcomes that have broad significance in other fields of research including cell biology, biochemistry, developmental biology and will generate basic knowledge that can be applied in medical science in Australia to understand or treat pathological conditions such as infectious, cardiovascular and autoimmune diseases.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103258 Whelan, Prof James M	This proposal aims to define the mechanisms of how mitochondrial growth and stress signalling interact and are regulated. Mitochondria are central machines in cells that use energy obtained through photosynthesis to drive growth and also play an important role in sensing and responding to non-optimal environmental growth conditions. As mitochondrial growth and stress signalling are antagonistic, growth is retarded when stress signalling is activated. Thus, the outcomes will be new knowledge and understanding of how plants balance growth and stress responses. This benefit of this knowledge and understanding is that it can be used to pursue novel avenues to optimise crop performance in changing and adverse environments.	86,250.00	183,500.00	151,750.00	54,500.00	0.00	0.00	476,000.00
	National Interest Test Statement Agriculture is an important industry in Australia, directly and indirectly it employs over 300,000 people, has stewardship over 48% of the landmass of Australia and accounts for $65 billion of export earnings. The agriculture industry as a whole, but plant agriculture in particular, is facing challenges from increasing competition (due to South American and Balkan production increasing over time) and adverse and variable climate conditions are increasingly impacting sustainability. This research is directed to identifying and defining novel growth and stress signalling pathways, how they are regulated and how they interact to affect overall plant growth and response to non-optimal environmental growth conditions. The knowledge that these pathways existed has only emerged and hence their impacts and affects on crop plant growth and stress responses are unknown. This proposal will define the components of these pathways and how they effect growth and stress responses. The new knowledge gained can be used as an additional route to optimise plant performance in limiting conditions.							
DP210103446 Kuntsche, Dr Sandra	This project aims to generate unique insights into the strains that Australian working mothers face in their daily lives and the impact these strains have on their alcohol consumption. Using innovative methods to understand strains resulting from two major life domains, family and work, the project expects to generate new knowledge which can be used to develop interventions to address this important issue. The results of this study can provide significant benefits not only to the quality of life of working mothers in Australia but also has society-wide implications. This is due to alcohol use being a leading avoidable cause for productivity loss alongside other social, community and economic costs.	51,403.50	106,378.00	82,688.50	27,714.00	0.00	0.00	268,184.00
	National Interest Test Statement This study will generate unique knowledge on predictors of heavy drinking among working mothers in Australia, which causes significant social and economic harm. Middle-aged women are currently the only group increasing their alcohol consumption in the context of otherwise stagnating or decreasing trends. Performing double shifts of paid work and family tasks are proposed to influence heavy drinking but at present, this group is largely understudied. By providing an in-depth understanding of the driving forces behind the daily strains resulting from the interplay between mothers' work and family duties, our results will address an important gap in knowledge not only to increase the quality of life in working mothers but also to reduce the social and economic costs resulting from absenteeism and productivity loss. Knowing that parental alcohol use shapes the knowledge and expectations of children, this research may have implications on the visibility and normativity of alcohol use within the home witnessed by underage children and as such on the intergenerational transmission of alcohol-related cognitions.							
	La Trobe University	716,571.50	1,431,869.50	1,311,094.50	659,296.50	63,500.00	0.00	4,182,332.00
Monash University								
DP210100018 Casey, Dr Andrew R	This project aims to measure the wobble in the position of distant stars that is caused by massive objects, using telescopes in space. This project expects to generate new knowledge on how binary stars, exoplanets, and stellar mass black holes are formed. Expected outcomes of this project include tight constraints on binary star models, new discoveries of neutron stars and black holes that are a few times more massive than the Sun, and samples of stars that do, and do not, host exoplanets. This should provide significant benefits including a catalogue of companion properties for billions of sources, new understanding of how stars die, as well as the first control sample of stars without planets to help understand how and why planets form.	67,500.00	135,000.00	135,000.00	67,500.00	0.00	0.00	405,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement This project contributes long-term economic and commercial benefits for Australia through the knowledge gained in data analytics, visualisation and statistical inference. The project will interrogate large datasets to provide a complete compendium of all so-called hidden companion stars in the Milky Way. The probabilistic tools developed in this project may therefore be applicable in other analyses of big data to quantify uncertainty. Enhanced connectivity between the fledgling Australian Space Agency and international agencies will further grow the $4 billion Australian space-based industries to increase the efficiency of Australian investment in this area (including the Australian-led GALAH survey). The Project will also provide social and cultural benefits to the Australian community, as the Gaia telescope is one of the most advanced engineering projects ever launched into space, the project appeals broadly to inspire future engineers, programmers, and research scientists of Australia.							
DP210100020 Duan, Prof Wenhui	The carbon waste from hydrogen production will be converted into carbon nanosheets on abundant construction materials for the creation of stronger and more durable concrete. Cutting-edge nanoscience-based experiments, as well as sophisticated modelling techniques including machine learning and finite element modelling, will be employed. The findings will drive advances in clean hydrogen production, carbon waste utilisation, cement hydration, nanotechnology and concrete technology for the next generation of an upskilled workforce and the promotion of a circular economy. This project will be carried out in collaboration with Australian and international renowned experts in computational modelling, nanomaterials and concrete materials.	97,101.50	196,417.50	195,839.00	188,046.00	91,523.00	0.00	768,927.00
	National Interest Test Statement The project will facilitate utilisation of carbon waste from hydrogen production in high-performance concrete materials by exploiting emerging nanotechnology, developing clean hydrogen production and cost-effective manufacture of construction material. The project will (a) create new revenue streams for the hydrogen industry to support hydrogen economy as well as the cement and concrete industry; (b) promote a circular economy with improved carbon waste utilisation and reduced greenhouse gas emission; (c) empower the workforce with the cutting-edge skills; and (d) develop new job opportunities. The newly developed concept will lead to clean hydrogen production with the utilisation of carbon waste promoting a circular economy, as well as superior advanced concrete infrastructure and building construction applications, especially observing stringent requirements for infrastructure materials in national strategic development plans.							
DP210100041 Aleti, Dr Aldeida	This project aims to help software engineers build complex software systems in far more reliable and cost-effective ways. It takes an interdisciplinary approach by applying machine learning techniques to automatically test complex software systems. Expected outcomes include a novel methodology for assessing the strengths and weaknesses of test suites generated by automated software testing techniques and the approaches required for generating high-quality test cases. Such advances are urgently needed to avoid disasters when deploying software systems in the real world.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
	National Interest Test Statement Software has become the most crucial infrastructure of our times, as many aspects of our society critically depend on it, such as digital health, transport systems, smart energy and financial systems, and software is at the core of Australia's Digital Future. Australia's Digital Economy Strategy is projected to add more than AU140 billion to our GDP. This project contributes directly to Australia's goal of becoming a leader in digital innovation by devising new technologies that will make it possible to build the software systems required to achieve this goal. The expected outcomes of this projected can also be applied to areas of competitive strength for Australia, such as digital health, which is one of the main research themes at the Faculty of IT.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210100045 Buntine, Prof Wray	This project will investigate novel technologies for the data-driven discovery of rare phenomena. Scientific disciplines are increasingly able to generate large amounts of data relevant to key discoveries such as novel photovoltaic materials or explanations of brain seizures. However, these discoveries typically correspond to extremely rare phenomena in high dimensional spaces, which current data science methods are unable to detect. The project will fill this void and yield novel methods, publications, and open source software for the data-driven discovery or rare phenomena. Thus, it will expand the capabilities of data science, providing better use of the massive data collections accumulating across science, government, and industry. **National Interest Test Statement** This project will develop data science technologies that enable the data-driven discovery of rare phenomena from high-dimensional sample spaces. As driving applications, we will investigate drug effects on the brain as well as the discovery of novel CO2 transforming catalysts—two high-profile scientific problems of immediate public benefit, with the latter being tied to the national research priority of climate change. Beyond those two problems, the developed methodology will be of use in a wide range of applications in science, business, and the public sector. All of these sectors are currently accumulating "big data"-assets but the answers to critical questions are buried in these assets like needles in a haystack. Our technologies will allow to uncover those needles and will be made publicly available through open source software that is directly compatible with the wide-spread standard data science tools and workflows. Thus, the output of this project will immediately assist the nation’s scientists, entrepreneurs, and public data analysts to make breakthrough discoveries.	66,332.00	149,050.00	158,970.50	76,252.50	0.00	0.00	450,605.00
DP210100060 Gasevic, Prof Dragan	This project aims to develop methods to assist the assessment and improvement of collocated teamwork, by making multimodal activity traces visible and available for computational analysis. This project expects to bridge the gap between promising sensing technologies and the dearth of tools to automatically assess teamwork. Expected outcomes include co-design and modelling methodologies for human-centred analytics that map from low-level data to higher-order constructs to enable non-data science savvy users to get actionable insights into multimodal team traces. This research aims to provide significant benefits to Australia, with communication and teamwork being two of the topmost critical skills required by Australian employers. **National Interest Test Statement** This project will strategically transform collocated teamwork from being opaque to computational analysis into a translucent phenomenon from which selected features can be rendered visible and analysable. The successful completion of the project will have a strong impact within the Australian vocational and higher education community while also placing Australia at the forefront of research and teaching and learning innovation worldwide. Empirical findings and prototypes developed in the project will provide new insights into how best to support the development of effective teamwork and communication skills to benefit a range of industries in Australia. In particular, this project will be conducted in the context of simulation-based healthcare education. The successful completion of the project will thus contribute to the development of more effective strategies to improve teamwork in healthcare throughout Australia. Through the project, one Research Associate and two HDR students will be trained.	27,030.50	67,359.00	87,555.00	47,226.50	0.00	0.00	229,171.00
DP210100072 Webb, Prof Geoffrey I	This project aims to increase understanding of complex dynamic processes by creating new ways of analysing large quantities of data collected over time. These new approaches will be specifically designed to greatly improve the understanding obtained from time varying data for trillions of global earth observation data points in an application-agnostic way that is applicable to many tasks. The outcomes are expected to advance the theory and practice of time-series data analysis and transform the analysis of complex dynamics. This should support innovation in industry, commerce, government and research and magnify benefit from many data investments including the $1 billion Australian governments invest annually in satellite imaging.	68,000.00	136,000.00	136,000.00	68,000.00	0.00	0.00	408,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Time series record the dynamics of processes as they evolve. Just as a film of the lead up to a traffic accident reveals more about its causes than any one frame, time-series reveal more about dynamic processes than a static record, such as typically analysed in data science. However, time-series analysis cannot currently benefit from large quantities of data. This project seeks to bring the power of big data to the analysis of dynamic processes. It will develop general-purpose widely-applicable technologies, driven by the need to scale-up to enable analysis of data from the whole globe. The application-agnostic time-series analysis technologies will enhance many applications of artificial intelligence in industry, commerce, government and other areas of research. Improved capacity to analyse observations of the earth will greatly amplify the contribution to Australian GDP from satellite monitoring, currently $3.3 billion per annum, by supporting 'smart' agriculture, intelligent natural resource management and informed natural disaster preparation and response.							
DP210100111 Mills, Prof Catherine J	This project aims to investigate how knowledge about the intergenerational transmission of health and disease is shaping antenatal care in Australia. It expects to generate new knowledge about how the science of epigenetics can be used to address social inequality and is anticipated to have impact across the social sciences, bioethics and public health. Expected outcomes of the project include novel theoretical approaches to the ethics of pregnancy, along with guidance tools to shape the use of epigenetics in antenatal care and social policy to reduce social inequalities. This should provide significant benefits, improving information and support available to vulnerable women as they negotiate maternal health and social services.	87,500.00	192,500.00	155,000.00	50,000.00	0.00	0.00	485,000.00
	National Interest Test Statement							
	Epigenetics is a rapidly developing science that examines the links between the origins of health conditions and pregnancy. It has significant potential social, economic and health benefits, but these need to be balanced against the risks it also entails, of discrimination against and social marginalisation of some women. This project will contribute to improving antenatal care in Australia by providing advice to practitioners and policy makers to ensure that epigenetics is used in ways that support social inclusion and the health of women, as well as their offspring. By developing tools to inform social policy and professional guidelines, the project will contribute to the optimal social and ethical translation of epigenetics in the management of antenatal care and pregnancy; it will have social, economic and health benefits, including to women of reproductive age and their children, maternal health service providers and policy makers.							
DP210100158 Fitz-Gibbon, Dr Kate	In 2014 family violence was declared a national emergency in Australia. In the years since there has been extensive law reform activity. Domestic violence disclosure schemes have emerged within this context as a policy option that may improve safety outcomes for victims. However, there is currently no evidence as to the impact of these schemes and no consultation with victims as to their value. This project aims to generate the evidence required to inform decisions about the introduction of these schemes, to better understand what victim/survivors want from them, and how such schemes can be effectively operationalised. The findings seek to be relevant to all Australian states and territories as well as international jurisdictions.	53,596.00	115,018.50	61,422.50	0.00	0.00	0.00	230,037.00
	National Interest Test Statement							
	Intimate partner violence is the most common type of violence against women and the leading preventable cause of death amongst Australian women between the ages of 15 and 44 years. Innovative interventions to prevent family and intimate partner violence are needed. This project will be the first national project to examine the merits, risks and impact of domestic violence disclosure schemes, which are designed to assist in preventing intimate partner violence. The findings will identify the extent to which domestic violence disclosure schemes can provide an effective intervention for intimate partner violence. The project aims to provide more positive health and criminal justice policy outcomes through identifying better means of prevention. The research will contribute to improved social, cultural and economic benefits for Australian women and the community by offering evidence to inform approaches to preventing intimate partner violence.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210100283 Kostogriz, Prof Alex	The increasing diversity of students in schools presents a significant challenge for the professional education and practice of teachers. The project aims to develop an original approach to measuring teacher capabilities to respond to and engage with difference. Its expected significance is in building new knowledge about teacher workforce development to achieve education goals and social cohesion in conditions of superdiversity. The project's expected outcomes include a metric of teacher capabilities that can inform the professional education of teachers and policy settings in this country and internationally. This large-scale study should return real benefits to ensure successful education and well-being of diverse students. **National Interest Test Statement** In conditions of superdiversity, Australia's aspirations to 'increase productivity' and 'achieve sustainable economic growth' depend on improved 'national well-being'. While education continues to be instrumental in achieving these aims, the project develops a new approach to teacher workforce development as the driving force of improving well-being of diverse students through a responsive, socially-just and empowering education. The project findings will inform a strategy to expand teacher capabilities to: (a) respond to the impact of superdiversity on education in rural and urban communities, and (b) provide equitable education that improves learning, inclusion and well-being and reduces disparities for disadvantaged and vulnerable students. In the evaluation phase, the study will generate a substantive evidence base for prospective changes in the professional education of teachers in order to increase their agency and opportunities to advance effective and socially just education.	32,500.00	85,422.50	106,237.50	103,346.50	50,031.50	0.00	377,538.00
DP210100308 Nakashima, A/Prof Philip N	This project aims to map electrons in nano-structured materials using a new technique combining the latest solid-state theory with electron scattering experiments in one of the world's most advanced electron microscopes. It is expected that by revealing the electronic structure of nano-scale features in bulk materials for the first time, their functions will become fully explainable. Aside from this new capability, other expected outcomes include discovering how heat is converted into electricity in thermoelectric materials and how precipitates affect alloy strength. The benefits may include more informed materials design, more efficient thermoelectrics for sustainable energy technologies, and higher strength-to-weight ratio alloys. **National Interest Test Statement** This Project seeks to investigate energy materials and structural alloys at the most fundamental level of electronic structure, and at a scale never investigable before, in order to understand their properties. The research will employ advanced electron microscopy techniques to map electrons in some of the nano-structured materials which underpin key technologies in our economy, including the energy and advanced manufacturing industries. The knowledge gained in this project will enable the bottom-up design of these specialised nanostructured materials, and may be more generally applicable to other materials. Outcomes will include improved materials design, and added value for high-performance materials. Specifically, the improved performance of thermoelectric materials and aluminium alloys will have boost sustainable energy technologies as well as the automotive, aerospace and packaging industries.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
DP210100323 Chapple, A/Prof David G	This project aims to provide the first quantification of the impact of feral cats on Australian reptiles, the country's most diverse vertebrate lineage. This project expects to provide crucial missing pieces of the puzzle by adopting an innovative behavioural approach to determine how cats hunt for lizards, and how lizards respond to cat predation risk. The expected outcomes are an improved understanding of the capacity of native lizards to recognise cats as predators and respond appropriately, and a determination of the magnitude of threat that cats pose to native lizards. Importantly, our study aims to trial management strategies to mitigate the impact of cat predation on native reptiles.	107,500.00	197,500.00	165,000.00	75,000.00	0.00	0.00	545,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Feral cats are considered a key threatening process to Australian wildlife. Mitigating the impacts of feral cats is a core focus of Australia's threatened species strategy. Reptiles have only recently been recognised as a significant component of feral cat diet, with at least 650 million individuals killed by cats in Australia each year (1.8 million per day). As the conservation status of Australian reptiles has significantly deteriorated in the last 25 years, research is urgently needed to quantify the threat that feral cats pose to native lizard species. This project will use field- and laboratory-based behavioural studies to determine how cats hunt lizards, how lizards respond to cat predation risk, and investigate how susceptible Australian lizards are to cat predation, and test novel ways of reducing cat impacts on lizards. In doing so, this project will address a Science and Research Priority, and trial management strategies to limit the impact of feral cats on native lizards.							
DP210100328 Peters, Dr Anne-Marie	As individuals age, their body functions and survival prospects decline. Why some individuals deteriorate slower and later in life, is a critical question we cannot adequately answer, although the social environment has been suggested to be important. Using a recently established molecular biomarker of aging, this project aims to experimentally investigate in a wild bird if age-related decline is faster when individuals lack social support or face sexual competition. Expected outcomes are insights into key determinants of delayed aging and longer lifespan. Potential benefits include improved understanding of drivers of healthy aging, and improved ability to predict population persistence and identify conservation priorities.	57,500.00	129,000.00	142,000.00	70,500.00	0.00	0.00	399,000.00
	National Interest Test Statement							
	This Project will provide answers to the key question why some individuals age more slowly and/or live longer. Specifically, it will determine whether the social environment can directly affect aging outcomes. Better social conditions are associated with slower aging, but whether social support is the direct cause of this improvement, can only be tested with experiments. To do so, the project uses wild social birds as a model, because they have a suitable social system, and are amenable to experimentation. The outcomes will show if age-related decline is faster when individuals experience stronger competition or lack social support. Anticipated benefits of this project are pioneering discoveries in evolutionary aging research, strengthening Australia's leading role in this area. Because individual risk factors for rapid aging and short lifespan extrapolate to risks for decline of wildlife populations, further benefits include improved ability to design targeted wildlife conservation strategies. Outcomes may ultimately help identify factors contributing to healthy aging in human populations.							
DP210100374 Turner, Dr David R	The project aims to explore new synthetic routes to functional supramolecular cages/containers which are able to selectively host small molecules in their interior space, and may provide feedback upon the presence of a guest (i.e. molecular sensing) or catalyse reactions within the enclosed cavity. The project expects to produce chiral cages that are capable of detecting specific enantiomers in solution and act upon them. The expected outcome is a deeper understanding of the structure/property relationship of these novel species and steps towards application. This should provide benefits given the application of solution-based methods for enantioselective sensing/catalysis are of significance in high-value pharmaceutical synthesis.	36,000.00	69,500.00	68,500.00	35,000.00	0.00	0.00	209,000.00
	National Interest Test Statement							
	The project will explore new synthetic routes to create molecular cages that are able to selectively sense, sequester, or enhance the reaction of important biological or pharmaceutical compounds in solution; these functions are of downstream importance in high-value synthetic applications, particularly pharmaceutical synthesis, environmental and biomedical fields. Developing new classes of materials, and understanding their behaviour at a chemical level, is of great importance to advance this field towards applications and benefits. The project will develop a sound understanding of the processes behind capturing important molecules within this new class of confined nanospace. The outcomes of this project will be materials with future scope for commercial application in pharmaceutical or biomedical applications. These have the potential for benefits to health (through more efficient drug synthesis and delivery) and corresponding economic benefit to Australia.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210100393 Frith, Dr Jessica F	This project will develop materials whose stiffness can be reversibly increased and decreased by the simple application of light, and use these to build knowledge of how stem cell fate is regulated. The influence of mechanical cues on the structure and organisation of the nucleus will be determined. Expected outcomes are new synthetic and light-reversible culture materials, and fundamental insights into how forces change the nucleus to alter stem cell aging and fate. The findings will provide critical information required for the future development of assays to measure cell potency and instructive biomaterials to drive stem cell expansion and tissue-regeneration and will have impact by underpinning future advances in stem cell technologies.	75,600.00	145,600.00	130,900.00	60,900.00	0.00	0.00	413,000.00
	National Interest Test Statement Stem cell and tissue-engineering could drive significant growth for Australia via the manufacture of high-value, specialised goods. Estimates suggest that capturing just 5% of the market would bring $6 billion/yr revenue and create thousands of highly skilled jobs. The ability to fully restore the function of damaged body tissues would also benefit many, particularly in our aging population. Mesenchymal stem cells are a key cell type whose demand is escalating for use in fundamental studies through to clinical trials. A critical problem is our inability to produce high-quality cells and they rapidly lose their beneficial properties when cultured using existing technologies. This is influenced by the way that cells react to the conditions around them. This project will generate new understanding of how cells are altered by their physical environment by combining the cells with biomaterials whose properties can be controlled by light. The information can be used to develop improved technologies for stem cell production whilst the biomaterials will have wider application across multiple cell and tissue types.							
DP210100412 Hong, Dr Yi	Future wireless networks comprising unmanned aerial vehicles (UAVs) in millimeter wave bands will provide ubiquitous connectivity to a massive number of devices, even in unexpected situations such as disaster relief. Common wireless security solutions are developed only for terrestrial infrastructures but are unsuitable for mmWave UAVs due to the high mobility and limited energy supply. This project aims to develop novel energy efficient physical layer security techniques to prevent system attacks and malfunctions. The expected outcomes will deliver innovative solutions to safeguard future wireless networks. The project should benefit Australia in advancing knowledge base in wireless security and supporting future critical infrastructures.	62,952.50	128,119.50	132,541.00	67,374.00	0.00	0.00	390,987.00
	National Interest Test Statement Security technology for unmanned aerial vehicles (UAVs) aided millimeter wave communications is an area of strategic worldwide interest, with far-reaching potential for industrial, economic, environmental, and social impact. Without strong security foundations, malicious attacks in UAV-aided mmWave communications will threaten to outweigh its benefit. UAVs' high mobility and the use of limited power resource make them vulnerable to attack. Current research on wireless security focuses on terrestrial wireless communications, which is not suitable to overcome these challenges. The outcomes of the project will go beyond current wireless security limitations to open up new opportunities for Australian industrial innovation in the area of UAV and mmWave communications. Our innovations will present valuable opportunities to provide Australian young researchers with world-class training in the area of wireless security technology, thus maximising our national competitive advantage in the relevant field.							
DP210100430 Walker, Prof Jeffrey P	This project tests alternate configurations for remote sensing of soil moisture using a new state-of-the-art Active/Passive (ie radar/radiometer) P-/L-band (ie microwave) satellite concept through a series of airborne field experiments. Timely soil moisture information is critical to improved water management for food production in the face of climate variability. The challenge is to do this accurately over large areas with an appropriate spatio-temporal detail, and for a soil depth that closely approximates the layer which impacts crop/pasture growth and influences management decisions. The longer P-band allows deeper penetration into the soil while the active/passive combination uses the respective resolution and accuracy characteristics.	100,000.00	200,000.00	200,000.00	100,000.00	0.00	0.00	600,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Soil moisture is a highly critical resource for the Australian agricultural economy which is stressed by climate change. Daily monitoring of paddock scale soil moisture from space represents a powerful tool to inform land management, allowing accurate crop yield and pasture growth predictions. At the continental scale, soil moisture information will result in better weather, climate and extreme flood prediction skill and the ability to assess effects of climate change on Australia. It is therefore critical that farmers and scientists have access to the soil moisture data they need, so the available water can be optimised for food production and the climate impacts better understood. This project lays the foundation for a new satellite capability to meet this need; successful demonstration of a combined L- and P-band Active and Passive sensing technology may lead to a dedicated satellite that would supersede the L-band SMOS (passive only) and SMAP (active and passive) satellites. It will also allow for operational soil moisture from the L-band NISAR and P-band BIOMASS active satellites soon to be launched.							
DP210100571 Farrelly, A/Prof Megan A	This proposal aims to investigate how the processes of experimenting with alternative urban infrastructure systems can lead to sustainable urban transformations. Focusing on the urban water and energy sectors, this project expects to generate new cross-sector knowledge regarding the transition dynamics associated with delivering sustainable urban futures. The anticipated outcomes of examining how innovations become mainstream include, improved institutional strategies and enhanced policy and program interventions. This work expects to positively impact the value and associated outcomes of government and private investment in innovative urban infrastructures dedicated to advancing sustainable and resilient urban environments.	79,539.00	164,228.50	166,754.50	82,065.00	0.00	0.00	492,587.00
	National Interest Test Statement							
	Australia is at the cusp of significant urban infrastructure transformation: with $200 billion set to be invested in revitalising key sectors including water and energy in the coming decade. At the same time there is a global and national push to delivering sustainable cities with flexible, resilient infrastructure. This demands new thinking, technologies, systems and governance practices. This research will undertake multiple case studies of innovative practices across the water and energy sectors to produce the first national evidence-base focused on best practices relevant to cross-sectoral infrastructure transformation. This new knowledge will offer significant benefit to Australian infrastructure planning, at the local, state and national level. The outcomes will directly support the improved value, and associated outcomes, of government and private investment in future innovation within Australia and internationally.							
DP210100572 Stubbs, A/Prof Wendy	Our planet is on the brink of environmental disaster: biodiversity loss is at mass-extinction rates, agricultural systems are under strain and pollution is threatening human health. Business enterprises have a crucial role to play in addressing these time-critical issues. This project examines how small to medium enterprises' (SMEs) capacity for experimentation and innovation enables their adoption of sustainable business models to drive sustainable transformations. The research outcomes are critical for understanding and supporting innovative strategies for organising and governing SMEs' pathways to a sustainable society. The knowledge developed will support business sustainability transformations in Australia and internationally.	50,000.00	120,000.00	117,500.00	47,500.00	0.00	0.00	335,000.00
	National Interest Test Statement							
	Small-medium enterprises are a significant contributor to Australia's economic, social and environmental welfare. They are critical to Australia's transition towards a more sustainable economy and society. This research will advance the capacity and support for small-medium enterprises to adopt sustainable business models. The study will inform potential policy and practice that supports small-medium enterprises in becoming hubs of sustainable innovation. Australia and other countries are grappling with the significant policy challenge of accelerating economic growth while also implementing sustainable transformation. This project will help identify cost-effective ways for small-medium enterprises to access government and other organisations' resources for embedding sustainability. It will also provide insights into ways for streamlining associated government policies. This knowledge will directly benefit Australia's economic and environmental prosperity via facilitating small-medium enterprises' sustainable transformations.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210100597 Modi, Dr Kavan	The project aims to characterise and control quantum machines available today. These machines overwhelmingly suffer from noise with complex structures. Thus, a key target of the project is to develop a theory to describe and manipulate complex quantum processes. The project then intends to apply this theory to commercial-grade quantum computers. This approach is anticipated to lead to a new understanding of time-correlated complex quantum processes and develop methods to enhance the performance of today's quantum computers. Noise characterisation and mitigation should have commercial value and benefit research groups working to develop quantum technologies, both in Australia and internationally.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement Australia has made substantial investments in the development of quantum technologies. Yet, Australia is often thought to lag in terms of commercial activities, especially in comparison with the level of activity in North America, Europe, and China. Our project aims to integrate cutting edge research in quantum computing with commercial activities. We will develop new methods to mitigate noise in quantum technologies and test them on IBM's commercial-grade quantum computers. Thus, our research activity has a high potential for commercialisation. Our project is designed so that Australia remains a key player in the development of commercial-grade quantum hardware and software. Our project will also have non-commercial outcomes: a theory for complex correlated quantum noise. This knowledge will be available to academic researchers in Australia, many of whom are working to build commercial-grade quantum computers and quantum sensors. They will be able to make use of these scientific discoveries to enhance the performance of the technologies in their labs.							
DP210100606 Zhang, A/Prof Jie	Important devices in modern society such as batteries, fuel cells and medical sensors exploit special properties of complex electrochemical reactions. The aim of this multidisciplinary project is to develop an integrated approach to intelligent collection and analysis of large electrochemical data sets in a machine-learning environment. As a result, it will become possible for the first time to globally model and quantitatively parameterise all aspects of the dynamic electrochemistry associated with exceptionally complex electrochemical reactions in a statistically significant framework. Problems to be addressed are of biological and chemical significance. An end product will be a commercially viable, user-friendly instrumentation package.	75,000.00	165,000.00	165,000.00	75,000.00	0.00	0.00	480,000.00
	National Interest Test Statement Fuel cells, batteries and biosensors underpin much of modern society. Since they are based on electrochemical principles, dynamic forms of the technique can be used to interrogate the phenomena that govern their operation. However, the complexity of the mechanisms that underpin these devices has restricted quantitative modelling and parameterisation. In this multi-disciplinary project, an intelligent electrochemical system will be developed for quantitative studies of complex chemical and biologically significant processes by integration of in-house instrumentation and simulation packages, machine learning and Bayesian inference. The outcomes will include a commercially viable user-friendly system that can be exploited by users of electrochemistry with limited understanding of the mathematical basis. This research represents a contribution to breakthrough science and smart information use and ultimately will support instrument development by an Australian company.							
DP210100652 Oka, A/Prof Tatsushi	This project aims to develop new methods of extracting non-central, irregular patterns from data, and to detect such patterns in climate data and city-level racial composition data. The project expects to have methodological and empirical contributions, propose innovative data-driven approaches, and extract important features of climate and racial-composition data. The anticipated outcomes of this project are new methods of measuring the relationship between human activities and extreme weather, and for quantifying dynamic racial composition. These empirical results should demonstrate the substantial benefits of the new methods by presenting important empirical evidence for designing policies against extreme weather and racial segregation.	63,517.00	130,869.50	99,664.50	32,312.00	0.00	0.00	326,363.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Data is a valuable resource that is used to improve public policies and to generally enhance the wellbeing of Australia. The Australian Government has released administrative data sets for academic research. Accompanying the rise of massive data, this project proposes innovative scientific methods to extract relevant information for policy design in Australia. First, the Australian Government promulgated environmental change as one of nine national research priorities. The methods developed under this project are intended to uncover the relationship between human activities and extreme weather, which possibly causes droughts, floods, and wildfires. The result will be beneficial for understanding how we can achieve sustainable economic growth while minimising threats of extreme weather to society. Second, this project aims to measure dynamic racial composition data in Australian cities and understand which kinds of cities are more likely to exhibit racial segregation. The result will have important implications for Australia in the maintenance of its successful multicultural society.							
DP210100900 Oppy, Prof Graham O	This project aims to develop a new and improved theory of argument and disagreement. The project expects to overcome a problem that affects researchers in various fields, including cognitive psychology, education, linguistics, philosophy and political science, and that negatively impacts the quality of public debate across the board. Expected outcomes of this project include enhanced capacity to investigate the function of reasoning in human beings, and improvement in the quality of arguing in diverse areas, including academic and public debate. This project should provide significant benefits for fundamental research into human behaviour and evolution, and for the understanding of argument and disagreement across a wide range of domains.	28,273.50	47,023.50	55,586.50	36,836.50	0.00	0.00	167,720.00
	National Interest Test Statement							
	Disagreement is a basic feature of human interaction that impacts relationships at personal, local, national and international levels. Understanding the nature and proper use of reasoning and argument in the negotiation and resolution of disagreement will be beneficial in a range of contexts that require the capacity to resolve inherent disputes and tensions, across such fields as artificial intelligence, communications, linguistics, political science and psychology. By clarifying the nature of 'good argument', and by pioneering efficient and practical methods for improving our collective arguing skills, this project aims to improve reasoning and critical thinking skills within schools, universities, corporations, and in public life more broadly.							
DP210100901 Hill, A/Prof Matthew R	This project aims to address the hydrogen transportation challenge by utilising liquid organic hydrogen carriers rather than other techniques involving high pressures or cryogenic temperatures that need complex infrastructure. This project expects to generate knowledge in the hydrogen economy area using the novel approach of simplifying the separation of the liquid carriers before and after their release of hydrogen. Expected outcomes of this project include largely enhanced hydrogen transportation efficiency by recently discovered new materials. This should provide significant benefits such as a huge economic opportunity for Australia, both for domestic low cost clean energy, and for export to Asia in the hydrogen economy.	84,007.00	171,228.50	177,403.50	90,182.00	0.00	0.00	522,821.00
	National Interest Test Statement							
	This project underpins the development of new jobs in Australia. The research will have impact across the energy and manufacturing sectors. The hydrogen economy is an area of priority development of the nation, and this project seeks to speed and empower that by allowing current infrastructure to be used. By transporting hydrogen within a liquid carrier, all the nation's petrochemical infrastructure can be utilized for an additional purpose. This project addresses a key bottleneck, which is the efficient release of the hydrogen from within its liquid carrier. A unique Australian discovery has been previously made with regards material that can achieve this separation, and here we seek to more deeply understand this concept so that a working prototype can be delivered at the end of the project.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210100931 Weber, A/Prof Leanne	This project aims to investigate the convergence of migration control and criminal justice by analysing pathways to criminal deportation. The project expects to generate new criminological understandings of deportation as a means of promoting community safety using interdisciplinary approaches that capture regional and metropolitan practice. Expected outcomes include knowledge of how information flows between migration control and criminal justice agencies, and the implications for policing, courts, and prison administration. This should provide significant benefits for policy-makers and practitioners, by articulating emerging and unexplored practices that have major consequences for community safety, social cohesion and the rule-of-law. **National Interest Test Statement** National security and community safety concerns in Australia are converging. An example is the increasing focus on the criminal offending and character of non-citizens, and subsequent criminal deportation. Little is known about how criminal justice processes and criminal justice practitioners such as police, lawyers, and judges have been affected by this changing focus. This project will provide a detailed analysis and assessment of the operation of the criminal justice and migration control systems in response to offending by non-citizens. The project's focus on the pathways leading to criminal deportation will offer insights for Australian policy-makers regarding how key systems and institutions are influenced by changing enforcement priorities. The multiple-site approach, capturing metropolitan and regional practice, will also benefit communities by enhancing understanding about this approach to community safety.	47,961.50	121,006.50	118,496.00	45,451.00	0.00	0.00	332,915.00
DP210100990 Hourigan, Prof Kerry	This project aims to address vibrations of solid structures by utilising a combination of advanced experimental and computational methods. This project expects to generate new knowledge in the area of flow-induced vibrations utilising the new techniques of machine learning and evolutionary shape optimisation. Expected outcomes of this project include greatly accelerated discovery of mechanisms leading to structural vibrations and optimising structure geometries to either enhance or suppress the vibrations. This should provide significant benefits, such as the design strategies for improved energy harvesters, such as current oscillators, or more stable structures, such as platforms for offshore wind turbines. **National Interest Test Statement** The performance or integrity of many operations in Australian industry is limited by the harmful vibrations caused by air flow or water currents, such as cross-flow heat exchangers and building structures, and marine or floating wind turbine platforms. On the other hand, some energy harvesting devices, such as current or wave generators, rely on making these vibrations as powerful as possible. The discovery study has the potential to improve the control of such vibrations and improve the performance, safety and efficiency of these devices in Australian industry. For example, flow-induced vibrations are highly damaging to the structural integrity and performance of a range of valuable off-shore facilities, including floating wind turbines, oil-gas platforms and semi-submerged vessels. Discovering the mechanisms leading to these vibrations, and means of controlling them, with minimum structural and maintenance costs will have enormous benefits to these industries.	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00
DP210101042 Rosa, Prof Marcello	This project aims to demonstrate the presence, computation, and use of an invariant representation for texture structure. The proposed approach is interdisciplinary and combines image analysis, electrophysiology, optogenetics and computational modelling. Expected outcomes of this project include learning how neurons encode properties of natural images, defining a novel computational tool for analysis of textures, and new knowledge of how multiple brain areas work together to represent the visual world. This should provide significant benefits for the development of artificial visual systems, and impact on brain research broadly by increasing the number of tools available to predict complex representations at the cellular level.	86,803.00	171,786.50	159,490.00	74,506.50	0.00	0.00	492,586.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	The intended outcomes of this project relate to neurally-inspired computation; a growing industry that includes artificial intelligence and machine learning. Tasks like driving, analysing satellite images for military intelligence, or medical images to evaluate disease are on the cusp of automation. By increasing understanding of how the human brain computes the characteristics of textured surfaces, we may benefit industry by accelerating these fields. Better automation benefits health and safety by guarding against human error. This project will train two PhD students in advanced techniques in both biology and computing, and will expand Australia's research capability by introducing a protocol for optogenetic manipulation in non-human primates. It will also add the national research capacity in visual neurophysiology by promoting collaborations with international leaders in this discipline.							
DP210101045 Cheng, Prof Wenlong	Next-generation wearable electronics should be thin, soft and even transparent, enabling applications impossible to achieve with traditional rigid electronics. Such future electronics will require disruptive soft skin-conformal energy devices to power. This project aims to develop a bi-modal gold nanowire percolation strategy to design ultrathin conductors that are electrically conductive, optically transparent and mechanically stretchable. It expects to generate new knowledge in nanomaterials design and new technologies to fabricate skin-like invisible wearable generators. This should provide significant benefits in advancing Australian standing in the fields of nanotechnology and energy science, and bringing potential economic gains.	77,227.00	157,951.00	161,533.00	80,809.00	0.00	0.00	477,520.00
	National Interest Test Statement							
	As traditional Australian industries (e.g. Automobile) phase out, wearable technologies represent an unprecedented opportunity to generate innovative new industries because of their broad implications in healthcare, robotics, IOT and artificial intelligence. In this context, Prof Cheng has initiated soft gold nanowire wearable electronics platform at Monash University, demonstrating promising applications in remote health monitoring. This project aims to expand/extend such world-leading capability to wearable generators that can convert everyday biomedical energy into electricity, by proposing innovative bi-modal percolation design. Such research will generate new knowledge in materials synthesis and design, leading to high-impact journal publications, hence further advancing Australia's world standing in the field of disruptive wearable electronics, nanotechnology and energy science. It expects to generate patentable technologies for translational outcomes and new start-ups, bringing economic gains to Australia. This innovative project will also deliver unskilled workforce training prepared for new economy.							
DP210101126 Lithgow, Prof Trevor J	This project aims to understand the capabilities of a type of virus called bacteriophage (phage). Significant economic loss in the food industry has led the USA and Europe to deploy phage to decontaminate food-processing machinery. These phage kill food-spoiling bacteria. This project expects to fill gaps in our knowledge, particularly to assit in choosing phage that are of increased stability and thus more long-lasting for deployment in industrial settings, and to inform additives to the phage preparations to increase their potency in killing bacteria. The project should provide significant benefits in training students and staff in methodology for investigating phage for future applications in Australian industry and biotechnology.	57,320.00	116,540.00	120,344.00	61,124.00	0.00	0.00	355,328.00
	National Interest Test Statement							
	Food security is essential in the 21st century, yet bacterial contamination of food causes significant sickness and death worldwide (e.g. in the USA, 9.4 million illnesses, and 1350 deaths annually). In the food industry, companies are driving developments to deploy phage (viruses that kill bacteria) to solve this problem, with phage-based products having received regulatory approval to remove bacteria from food and food-processing machinery. However, substantial gaps in our knowledge base about phage limit their effectiveness in industrial and health settings as well as the development of new applications. This project will use Australian national infrastructure for nanoscale imaging of phage to predict how stable they will be in industrial settings, and biological assays to determine how to maximize their potency in killing bacteria. The intellectual property and knowhow generated in the project will underpin the use of phage in food safety and other new health and biotechnological applications which could unlock substantial economic and commercial benefit for Australian and international companies.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101171 Berry, Prof Amanda	This project aims to investigate the development of primary teachers' adaptive expertise in interdisciplinary mathematics and science. As a critical component of quality teaching, adaptive expertise is essential for teachers to innovate their teaching to enhance student learning and interest, yet little is known about its development. The project aims to explore how adaptive expertise can be fostered through classroom innovations purposefully co-designed by teachers and researchers in the context of interdisciplinary mathematics and science. Expected outcomes include a better theoretical understanding of adaptive expertise in the context of interdisciplinary mathematics and science to benefit teacher learning and improve student outcomes. **National Interest Test Statement** Knowledge and skills in mathematics and science are essential for young people to understand the world around them and to prepare them for future studies and jobs. However, (inter)national tests in mathematics and science consistently demonstrate a decline in both achievement and interest of Australian students in these subjects. Since student interest and achievement in primary mathematics and science strongly predicts uptake and success in these subjects later in life, primary teachers are key to reverse these trends. Interdisciplinary approaches to teaching mathematics and science have been shown to lead to deeper learning, enhanced engagement and development of skills such as problem solving, creative and critical thinking. Teachers need to develop adaptive expertise in order to teach mathematics and science in interdisciplinary ways. This project aims to contribute to the design of teacher professional learning programs that effectively foster the development of such expertise, leading to improved student achievement and interest in primary mathematics and science.	45,049.00	91,606.00	100,662.00	54,105.00	0.00	0.00	291,422.00
DP210101197 Burridge, Prof Kate	This project aims to uncover how older Australians talk about and understand depression and anxiety, and it seeks to raise awareness of these debilitating conditions via new media. There has been much medical research in this area, and while language has been identified as highly relevant for recovery, little is known of how people express their experiences around mental well-being. The research gap is even wider for the worst affected in the population — older adults. These illnesses are shrouded in taboo, and symptoms often go undetected. The expected outcomes of the project are improved communication about mental well-being and the celebration of the lives and stories of older Australians — an integral but vulnerable segment of society. **National Interest Test Statement** Many older Australians suffer from late-onset depression and anxiety, but little is known about these conditions due to a lack of research and the stigma surrounding these illnesses. Instead of talking openly about their mental health, older adults often camouflage their language when expressing how they feel. The fallout from this behaviour is potentially disastrous – symptoms go undetected and treatment does not come in time. Yet health and illness are not solely physiological conditions; they are also sociocultural concepts that can best be captured by examining the language we use to describe them. The aim of the research is threefold: to uncover how older Australians talk about and understand mental wellbeing; to raise public awareness of these debilitating conditions via new media such as podcasting; and to suggest language strategies for clinical and nursing professionals working in aged care. By lifting the taboo around late-onset depression and anxiety, the project ultimately seeks to help older Australians lead happier and healthier lives.	18,500.00	50,500.00	82,750.00	50,750.00	0.00	0.00	202,500.00
DP210101299 Lattanzio, Prof John C	This project aims to develop a new method for calculating mixing and burning in stars, by combining the results of supercomputer calculations with a novel 2-stream mixing idea. It will develop new techniques suitable for studying the long-term evolution of hot gases that are both mixing and burning at the same time. Expected outcomes will be advances in computational gas dynamics, a robust new model for mixing in stars, and an improved understanding of the production of the heaviest elements. Benefits will include advances in computational gas dynamics, astronomical modelling, and strengthened research connections with astronomers and computational scientists in the UK and Sweden.	75,000.00	155,000.00	160,000.00	80,000.00	0.00	0.00	470,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	This project will generate advances in computational fluid dynamics through a new model for mixing in stars which explains the production of the heaviest chemical elements. Benefits will accrue through advances in computational gas dynamics, astronomical modelling, astronomy and computational science to underpin downstream industries. For example, the computational techniques we develop will be applicable to other problems in gas dynamics, including mixing and combustion, with potential commercial applications. Specifically, the tools developed could unlock significant economic and commercial the aerospace industry and new space initiatives, through the design of improved fluid transport modelling for engines, and advanced computational techniques based on the modelling in this project. In this way, the project will support the objectives of the fledgling Australian Space Agency.							
DP210101398 Kasza, Dr Jessica E	Stepped wedge cluster randomised trials are increasingly being used to test interventions, across many disciplines. This project aims to develop highly efficient trial designs and new methods for the estimation of causally interpretable effects when adherence to interventions is not perfect. This project expects to generate new design types that reduce resources required to test interventions, and methods to understand how these interventions work. Expected outcomes include tools to help researchers develop cheaper and more appealing trials, tools to estimate causal effects, the methodology underpinning these tools, and new collaborations. This should provide significant benefits by allowing more interventions to be tested and understood.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
	National Interest Test Statement							
	This project aims to develop statistical tools for the design of cluster randomised trials that reduce waste and improve efficiency. Advances from the project will allow the design of new biological, physical or social interventions that require fewer resources than would otherwise be needed to implement and yet yield meaningful results. This reduction in research waste will reduce costs and improve the efficiency of translation for interventions being tested and then implemented in the real world for the benefit of Australian society. This benefit will accrue across application areas, but will be seen in the medical and pharmaceutical industries where cluster randomised trials are gaining popularity in clinical trials, as well as in public policy where public health and education interventions are targeted at the group level.							
DP210101414 Whittaker, Prof Andrea M	This socio-cultural study aims to undertake a comparative study of the new Australian Uterine Transplant (UTx) trial with established and emerging UTx programs in the US and India. Expected outcomes of this project include: enhanced understandings of the experiences and meanings of uterine transplant for women donors, recipients and staff involved in UTx trials; an exploration of the ethical issues raised by this technology; and a comparison of social responses to uterine transplants across different societies.This study is anticipated to provide theoretical insights on the social and ethical impacts of this technology for improved public policy responses.	60,180.50	133,698.00	123,370.00	49,852.50	0.00	0.00	367,101.00
	National Interest Test Statement							
	This project will have social benefits to Australia in providing better understanding of the social and ethical impacts of this new reproductive intervention through a comparative study of the new Australian Uterus Transplant Team Trial at Royal Prince Alfred Hospital with established and emerging Uterus transplant programs in the US and India. It will enhance Australia's international reputation for scholarship in the social sciences and ethics, in particular our reputation for leading innovative theory associated with reproductive technologies. The project will build a dynamic collaboration between leading Australian and international researchers and institutions in social science and medicine as well as provide research training opportunities in Australia. Translation of the findings will inform the formulation and design of national/international policies and practices and will inform public debate over the development of new reproductive technologies							
DP210101423 Bowman, Prof John L	This project aims to investigate how a genetic system, comprised of a homeodomain protein encoding gene family controlling the haploid to diploid transition, has evolved during land plant evolution. The project expects to generate new knowledge concerning the evolution of land plants from which our food and fibre are derived. The intended outcomes include an elucidation of how an ancestral genetic network was elaborated during the evolution of a multicelluar organism, including the retention of ancestral functions and the origins of new functions. An anticipated benefit is the ability to manipulate the the growth and development of plants based on fundamental principles, which has broad agricultural implications.	89,000.00	174,000.00	170,000.00	85,000.00	0.00	0.00	518,000.00

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Nearly all of our food is ultimately derived from land plants and humans have long managed plant growth in cultivated crops. Nearly all crops are flowering plants, representing a derived lineage of land plant diversity. This study will investigate the genetic basis and evolution of the land plant life cycle, in which both haploid and diploid phases consist of complex multicellular bodies. This project will generate new understanding of the genetic basis underpinning the development of land plant bodies made using two model laboratory plants. Our findings will be applicable to all land plants and will help understand important processes such as pollen and seed production and lay the foundation for their manipulation based on fundamental principles. The application of knowledge gained has the potential to enhance targeted selection of new forms of crops for increased biomass, better drought resistance and regulated fruit and seed development, and will inspire the next generation of agricultural innovators.							
DP210101451 Bourgeois, A/Prof Laure N	This project aims to characterise a new way of generating strengthening precipitate structures for lightweight aluminium alloys. Precipitation in the solid state is key to the performance of many materials, but is especially important for light alloys used in structural applications. This project expects to deliver greater fundamental understanding of precipitation mechanisms and generate experimental and computational methods for three-dimensional characterisation and simulations at the atomic-scale of embedded nanostructures. This should provide significant benefits for the improved design of light alloys, such as for the automotive and aerospace sectors, but also for high-tech materials whose function depends on precipitates.	87,500.00	170,000.00	147,500.00	65,000.00	0.00	0.00	470,000.00
	National Interest Test Statement							
	By generating knowledge about the atomic-scale mechanisms of precipitation in aluminium alloys this project aims to provide a fundamental basis for improving the design of such alloys in order to reduce their cost or increase their performance. This would benefit the industries using these alloys in the medium to long term, such as the automotive, aerospace, packaging and manufacturing industries. The scientific findings expected from this project should additionally benefit the design of many other technologically important materials containing precipitates, such as materials for magnetic storage or for generating electricity from waste heat (thermoelectric materials). By developing new techniques for probing and simulating three-dimensional nanostructures at the atomic scale, this project should also stimulate future explorations into the structure of materials. Australia has a large primary industry, and efforts to value-add to the primary products by developing engineering materials should be beneficial to the Australian economy.							
DP210101500 Harris, Prof Nicola L	This project aims to identify more sustainable control strategies of nematode parasites of livestock, which cost more than 400 million yearly to the Australian wool and meat industry. The project expects to identify novel nematicides and generate knowledge of the parasite biology using a combination of high-throughput drug discovery screens with cutting-edge OMICs approaches to target a key molecular pathway of importance to the survival of nematodes, namely their blood-feeding behaviour. Expected outcomes of this project include a likely enhancement of international efforts in controlling these parasites as well as nematicides commercialisation. This should provide significant benefits to agricultural producers in Australia and worldwide.	76,250.00	149,975.50	146,375.00	72,649.50	0.00	0.00	445,250.00
	National Interest Test Statement							
	Nematodes (worms) are ubiquitous parasites infecting livestock and companion animals. Infection causes sickness and impedes growth, impacting on wool and meat production and imposing a significant economic burden on farmers and economies. Haemonchus contortus, is one of the most common nematode of veterinary importance and causes devastating disease in cattle, goat and sheep. Losses associated with nematide parasite in sheep alone have been estimated to cost Australia $436 million AUD annually. Treatment options are limited, with no effective vaccine available and an increasing emergence of parasite resistance against the different classes of nematicides available for livestock. Blood-feeding is central to this parasite’s development and survival, as well as being the major cause for disease in animals. This project aims to identify sustainable control strategies by furthering our understanding of the parasites ability to feed on blood, and to use this information to identify urgently needed new drugs and vaccines.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101504 Sexton, Prof Patrick S	Life relies upon the fundamental ability to convert external stimuli into an appropriate biological response. Such stimuli are transmitted by cell surface proteins (receptors), which convert this stimulus into an intracellular signal. The largest group of cell surface receptors is the G protein-coupled receptor (GPCR) family. Despite advances in GPCR structure determination, many questions regarding the structural basis of GPCR function and signalling remain unanswered. The primary outcome of this project is to provide mechanistic insight into the dynamics of GPCR ligand recognition and activation to advance our understanding of GPCR signal transduction, a fundamental biological process for all living organisms.	105,739.00	214,793.50	216,856.00	107,801.50	0.00	0.00	645,190.00
	National Interest Test Statement This project will provide major advances in our fundamental understanding of how key proteins (receptors) that are used by the body to receive signals that control cell and organ function can be activated by natural peptide ligands. This is critical to understanding the physiological control of numerous important bodily functions including feeding and metabolism, gastrointestinal motility and the communication between the gut and the central nervous system. The project also utilises state-of-the art technologies, including single particle cryo-EM and hydrogen-deuterium exchange-mass spectrometry, and will further advance this science to enable study of protein structure and function. CI Sexton's laboratory is a world leader in application of cryo-EM to understanding membrane proteins and this project will further enhance Australia's position as an international leader in structural cryo-EM leading to new opportunities for commercial investment. In the longer term, the advancement in understanding of receptor biology enabled by the project could improve future design and development of novel therapeutics.							
DP210101595 Cook, Prof Perran L	Emissions of the greenhouse gases nitrous oxide and methane are increasing from unknown sources. High concentrations of these gases have been observed in coastal waters which bear the brunt of nutrient pollution (primarily nitrogen) from cities and agriculture. This project aims to investigate the sources of these gases within these environments and the processes that lead to their formation. This new knowledge is expected to develop new models which aim to enable us to better predict the emissions of greenhouse gases within coastal waters. Expected benefit of this will be strategies to reduce greenhouse gas emissions.	111,261.00	233,140.00	224,477.00	102,598.00	0.00	0.00	671,476.00
	National Interest Test Statement Greenhouse gas emissions are the key contributors to climate change, which has a negative impact on Australia's agriculture ecology and liveability. Direct emissions of greenhouse gas emissions from human sources such as industry and transport are relatively well quantified. Indirect emissions from the environment and how this is enhanced through human activities such as nutrient release, is however less well quantified. This project will provide new understanding and models to help us quantify the production rates of greenhouse gases in coastal waters and how this can be reduced. This knowledge will provide Australia and other countries with critical information needed to meet its international obligations to reduce greenhouse gas emissions.							
DP210101639 Jones, Prof Cameron J	The project aims to generate novel, earth abundant main group compounds, with the ultimate objective of developing these as sustainable replacements for toxic/expensive late transition metal complexes, that are currently central to numerous stoichiometric and catalytic synthetic transformations. The project expects to generate major fundamental and applied advances in chemistry, using innovative synthetic and computational approaches, and a multidisciplinary collaborative team. Expected outcomes include building of academic and, later, industrial research capacity, knowledge, an international research network, and a highly trained workforce. Success should see substantial economic, environmental and societal benefits flowing to Australia.	80,000.00	160,000.00	160,000.00	80,000.00	0.00	0.00	480,000.00
	National Interest Test Statement This project will develop a new class of chemical compounds, derived from so-called main group metals, to underpin sustainable, low-cost and low-toxicity catalysis in industrial settings. Developing these alternatives to current transition metal catalysts will be of significant economic and commercial benefit to the fine chemical industries, which could face substantially reduced costs in chemical and pharmaceutical production. Environmental benefits will derive from the reduced accumulation of toxic heavy transition metals in the ecosystem and a reduction in the exploitative, polluting mining of such metals. The transfer of knowledge in a rich international and industrial ecosystem will ensure the production and future pursuit of valuable intellectual property.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101752 Cryle, A/Prof Max J	This project aims to uncover the origins of selectivity exhibited by the biosynthetic machinery that produces non-ribosomal peptides through advancing our understanding of how the central peptide synthesis domain functions. This project intends to generate new knowledge about peptide biosynthesis using a highly interdisciplinary approach and essential tools that have been developed. The anticipated outcomes of this project will be an enhanced understanding of the structural basis for substrate selection exhibited during peptide synthesis, revealing the specificity code of these key domains. This knowledge is vital for future efforts to reengineer such biosynthetic peptide assembly lines to produce new bioactive peptides. **National Interest Test Statement** Nature provides an abundance of complex short chains of amino acids (peptides) which are routinely screened for important applications in agriculture and health (among other areas). However, the natural cellular process to make many complex peptides is distinct from the well-known process of synthesising proteins within the ribosome. As a result, our ability to synthesise important complex peptide analogues commercially is hindered. This project will provide essential insights into the enzymes responsible for synthesising these so-called non-ribosomal peptides. The research will therefore unlock new efficiency and capability within the multimillion dollar Australian biotechnology industry and will underpin efforts to reengineer peptide assembly lines to produce new bioactive compounds and alter existing ones at commercial scale.	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00
DP210101755 Rosenbluh, A/Prof Joseph	Circular RNAs (circRNAs) are a, recently discovered molecule. circRNAs are highly abundant and expressed in a tissue and disease specific manner. Yet, currently the understanding of how circRNAs regulate biological processes is very poor. This project aims to use pooled shRNA libraries to screen a large panel of cell lines and systematically identify cellular activities that are regulated by circRNAs. The expected outcome of this study will be a catalogue of functionally active circRNAs. Over the past decades, the wealth of knowledge on the function of linear mRNAs has had a significant impact on medicine and agriculture. Similarly understanding how circRNAs regulate cellular activities may have an analogous impact on humans. **National Interest Test Statement** Circular RNAs (circRNAs) are a newly discovered, abundant class of molecule found within living cells which are likely to have critical biological functions. These molecules are found in a tissue and disease specific manner, suggesting they could also be key biomarkers of cellular function and disease for future diagnostics. However, currently our understanding of circRNA function is limited to a very small number of circRNAs. This project will define a blueprint of functional circRNAs and will target a handful of promising candidates for further downstream study. The project will deliver a knowledge base of circRNAs with defined cellular functions and developmental pathways. These findings may provide springboards for new therapeutic approaches in a range of diseases, with associated valuable intellectual property.	84,025.00	170,250.00	168,400.00	82,175.00	0.00	0.00	504,850.00
DP210101758 Wang, Prof Huanting	This project addresses the urgent challenge of chiral separation in the manufacturing of pharmaceuticals and agrochemicals by creating a new class of membranes produced by engineering functionalised porous framework crystals. This project expects to generate new knowledge regarding how membrane chemistry and architecture can be used to achieve highly selective, fast chiral molecule transport. The expected outcomes of the project include new membrane compositions, design principles, fabrication techniques, and proof-of-concept production of scalable, high-performance composite membranes. This project should produce significant economic and environmental benefits in the development of advanced membranes, pharmaceuticals, and agrochemicals.	84,705.00	158,185.00	148,505.00	75,025.00	0.00	0.00	466,420.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Chiral separation is required for manufacturing pharmaceuticals and agrochemicals, but it is a challenging task because of the same sizes and equal physical properties of chiral molecules. Australian agriculture heavily relies on the use of crop protection products (agrochemicals), which contributed around $20.6 billion annually to Australian agricultural output. For agrochemicals that are active in just one chiral form, inefficient or absent separation technologies leave up to 50% of inactive, toxic and polluting forms in the product, leading to unnecessary environmental pollution. A new membrane technology will be developed in this project to achieve high separation efficiency and reduce manufacturing costs, making chiral agrochemicals (such as herbicides and pesticides) more affordable and less environmentally damaging. Furthermore, the new membranes will provide an advanced remediation solution for removing chiral pharmaceuticals from wastewater, addressing an increasing concern of the adverse effects of these pollutants on human health and environment.							
DP210101863 Chen, Dr Zhaolin	This project aims to bring about a paradigm shift from the conventional non-quantitative magnetic resonance imaging to ultra-fast, quantitative, and artefact free imaging. This project integrates biophysics and artificial intelligence, and it is expected to bring new knowledge in both fields. The expected outcomes of this project include next generation magnetic resonance imaging methods with a fundamental shift in the approach to image artefacts and image quantification. This project is expected to advance both single subject and population level biomedical imaging with greater accuracy and cost-effectiveness. This project also promotes explainable and generalisable artificial intelligence in medical imaging.	70,850.00	187,200.00	188,500.00	72,150.00	0.00	0.00	518,700.00
	National Interest Test Statement							
	Each year more than 9 million Australians access 24 million radiology services. The motion introduced image artefacts alone cost $115,000 per magnetic resonance imaging scanner per hospital annually according to Radiology Society of North America. The expected outcomes in this project include advanced biomedical imaging technologies which will help to reduce the healthcare cost in Australia. These technological advances will further strengthen Australian industry and innovation to compete on the world stage in a field dominated by a handful of international industry giants, therefore maximising Australia's competitive advantage in the critical sector of biomedical imaging and advanced biomedical engineering. New knowledge from the biophysics informed artificial intelligence is expected from this project, which promotes the integration of physical and computational sciences in accordance with Australian strategic research programs.							
DP210101883 Melville, Dr Jane E	This project aims to address major macroecological concepts in reptile and frog communities through time, focusing on environmental and climatic gradients in species diversity and body-size variation. This project expects to generate a unique macroecological dataset by integrating data from Quaternary fossil sites spanning a 3000km latitudinal gradient with current ecological data. Expected outcomes include the first comprehensive ecological assessment of Australian reptile and frog communities through Pleistocene climate oscillations, with predictions into the future. This research will benefit Australian society by providing evidence-based knowledge of faunal community composition through time in association with changing climates.	67,785.00	181,433.50	207,135.50	93,487.00	0.00	0.00	549,841.00
	National Interest Test Statement							
	The forests of eastern Australia are a major biodiversity hotpot. The reptile and frog species of this biome are unique, with far higher levels of endemism than other vertebrates. We bring together a team of leading evolutionary ecologists, geneticists and palaeontologists to investigate the ecological origins of this globally important fauna. We will provide the first comprehensive assessment of how the frog and reptile communities of eastern Australia have changed over the last 500,000 years. We will answer many central ecological questions, providing important insights regarding how communities respond to climate changes - past, present and future. This research will benefit Australian society by highlighting the rich ecological history of our uniquely diverse reptile and frog fauna. Our findings will provide a significant advance in conservation management and future-proofing this unique faunal assemblage.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102015 Choe, Prof Chongwoo	This project aims to provide economic analyses of the costs and benefits of business strategies driven by consumer data, while considering consumers' privacy concerns. This is highly relevant and timely given the vast amount of consumer data collected, shared and used in the digital era. Expected outcomes include better understanding of how data may lead to market power and how to safeguard against abuse of market power and privacy breach. This project should make significant contributions to the nascent academic research and policy discussions in this area. This should also place Australia at the forefront of international scientific community and policy circle on the regulation of data-driven business strategies and privacy regulation.	44,500.00	98,000.00	88,500.00	35,000.00	0.00	0.00	266,000.00
	National Interest Test Statement Dominant large tech companies are leading sociocultural evolution in the digital era built upon vast amount of consumer data. This project will make significant contributions to understanding various business strategies primarily driven by consumer data, hence providing a safeguard against abuse of market power and privacy breach. It will also place Australia at the forefront of international scientific community and policy circle on the development of a regulatory paradigm in the digital era. This project is also related to cybersecurity, one of the Australian Government's National Science and Research Priorities: it will provide analysis of how consumer data can be acquired, retained, and used by firms; it will also provide a framework to think about consumer privacy and the regulation on how to safeguard sensitive data against possible breach while not harming innovation. This will help policymakers in balancing economic benefits from digitalisation against the potential harm to social fabric that may be caused by digitalisation.							
DP210102076 Guo, A/Prof Yuming	Catastrophic bushfires are a major natural disaster, causing serious air pollution. However, aligning bushfire air pollution and public health policies becomes a significant challenge, because limited studies are available on relationships between bushfire air pollution and human health, particularly for the prolonged exposure. We will characterize the nature of the relationships between bushfire air pollution and mortality/morbidity by developing a multi-country study; and estimate the burden of diseases attributed to bushfire air pollution. This project will provide essential scientific evidence to policy-makers and stakeholders in the development, prioritization and implementation of health protection strategies and policies.	69,624.00	155,473.00	163,858.00	78,009.00	0.00	0.00	466,964.00
	National Interest Test Statement This research project is directly in line with two national strategic research priorities: "Environmental Change" and "Health". Specifically, they include: 1) As climate change will increase the frequency, intensity and duration of bushfires, this project is important to increase fundamental knowledge and practical skills on the integrated and interdisciplinary assessment and management of health risks of bushfires; 2) The results of the project will inform public health policy to strengthen intervention strategies, which can protect vulnerable populations and workers from negative impacts from bushfires; and 3) The project encourages stronger collaborations between researchers, health, social and emergency services leaders, and governments. Accurate and meaningful health information from this study is essential important to improve public health policy.							
DP210102089 Beck, Dr Ben	This project aims to develop a world-leading platform for city-wide modelling of cycling exposure. This project will provide unparalleled insights into cycling exposure by combining multiple cycling data sources through the use of advanced spatial statistical and machine learning techniques. The expected outcomes of this project are a novel inventory of cycling infrastructure, a cycling route choice modelling system and robust predictions of cycling volumes on individual streets. This project will deliver a step change in cycling that will lead to increased cycling participation, enhanced safety, and improved infrastructure planning, thereby resulting in substantial gains in population and environmental health.	90,000.00	176,000.00	121,000.00	35,000.00	0.00	0.00	422,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement Cycling has numerous health, environmental and social benefits, through factors such as reduced traffic congestion and air pollution, and by promoting an active lifestyle which in turn improves population health. How safe someone feels when riding a bicycle is the major barrier to increased cycling participation. Therefore, providing protected cycling infrastructure (such as bicycle lanes that are physically separated from traffic) has the power to increase the number of people who ride bikes. However, there is a complete absence of detailed data related to where and when people cycle. In this project, we propose to develop a platform that will enable us to model the number of cyclists on each road in a city. This will enable us to address significant knowledge gaps in cycling safety, identify areas in which we need enhanced cycling infrastructure and enable us to evaluate the effectiveness of existing infrastructure. Overall, we anticipate the use of these data will result in improved safety for cyclists, lower injury rates, increased cycling participation and reduced inequities.							
DP210102107 Price, Dr Nicholas S	This project aims to investigate the origins of variability in the control of movements. This project expects to generate new knowledge in the area of sensory and motor neuroscience by determining how variability in the activity of sensory and motor neurons accounts for variability in the initiation and control of eye movements. Expected outcomes of this project include international collaboration, development of new methods for imaging neural activity in vivo, and refinement of theories concerning the cause and implications of noise in the brain. This should provide significant benefits such as a better understanding of why our movements are variable, and whether it is desirable or possible to minimise this variability.	107,432.00	228,695.00	219,773.00	136,038.50	37,528.50	0.00	729,467.00
	National Interest Test Statement This project will yield social benefits by revealing the neuronal mechanisms that underlie the control of movement and the generation of precise movements. Even elite sportspeople demonstrate variability in their well-practiced movements, but it remains unclear if this variability is detrimental and should be minimised, or if it is somehow desirable, or if the best sportspeople are those who can take into account their own variability. This project may yield commercial outcomes in the longer term, by defining energy-efficient, biologically-inspired algorithms for implementing the types of visually-guided motor control required by self-driving cars and object-tracking “follow-me” drones. In the longer term, understanding the mechanisms that account for variability of neural activity in the visual system of healthy brains, as studied here, will help develop prosthetic devices to aid people who are blind.							
DP210102275 Sunnucks, Prof Paul J	This project aims to characterize the evolution of novel, extended sex chromosomes in an Australian bird, then elucidate their role in climate-associated adaptive evolution. The species falls into two lineages bearing distinct mitochondrial genomes and nuclear-encoded mitochondrial genes carried on sex chromosomes. The project aims to test whether this extraordinary genome arrangement is splitting the species into two forms: one adapted to hotter, drier environments, one to milder ones. This would be tackled using an innovative combination of genomics, cytogenetics, and metabolic data. Understanding the mechanisms at play would represent a major advance in ecology and evolution, with potential implications for conservation management.	75,000.00	148,500.00	125,000.00	51,500.00	0.00	0.00	400,000.00
	National Interest Test Statement Australia is home to an exceptional diversity of birds, beloved by Australians and beacons for visitors. But Australia’s bird populations are collapsing through the combination of warming and drying conditions, and loss and fragmentation of habitat. The options for birds to respond include shifting their ranges, and adapting evolutionarily to new conditions. To understand how and where these might happen requires knowledge of the abilities of birds to thrive in different conditions, and how those capacities might evolve. Genome science presents previously unimaginable capabilities to understand how evolution happens. This project proposes using world-class genome and chromosome science, innovatively combined with detailed information on individual birds, to understand how the sex chromosomes of a group of Australian birds have helped them adapt their body systems to different climates. This information will equip decision-makers with the information needed to consider how species are likely to respond evolutionarily to changing environments, with implications for managing and conserving viable populations.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102342 Western, A/Prof Patrick S	Sperm mediate inheritance by transmitting DNA and associated chemical (epigenetic) modifications to offspring. We hypothesise that epigenetic modifications protect DNA from mutations during sperm formation. Using innovative models, our interdisciplinary team will determine whether loss of specific epigenetic modifications permits mutations in sperm and whether these mutations are transmitted to offspring. Our work will contribute to understanding how new mutations arise in sperm and potentially affect offspring phenotype, adaptation and evolution. As chemicals, drugs and diet can affect epigenetic function, our studies will also contribute to determining how epigenetic inheritance affects environmental, agricultural and healthcare outcomes.	80,707.00	165,964.00	177,862.00	92,605.00	0.00	0.00	517,138.00
	National Interest Test Statement Sperm and eggs transmit the parent's DNA and non-genetic information to offspring in mammals and other species. Both the DNA and non-genetic information are critical for normal offspring development, for animal health and for the evolution and adaptation of species. This discovery project will provide substantial advances in understanding how epigenetic modifications protect DNA against genetic mutations in sperm. Understanding this is essential for fully understanding inheritance, which is relevant to all sexually reproducing species. Moreover, as epigenetic modifiers are affected by environmental agents, the outcomes of this project will be relevant to understanding how chemicals, pollution or other environmental factors might disrupt the normal epigenetic program in sperm, and thereby indirectly cause mutations. The findings will provide information essential for understanding inheritance, which is applicable in the agricultural, veterinary, environmental, conservation and health industries, and potentially for determining how rapidly changing environments might influence species adaptation.							
DP210102480 Thomson, Prof Robert	This project aims to investigate the extent to which campaign promises made by politicians are kept or broken. It intends to conduct new research on Australian politics while advancing an established international research program. This project expects to generate and disseminate new knowledge that is urgently needed due to declining levels of trust among citizens in politicians. The expected outcomes include new theory and internationally comparative evidence on which campaign promises are kept and broken. This should provide significant benefits, such as greater public awareness of actual levels of promise keeping. It should also benefit policymakers who use campaign promises to anticipate and prepare government policies.	37,637.50	85,375.00	89,371.00	41,633.50	0.00	0.00	254,017.00
	National Interest Test Statement The strength of Australia’s democracy depends on citizens and policymakers knowing how it works. Parties' campaign promises are a vital part of democratic theory and practice. The majority of citizens believe that campaign promises are usually broken, and research has identified a strong link between this belief and low levels of trust in politicians. However, preliminary evidence on Australian politics and similar more comprehensive international evidence does not support this widespread belief. Instead, many promises are kept. This project aims to conduct new comparative research on campaign promises in Australia, and to improve public awareness of actual levels of promise keeping. The project is also relevant to the Australian law that requires the Parliamentary Budget Office to estimate the expected budgetary effects of parties’ campaign promises. The project will examine the actual fulfilment of all campaign promises, whether or not they have budgetary implications. It will also put Australia at the forefront of innovation in an established international research program that spans twenty countries.							
DP210102508 Eriksson, A/Prof Anna	This project aims to understand how innovations in the prison environment can promote positive human connections between prisoner and staff groups, which has the potential to reduce the dehumanisation and related harms associated with imprisonment in Australia. Using state of the art research methods and innovative theoretical tools, the project will explore how the concept of social infrastructure can be applied in prisons. Outcomes include new knowledge focused on the interaction between people and spaces in correctional settings when the purpose is positive human development. The anticipated benefits include the release of more prisoners who can be functioning citizens, contributing to community safety and productivity in the long term.	33,115.00	91,912.00	96,280.50	37,483.50	0.00	0.00	258,791.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Incarceration rates continue to increase across Australia, with all States and Territories engaging in expensive prison building programs. However, there is no evidence that this approach leads to a reduction in recidivism or make communities safer. One factor that contributes to the high level of recidivism is a lack of attention to the daily life in Australian prisons as it concerns both staff and prisoners. This project will address this significant challenge, by addressing the way staff and prisoners interact, and how innovations in the prison environment can support positive and respectful human connections. Outcomes will inform policy on how to do approach prison design and management with the aim of producing the best possible environment that can support a reduction in reoffending and long-term community safety.							
DP210102585 Gopnik, Dr Hilary	This project aims to use evidence from archaeology and historical texts to develop a new understanding of the consensus-based political system of the Medes of the Zagros Mountains in the first millennium BCE. In spite of the enduring presence of the Medes in the historical texts of Ancient Greece and the Near East, this research project would be the first major piece of scholarship to address the nature of Median communities. This research seeks to create a new model for how these agro-pastoral groups may have responded to imperial incursions by the Assyrian Empire. Its goal is to benefit scholarship by developing a better understanding of how democratic systems can develop as a flexible response to external pressures.	15,000.00	36,578.50	46,840.00	53,365.50	28,104.00	0.00	179,888.00
	National Interest Test Statement							
	This project aims to broaden our understanding of democracy by investigating the development of consensus-based political decision-making in the ancient world, exploring the multiple avenues towards formation of these systems in the Middle East. Reconceptualising the history of democracy in this way will contribute to increased cross-cultural understanding and increased social cohesion in Australian society. A new appreciation of the shared genesis of these political and intellectual structures in Western and Middle Eastern traditions will help to reconcile different cultural groups. Identifying and describing the historical roots of democracy in the Middle East will also inform Australia's strategic efforts to promote stability in the region and elsewhere by giving a broader sense of ownership of democratic systems beyond the Western tradition.							
DP210102677 Tabor, A/Prof Rico F	This proposal seeks to provide a roadmap for the development and application of a new generation of microcapsules, based around sustainable, plastic-free technology. Renewable resources such as cellulose particles will be combined with innocuous inorganic binders in order to encapsulate valuable cargoes for delivery with potential applications in agrochemical delivery and consumer care products. The mechanical properties of the capsules will be measured and modelled, indicating how they behave in processing and use, and enabling their tailoring to release their contents at the right time. Surface modification of the capsules will be used to maximise their binding to materials of interest, such as clothes fibres in laundry products.	57,500.00	107,500.00	100,000.00	50,000.00	0.00	0.00	315,000.00
	National Interest Test Statement							
	This project aims to develop microcapsules to protect and deliver valuable chemical agents such as pesticides, but without using any plastics in their production. The capsule shells will be made from natural cellulose materials and silica, and will offer opportunities to tailor the release of materials contained inside. The capsules will be targeted for use in high value add areas to overcome the limitations of conventional (bulk) delivery methods. The project thereby offers the opportunity to not only add value in important industrial sectors such as agriculture and formulated consumer goods, but also to improve efficiency, reduce waste, and improve environmental outcomes by using carefully delivered doses of concentrated reagents that are highly targeted to their site of action.							
DP210102707 Egede, Prof Ulrik	In the decays of subatomic particles, there is an increasing number of discrepancies between the theoretical expectations and the measurements. This project aims to confirm or refute the interpretation of these results as arising from phenomena not described by the Standard Model of Particle Physics. The project expects to generate new knowledge to clarify this question by making an innovative set of measurements that are designed to minimise existing theoretical uncertainty. The expected outcomes are a deeper understanding of how the Universe works and an enhanced capability to collaborate internationally in Particle Physics. Significant benefits will be provided in terms of training in advanced computational methods.	76,500.00	150,000.00	148,500.00	75,000.00	0.00	0.00	450,000.00

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	The project will provide an enhancement of knowledge about how the Universe functions at the most fundamental level. It may lead to evidence of new forces of nature or new fundamental particles. This has a strong cultural benefit in the ever ongoing quest to understand the world we live in. The methodology developed in Particle Physics has a large impact on the R&D sector. Examples are the development of the world wide web, the application and understanding of machine learning in situations with complex data and the development of real time data processing. The project will lead to an increased collaboration with CERN, the world leading Particle Physics laboratory in the world, and increase the international connections of the research community. It will provide the capacity for Australia to take part in large international science projects in the future.							
DP210102714 Hutchinson, Prof Christopher R	This project investigates a new approach to engineering alloy design that explicitly takes into account, and exploits, the energy delivered into an alloy during deformation processing. The work intends to resolve fundamental questions concerning the effect of deformation processing of the evolution of the material structure and the effect this structure has on the resulting mechanical and corrosion properties. The new structures resulting from this approach are remarkably fine and uniform suggesting they will be both strong and corrosion resistant. The proposed work intends to uncover the origins of both these structures and new properties, and exploit them for the design of new engineering alloys with greatly improved properties.	37,500.00	87,500.00	105,000.00	80,000.00	25,000.00	0.00	335,000.00
	National Interest Test Statement							
	Engineering alloys, such as steel, aluminium and copper, are critical building blocks of modern society. They allow us to construct the buildings we work in, the cars and trains we ride to work, the planes we take on holiday, the infrastructure to generate and distribute electricity, and many more elements of modern society that we take for granted. This project is focussed on new approaches for making engineering alloys with greatly improved mechanical and corrosion properties for uses in transport, construction, manufacturing, electricity generation and transmission, ect. These are required to make our vehicles lighter and more fuel efficient, out structures more resistant to damage and failure, our manufacturing sector more competitive, our electricity generation and transmission more efficient and many more improvements that arise from having stronger, lighter, tougher, recyclable, and more easily processed engineering alloys.							
DP210102904 McGee, Dr Matthew D	Invasive species cause billions in economic damages to Australia, but we do not have effective means to identify dangerous species before they arrive and cause harm. This project aims to overcome this challenge using the latest techniques in machine learning combined with genetic, ecological, and functional datasets for thousands of species. This project expects to generate a novel framework that allows us to identify and rank dangerous invasive species in an unbiased way, helping to safeguard Australia's unique biological community. Expected outcomes include improved methods for detecting ecologically and functionally similar species, providing substantial economic efficiency benefits to Australian biosecurity.	55,394.50	113,289.00	115,789.00	57,894.50	0.00	0.00	342,367.00
	National Interest Test Statement							
	This project will assess invasion risk for all of the world's 16,000 freshwater fish species through the use of new machine learning methods combined with large-scale datasets of species relationships, ecology, and functional traits. These new techniques are capable of processing much larger datasets than past analyses, resulting in substantial improvements over old methods that require detailed evaluations of only one species at a time. We focus on freshwater fishes, as recent invasive freshwater fish species such as common carp have caused billions in economic damages worldwide and extensive damage in Australian waterways. Our research contributes to Australia's national interest by preventing economic damages through the identification of dangerous species before they invade and cause harm.							
DP210102924 Phillips, Dr Andrew J	The body's 24-hour clock regulates when we feel sleepy or alert. In shift workers, disrupted sleep and rhythms leads to fatigue and costly, often deadly, workplace accidents. Existing methods for measuring body clock timing are costly, impractical for operational settings, and do not work in real time. Using a shift-worker population, this project will develop models that accurately predict body timing, sleep/wake patterns, and performance for an individual, requiring only a simple activity/light sensor and an assessment of the body clock's sensitivity to light. The new model would revolutionise fatigue management and make safer work environments for millions of shift workers.	96,954.50	197,749.00	179,172.50	78,378.00	0.00	0.00	552,254.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement Fatigue in the workplace costs Australia >4% of GDP and leads to workplace accidents that cause immeasurable human suffering. The best predictors of fatigue are an individual's body clock time (circadian rhythm) and recent sleep/wake patterns. Currently, no methods exist for measuring circadian rhythms in real-time, nor for accurately predicting how an individual will sleep and perform on a given work schedule. This project will develop predictive models that are accurate at the individual level, which will transform existing approaches to fatigue management, enhancing safety and productivity in Australian workplaces. Disruption of the circadian clock (e.g., in shift workers) is a major contributor to obesity, diabetes, cancer, and depression, but we currently have no cost-effective way of tracking and reducing this threat. This project will generate the basic science to easily and cost-effectively determine an individual's circadian timing. This would put Australia at the forefront of a new paradigm in which body clock time can be routinely measured to improve health, productivity, and safety.							
DP210102931 Dowling, A/Prof Damian K	This project aims to unravel the evolutionary implications of heteroplasmy – a scenario in which multiple mitochondrial DNA genotypes exist in one individual. Recent studies indicate heteroplasmy is widespread, and can be caused by paternal transmission of mtDNA. But the effects of heteroplasmy on evolutionary processes remain unknown. Leveraging state-of-the-art methods, this project expects to generate new knowledge in the areas of evolutionary ecology and mitochondrial genetics. Expected outcomes include discoveries that advance understanding of fundamental biological processes, and student training. Expected benefits include strengthening of Australia's research capacity, by setting the research agenda in this rapidly developing field.	80,000.00	157,500.00	155,000.00	77,500.00	0.00	0.00	470,000.00
	National Interest Test Statement Mitochondria are the powerhouses within all our cells, passed down from generation to generation, but their role is even broader than that. This project will explore the evolutionary significance of genetic variation within mitochondria in adapting to environmental stress. By uncovering how this variation may underpin environmental adaptation, the project will generate significant benefit in understanding the evolution of organisms in the face of environmental change and also in understanding the processes that lead to mitochondrial disease. Specifically, the research may shed light on why some people develop mitochondrial diseases and other genetic carriers do not. Such discoveries may therefore ultimately assist in species conservation and in developing tools and therapies in biomedical science.							
DP210103010 Gleadow, Prof Ros	This proposal tests an emerging theory that allocation of resources by plants to growth or defence are interrelated, not alternatives as currently assumed. Like many crops, sorghum produces toxic cyanide, especially during droughts but its wild relatives make much less. This project aims to discover why cyanide is so common in domesticated plants and why levels increase with stress. This has important implications for developing crops that are high yielding and also climate resilient. Expected outcomes include full genome sequences for all of Australia's unique native sorghums, confirmation of new theories on the interrelationships between defence and growth and identification of new traits vital for developing the crops of the future.	71,500.00	143,000.00	146,500.00	75,000.00	0.00	0.00	436,000.00
	National Interest Test Statement The project will create economic and environmental benefits and contribute to the Australian Government's Science & Research Priority "Food: Enhanced food production - genetic composition of food sources appropriate for present and emerging Australian conditions". Sorghum is widely grown in Australia, particularly in the north. Most of its 19 wild relatives are only found in Australia. These crop wild relatives are an untapped and understudied source of traits that may be used to improve yields and resilience. Sorghum accumulates compounds that can cause cyanide poisoning in cattle, particular during droughts but the wild relatives are much less toxic. Why and how sorghum makes these toxins is not clear. The project capitalises on a unique opportunity to work with the U.S. Department of Energy's Joint Genome Institute to genetically sequence every one of these species. This project ensures that Australia will continue to lead the research into the genomes of its own plants and a vital step in drawing on our unique biodiversity to develop new climate-ready crops adapted to Australia's north.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103053 Lupton, Prof David W	To prepare new chemicals for the challenges of today, and those in the future, new ways to build materials are needed. These need to deliver maximum complexity (necessary for increasingly sophisticated applications) with minimal economic and environmental cost. In this proposal a family of reactions that are possible using light mediated chemistry will be developed. This approach will allow technologies to be discovered that will enhance the scientific communities ability to deliver materials designed for a wide array of functions from medicinal chemistry, through to materials science.	50,000.00	100,000.00	100,000.00	50,000.00	0.00	0.00	300,000.00
	National Interest Test Statement Many industries integral to Australia's future proposerity will rely of advanced materials capable of addressing future challenges ranging from energy production to the production of therapeutic agents and food security. The ability to manufacture such materials in an ecconomically and environmentally viable fashion will be integral to the uptake of such potentially transformative technologies. In this proposal new ways to build chemicals using an innovative strategy that exploits catalysis using light, with acids and bases, will be developed to access materials beyond the reach of current technologies. These technologies will be immediately available to the Australian science and technology community providing a competitive advantage to this country in the global fine chemical sector.							
DP210103056 Roujeinikova, A/Prof Anna	This project investigates the bacterial flagellar motor specialised for locomotion in viscous fluids. Its striking feature, revealed by cryo-tomography, is a complex cage-like protein scaffold that is hypothesised to stabilise the wider force-generating ring of the motor to sustain a larger turning force. The aim is to unravel the make-up of this scaffold and the structural basis for its ability to recruit more force-generating units, in order to advance our fundamental knowledge about the mechanism of the bacterial flagellar motor, and about strategies used by nature to increase its performance under high viscosity conditions. This research is expected to add a new paradigm for how polar flagellar motors assemble and function in bacteria.	95,200.00	192,550.00	187,175.00	89,825.00	0.00	0.00	564,750.00
	National Interest Test Statement Bacteria have evolved ingenious whip-like motors (flagella) which efficiently power movement in a fluid-filled environment. This project will reverse engineer the structure of these living motors which operate in the very viscous fluid environment of the human gut. The research will develop a blueprint of the powerhouse of these motors which harness electrochemical energy into the mechanical energy of rotation. This foundational knowledge is one of the first steps towards engineering biological motors at the nano-scale. Ultimately, breakthroughs in this area could help realise health and medical applications ranging from flagella-powered micropumps for lab-on-a-chip diagnosis to micro-robots for self-propelled, targeted cancer and gene therapy delivery.							
DP210103074 Nguyen, Dr Lan K	This project aims to elucidate how mammalian cells exploit the same molecular machinery to perform completely distinct jobs. While the repurposing of proteins by cells seems widespread, the mechanisms by which this occurs remains largely undefined. The project expects to generate new knowledge in the areas of cell signalling and systems biology, with important implications for many multi-functional proteins. It will utilise a highly innovative and interdisciplinary approach that tightly integrates mathematical modelling and biological experiments. The expected outcomes will aid strategies for reprogramming cells towards a desired phenotype, which will bring significant benefits to the fields of synthetic biology and bioengineering.	73,550.00	142,450.00	137,131.00	68,231.00	0.00	0.00	421,362.00
	National Interest Test Statement This project aims to deliver new quantitative knowledge of the mechanisms that living cells use to control their behaviours. These knowledge will ultimately lead to development of new effective approaches that reprogram cells towards specific desired outcomes, which will bring significant benefits to major industries such as bioengineering and biofuel production. Specifically, increased cell proliferation could be exploited for high-level bacterial or mammalian cell production that is critical for green energy generation, while enhanced cell migration could be used to enhance wound healing or tissue regeneration that are essential in regenerative medicine. Furthermore, since this project integrates mathematical and biological sciences and uses mathematical tools to understand biology, it will provide critical training opportunities that aid the development of Australia’s next generation of research leaders in the crucial field of ‘quantitative systems biology’. By doing so, it will place Australian science centre-stage internationally as a leader in this important and rapidly growing research area.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103092 Droniou, A/Prof Jerome	This project aims to design novel high-performance numerical tools for solving large-scale forward and inverse problems dominated by stochastic interfaces and quantifying associated uncertainties. In real-world applications such as groundwater, these tools are instrumental for assimilating big datasets into mathematical models for providing reliable predictions. By advancing and integrating high-order polytopal schemes, multilevel methods, transport maps, and dimension reduction, this project's anticipated outcomes are highly accurate and cost-efficient numerical schemes, certified by rigorous mathematical analysis. This should provide data-centric simulation tools with enhanced reliability, for engineering and scientific applications. **National Interest Test Statement** Seawater intrusion in freshwater reservoirs is an inevitable risk faced by coastal communities. Understanding the intrusion process is extremely challenging, as it involves reactive fluids flowing through porous media with various types of interfaces. The situation is worsened by the imprecise knowledge of reservoir parameters, roughly inferred from partial measurements. Computational science, underpinned by mathematics, is the only way to generate credible intrusion predictions by solving such complex inverse problems. This project will contribute to developing rigorous models and high-performance numerical algorithms to estimate reservoir parameters through simulations of groundwater flows in the presence of multiple interfaces. In practice, such models involve big datasets and are computationally intensive. Our advancements in both mathematical foundation and computational algorithms will provide enabling technologies for large-scale data-centric simulations at a reduced cost. The software produced by this project will benefit Australian scientists by helping them predict and mitigate environmental risks.	50,000.00	177,500.00	187,500.00	60,000.00	0.00	0.00	475,000.00
DP210103094 Poskitt, Prof Donald S	This project aims to develop new econometric and statistical techniques to quantify causal effects in treatment models with discrete outcomes. Expected outcomes include a much-needed weak instrument test, a measure for identification strength in partial identification setting, and an instrument-covariate selection procedure for high dimensional discrete models based identification power. The benefits include advanced knowledge in econometrics and statistics, and enhanced tools for program evaluation and policy assessment in empirical causal analysis using observational data. The project falls into the category of smarter information use and is relevant to any national priority areas where policy interventions require assessment. **National Interest Test Statement** This project aims to develop improved tools for program evaluation and policy analyses. A fundamental aspect of empirical data analysis relates to the identification and estimation of causal effects of policy relevant interventions. This research aims to improve the precision and robustness for estimating such effects. Research outputs have the potential to further enhance Australia’s international academic profile in econometric methodological research. The benefits of this research could reach far beyond academia to any national priority fields that require cost benefit analysis using observational data. As such, this research can bring national benefits in cultural, environmental and socioeconomic realms. The project falls into the category of smarter information use and it is relevant to several national priority areas such as health, energy, environment, transport, and food, where any new investments and policy interventions require routine cost benefit evaluation using real world data.	59,015.50	118,031.00	118,031.00	59,015.50	0.00	0.00	354,093.00
DP210103122 O'Keeffe, A/Prof Meredith	Understanding the basic functions of interferons, how they signal to cells, is central to understanding fundamental immunity. Interferons are crucial molecules of the immune system that are important for normal cell development and they protect the body from viral infection and cancer but can be deleterious in different autoimmune diseases and trauma settings. Preliminary Data shows there is a pathway of interferon signalling that has previously been overlooked. This project aims to understand how this pathway works and how it contributes to the normal workings of cells. This fundamental science has future consequences for the design of vaccines and for the design of therapeutics to treat diseases that show defective interferon signalling.	154,175.00	308,025.00	307,400.00	153,550.00	0.00	0.00	923,150.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement The project aims to decipher a cell signalling pathway central to immune responses. The work will change the way we currently understand the basic workings of the immune system. It will attract attention in the scientific community due to the novelty of the work and as such will result in publicity for the institutions involved and important publications. Moreover, it is likely that the findings will attract industry attention since the results of this work may contribute to the design of new vaccines or therapeutic medicines to treat autoimmune disease. The research will thus likely bring economic benefit to Australia. International collaboration will bring benefit to trainees working on the project and assist to build collaborations that may attract international funding to Australia.							
DP210103136 Purcell, Prof Jessica S	This project aims to resolve important open questions in low-dimensional topology, by connecting hyperbolic geometry to invariants arising from quantum topology, cluster algebras, and spinors. The spaces studied in this project, namely 3-manifolds and knots, arise in applications across engineering and science. The project expects to generate new insights into these spaces by applying tools connecting them to hyperbolic geometry. Expected outcomes include efficient techniques to compute important data about 3-manifolds and knots, particularly certain polynomials encoding geometry, and exact calculations of circle packings. This should provide significant benefits, such as progress on difficult conjectures in hyperbolic geometry.	37,500.00	107,500.00	140,000.00	70,000.00	0.00	0.00	355,000.00
	National Interest Test Statement This fundamental mathematics project will uncover insights in topology that can underpin advances in a variety of downstream applications. One immediate benefit of the project will be to boost Australia's capacity in a research area of international importance. The project will equip researchers with tools important for the economy; students and researchers working on similar projects have used the skills they have developed for data analysis, computing, and mathematical biology. The objects studied in topology, such as knots and manifolds, arise in a wide range of applications. These include the folding of proteins and knotted DNA in biology, and so-called configuration spaces in engineering and robotics, describing a robot's position in space. Longer term, breakthroughs in this project will yield insight that may deliver new tools in these areas, for example leading to therapeutic interventions related to knotted DNA clumps in life sciences, or increased efficiency of robots in manufacturing.							
DP210103174 Johnston, Dr Angus P	Improved stability and control over activity are key to unlocking the full potential of enzymes. Advanced polymer synthesis and synthetic biology will be combined to engineer stable, bioresponsive enzyme/polymer hybrids. This study will: 1: Develop a rapid screening method to identify the optimal sites for polymer-to-enzyme attachment 2: Evaluate the stability and bioresponsive activity of enzyme/polymer hybrids 3: Formulate enzyme/polymer hybrids into a targeted nanoparticle delivery system This project will examine the performance of polymer-enzyme hybrids with cells, however these innovations will also have significant applications in other fields using enzymatic processes, such as food processing, biofuel production, and agriculture.	70,000.00	140,000.00	140,000.00	70,000.00	0.00	0.00	420,000.00
	National Interest Test Statement Synthesising protein/polymer hybrid materials is a sophisticated, yet straight forward way to improve the properties of enzymes. These hybrid materials have the potential to revolutionise the use of enzymes in fields as diverse as agriculture (by improving soil fertility), biofuel production (by converting cellulose to fuel) and therapeutics. This proposal will engineer the precise attachment of polymers to enzymes to control their stability, activity and to improve delivery of enzymes to the places where they are required. Enzymes are a high value manufactured items, and there is a significant potential to value add to Australia's world leading expertise in polymer manufacturing. The project will expand Australia's knowledge base in biotechnology through the training of interdisciplinary researchers. It will also develop intellectual property that will benefit the emerging Biotec and MedTec industries in Australia, and will provide significant economic, commercial and healthcare impact.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103263 Lieschke, Prof Graham J	As cells migrate through tissues, they encounter complex, 3-dimensional environments that provide cues to guide them and present obstacles in their path. This project focuses on macrophages, a large immune cell capable of both amoeboid and mesenchymal modes of migration. The nucleus is the largest organelle and its bulk and stiffness must be managed as migrating cells travel through constrictions. The project uses specialised high-end microscopy and genetic methods to examine how the nucleus of migrating zebrafish macrophages deforms, repositions and is restructured during migration in living tissues, and how this influences macrophage locomotion. The goal is to provide fundamental insights into the cell biology of macrophage migration.	63,028.00	127,145.50	131,953.00	67,835.50	0.00	0.00	389,962.00
	National Interest Test Statement This project will generate foundational new scientific knowledge about macrophages, a cell type that all types of vertebrate animals including humans deploy throughout life in development, growth, immune defence against microbes and disease, tissue repair and organ regeneration. Immediate economic benefit will result from the research activity itself, including its timely deployment of Australian government investment in high-end computing, microscopy and biological research infrastructure. Future economic benefit may result from application of its foundational scientific knowledge, which we expect to be incorporated into textbook descriptions of white blood cell biology, enhance future research endeavours about these cells, and ultimately to improve animal and human health maintenance and disease management, particularly in the areas of immunity, inflammation and infection.							
DP210103296 Barr, Dr Jeremy J	This project aims to experimentally validate the largest ever collection of bacterial viruses (bacteriophages) within the gut microbiome. This project expects to generate new knowledge in the area of bacteriophage biology and genomics by using the innovative approaches of wet-lab and bioinformatic genome analyses. Expect outcomes of this project include the discovery of novel phages using bioinformatics, wet-lab validation of their activity and characterisation of their potential to contribute new bacterial host metabolism. This should provide benefits, such as advancement to our understanding of bacteriophages, improved bioinformatic software, and a characterised collection of commercially valuable bacterial strains and phages.	56,821.00	123,877.50	142,523.50	144,217.50	68,750.50	0.00	536,190.00
	National Interest Test Statement Bacteriophages are viruses that infect and kill only bacteria. This project will deliver significant new knowledge of the biology and diversity of bacteriophages within the human gut. The research will reveal bacteriophage strains that have the potential to enable the future generation of therapies targeting bacterial pathogens of the human gut. Other strains could serve as protective factors to be applied as biological control agents in Australian medical, agricultural and food production industries. The assembled library of bacteriophages and the changes they can induce in host bacteria will therefore be a valuable resource in generating and screening so-called ‘phage therapies’ as a new line of antimicrobial defence for human and animal systems which will generate future economic and health benefits for Australians.							
DP210103327 LE NOURS, Dr JEROME	The immune system has evolved to protect hosts from pathogens. T cells are a critical component of the immune system that can recognise infected host cells. However, there remains many facets of T cell function that we do not understand. This project aims to investigate a major aspect of T cell immunity that is poorly understood, namely, gamma/delta T cell immunity. Specifically, using a multi-disciplinary approach, the anticipated outcome of the project is to unearth the molecular recognition determinants of gamma/delta T cells. The intended outcome is to provide basic fundamental insights and conceptual advances into a poorly understood, but crucial, component of the immune system.	118,340.50	237,880.00	242,644.50	123,105.00	0.00	0.00	721,970.00
	National Interest Test Statement Unlike alpha/beta T cells, gamma/delta T cells can recognise a staggering range of molecules that differ dramatically in size, molecular structure, and chemical nature. Given the importance of current T cell-based therapies and vaccine designs based on alpha/beta T cell immunity, it is anticipated that fundamental new knowledge of gamma/delta T cell immunity generated in this project will lead the way for new forms of immunotherapy to be explored. Generating knowledge in this area may yield valuable intellectual property and the project will ultimately build links with biotechnology companies in Australia and overseas, to ensure commercial and economic benefit, building upon Australia’s reputation as a powerhouse of biotechnology and pharmaceutical innovation.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103361 Neild, Prof Adrian P	Mammalian reproductive tract is a complex microenvironment that has evolved to select the best sperm for fertilisation using a range of rheological, biochemical and geometrical cues. The project aims to engineer the first multiplexed platform, informed by the natural process, for fully automated and rapid selection of sperm based on all key selection criteria: morphology, swimming behaviour, and DNA integrity. The expected outcome is the next generation technology for sperm sorting and analysis. This should provide significant benefits, such as new biophysical insights into mammalian reproduction, with potential for future improvement of assisted reproduction technologies – a field in which Australia has a world leading history. **National Interest Test Statement** Australia has a proud history in assisted reproduction, including the world's first In Vitro Fertilisation pregnancy. Infertility is on the rise in Australia and worldwide, affecting 1 in 6 couples. In 2016, the Australian Government spent $200 million through Medicare benefits for assisted reproduction, a 2-fold increase since 2006. However, the success rate of assisted reproduction has plateaued at just ~33% per cycle, mainly due to lack of technological development to improve sperm selection. Current methods require human intervention to manually select sperm, which is inefficient and prone to operator-error. This project aims to develop a fully automated and multiplexed technology platform to sort cells based on key sperm selection criteria (morphology, motility and DNA integrity). The project will create a made-in-Australia technology for high-quality sperm sorting; beyond this project, this technology will have the future potential to improve infertility care worldwide, with significant socioeconomic impacts.	63,540.50	117,855.50	108,610.00	54,295.00	0.00	0.00	344,301.00
DP210103374 Lyras, Prof Dena	This project aims to investigate how the large clostridial toxins are secreted from important animal bacterial pathogens. This project expects to generate new knowledge about how bacteria interact with hosts through protein secretion, using a collaborative and interdisciplinary approach and cutting-edge techniques. Expected outcomes of this project include building a deep understanding of the role of export machinery in toxin secretion from bacteria, and the identification of new systems by which this is achieved. This should provide significant benefits, such as gaining new insights into new bacterial protein export mechanisms, with the aim of identifying targets for future veterinary disease interventions or biotechnological applications. **National Interest Test Statement** Infectious diseases pose economic, environmental and health threats to animals in Australia and worldwide. However, our studies of many microbes have been limited by the methods available to us in the laboratory, which have constrained our ability to answer important questions about how these microbes function. This research project will develop the tools required to study these microbes in molecular detail, and will provide training in this important research area to early career researchers and students. The outcomes of this project are intended to make important contributions to our understanding of how pathogens cause disease in their hosts and to provide insights into how they evolve to become more virulent. The aim of this proposal is to inform future disease prevention or treatment strategies and to identify targets for veterinary disease interventions or biotechnological applications. This is especially important for optimal food production and will thus support Australia’s economic future and national interest.	104,088.50	212,656.00	212,414.50	103,847.00	0.00	0.00	633,006.00
DP210103388 Coulibaly, A/Prof Fasseli	Baculoviruses are rare examples of viruses recognised for their positive impact on human activities. These viruses infect a broad range of insects and have been widely used in biological research, biotechnology and agricultural pest control. This Project aims to elucidate the structure and assembly of these beneficial viruses using advanced structural, biochemical and imaging approaches. The Project is expected to generate high-resolution models that define hallmarks of a new viral lineage, a significant breakthrough in our understanding of the virosphere, and underpin the future development of innovative baculovirus-based technologies such as selective bioinsecticides for the sustainable control of invasive insects.	84,500.00	172,200.00	170,200.00	82,500.00	0.00	0.00	509,400.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement The Project aims at a breakthrough in understanding of the biology of baculoviruses, a family of viruses affecting most insect species. This research is expected to attract broad scientific interest given the wide use of baculovirus as a critical tool in basic research and the commercial production of proteins for biotechnology applications. The Project is based on frontier structural biology and will train high-level scientists in cryo-electron microscopy, a field that has a national shortage in skilled research capacity. This will allow Australia to fully benefit from the "Resolution Revolution" and remain at the forefront of advanced imaging. Moreover, the knowledge and high-resolution models produced in the Project are anticipated to have economic, social and environmental benefits to Australia by paving the way to the rational design of novel virus-like particles for biotechnology and cost-effective bioinsecticides to combat invasive insects, which threaten Australian environment, health and agriculture security.							
DP210103425 Chan, Prof Philip W	This project aims to realise new and efficient catalytic chemistry for carbocyclic and heterocyclic synthesis, an immensely important compound family due to their synthetic, biological and material applications. This would be shown by providing new sustainable solutions that minimise resources use and waste production urgently demanded by industry and society to lessen the ecological impact of chemical manufacturing. Expected outcomes include new materials and chemical processes giving Australian industry and academia the cutting-edge in research competitiveness and capacity. This should provide major benefits such as training the next generation of Australian synthetic chemists and wealth creation by supporting the chemical sciences.	35,000.00	75,000.00	80,000.00	40,000.00	0.00	0.00	230,000.00
	National Interest Test Statement Cyclic molecules are immensely important due to the significant contribution they make to the quality of life, from the medicine we take to the food that we eat. The discovery of new cyclic molecules to further improve the human condition, however, requires the constant creation of new knowledge in chemical synthesis. Thus, this project aims to develop powerful new chemical reactions that allow for the preparation of sophisticated molecules in an efficient manner and, in due course, impact the way materials for function are made. The new materials and catalytic methods will position Australia to gaining a greater share of the US$5.7 trillion global chemical industry by giving the Nation the cutting-edge in research competitiveness and capacity. It will realise new low-cost and sustainable solutions urgently sought after by industry and demanded by society to lessen the ecological impact of chemical manufacturing. It will also train the next generation of highly skilled synthetic chemists with the ability to address the scientific challenges of the future and essential to the growth of the Australian economy.							
DP210103501 Kaslin, Dr Jan V	This project aims to uncover specific cellular and genetic mechanisms that control growth and shape of the brain. How brain shape and size changes during evolution of vertebrates is enigmatic but important to know for better understanding of behaviour and function of intact and diseased brain. The project aims to assemble team of national and international experts to build international capacity and unique genetics model to generate new knowledge of the cellular and genetic components that drive evolution of different brain parts and shapes the vertebrate brain. In doing so the project aims to provide research training, excellence and knowledge that in future may benefit health and the society.	68,700.00	123,023.00	102,840.50	48,517.50	0.00	0.00	343,081.00
	National Interest Test Statement This project aims to uncover the basic biological mechanisms that control brain growth and evolution. The biology responsible for brain development and growth are central for neurodevelopmental disorders and neurodegeneration, resulting in reduced cognitive function and decline in the young and aging population, respectively. This project will generate new knowledge in how specific cells and genetic factors build specific brain parts and drive brain evolution. Defining the cells and molecules influencing specific brain growth will provide foundational knowledge that may lead to new stem cell and regenerative therapies, drugs or predictive diagnostic tools to target neurodegenerative conditions with significant socio-economic impact for Australians.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103549 True, Prof Jacqui	This project aims to reconstruct international legal and political mediation frameworks to increase the chances of facilitating durable peace. Current peace mediation is ineffective as most peace agreements fail within 5-years. There is evidence that women's participation in conflict-resolution leads to better peace. This project will distil practical mechanisms and generalizable lessons from women's successful community level mediation in a toolset that can inform and transform high-level mediation processes. This project will generate an evidence base for rethinking peace mediation design and practice, traditionally characterised by male-dominated institutions and disciplines, to resolve conflict and benefit national and global security.	46,103.00	134,816.50	151,968.00	63,254.50	0.00	0.00	396,142.00
	National Interest Test Statement Australia is a major contributor to the global peace and security framework. In 2016 Australia prioritised gender equality and women's empowerment in multilateral diplomacy, aid and development, and security engagements as part of the Australian government's foreign policy. This project seeks to assist with these efforts by identifying and detailing the professional practices of women mediators in diplomatic, expert, and community-level roles. The aim of this work is to enhance the success rate of various peace processes, currently more than half fail to find a positive resolution. The findings will help inform Australia's future efforts in conflict resolution and provide an opportunity for bolstering Australian global leadership on the implementation of the Women Peace and Security agenda and the 2030 Sustainable Development Goals.							
DP210103595 He, Dr Lizhong	Antibiotic usage in agriculture contributes to spread of resistant bacteria. Existing antibiotic alternatives to minimize such usage are focused on growth promotion of animals and infection prevention, but lack efficient treatment. This project aims to engineer enzyme nanoparticles, with synergy from multiple enzymes, to confer better antibacterial abilities against livestock pathogens. It will combine protein engineering, nanotechnology and biophysics to develop new enzyme nanoparticles that can be manufactured at low-cost through self-assembly process. The intended outcome is knowledge on molecular engineering of enzyme nanoparticles and innovative agriculture biotechnology for treatment of bacterial infectious diseases in livestock.	47,109.00	98,623.00	99,673.00	48,159.00	0.00	0.00	293,564.00
	National Interest Test Statement Nighty-eight percent of veterinary usage of antibiotics in Australia is for food-producing animals, contributing to spread of resistant bacteria. Antimicrobial resistance remains a significant threat to Australian animal sector including damaging effects such as poor animal health and welfare, decreased production and economic loss. Furthermore, it can potentially compromise food safety, resulting in higher cost for farmers and consumers of animal products. Existing antibiotic alternative products are focused on growth promotion of animals and infection prevention, with limited options for their treatment. This project will discover new knowledge on engineered enzymes as innovative antimicrobial alternatives for agriculture, such as topical treatment of skin diseases of livestock. The discovered principle of molecular engineering of enzymes will underpin development of innovative alternatives-to-antibiotic agents for agriculturally important livestock. The outcome will contribute to the Australian animal agriculture sector by providing better animal health, improved food safety and higher productivity.							
DP210103610 Boyce, A/Prof John D	Livestock infections cause major economic losses worldwide. The bacterium Pasteurella multocida causes multiple diseases in a range of livestock, including hemorrhagic septicaemia in cattle and fowl cholera in poultry. Two surface polysaccharide structures, capsule and lipopolysaccharide, are crucial for P. multocida to cause disease. Our data indicate that varying the amount/content of these structures also affects vaccine performance. This project aims to identify how the production of these P. multocida structures are controlled and if changes to these structures affect its ability to infect different animals/birds. Using this information, the project aims to develop state-of-the-art livestock vaccines with superior disease coverage.	102,957.00	238,065.00	265,633.00	130,525.00	0.00	0.00	737,180.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Efficient livestock industries are crucial to Australia's economic and cultural success. For decades, antibiotics have been used to decrease bacterial disease and increase production efficiency. But bacterial antibiotic resistance is at an all-time high, and there is a worldwide call to drastically reduce antibiotic use in production animals. To move towards this, better livestock disease prevention strategies are required. State-of-the-art animal vaccines must be a critical part of that strategy. Fowl cholera affects all poultry industries worldwide, including here in Australia. Fatal haemorrhagic septicaemia in cattle and buffalo is a serious disease in Asian countries and an ever-present quarantine risk for Australia. These are only two of the many diseases caused by just one bacterial species, Pasteurella multocida. Current Pasteurella vaccines offer only limited protection. This project aims to understand how to precisely manipulate the carbohydrate structures on the surface of this bacterium to enable engineering of more efficacious and broadly protective vaccines against this multi-species pathogen.							
DP210103690 Grodach, Prof Carl W	This project aims to examine the changing functions and roles of urban industrial land. Planning for industrial land remains rooted in approaches that are out of step with existing and emerging conditions. Urban policymakers sacrifice dwindling employment lands for property value growth and miss opportunities to incorporate industrial activity in sustainable planning goals. Through digital archival mapping, on-site analysis, and planner interviews, this project seeks to develop a deeper understanding of how industrial lands and their regulatory settings are linked to changes in urban development over time. This should lead to new knowledge to reinvent industrial zones to meet contemporary needs and adapt to future disruptions.	28,114.50	59,552.50	63,259.00	31,821.00	0.00	0.00	182,747.00
	National Interest Test Statement							
	This project will update and reorient planning for industrial land uses resulting in significant benefits to Australian communities. Through development and application of new digital archival resources alongside detailed analysis of contemporary industrial districts, the research will inform new approaches to planning for industrial areas. Research outcomes will assist planning practitioners in meeting the needs of contemporary industrial businesses within broader sustainable planning goals and in confronting future economic disruptions. Simultaneously, it will help to shift the Australian focus from property value growth to more balanced and equitable development. Industrial lands can provide the necessary affordable space for firm start-up, innovation, and growth, but these potential benefits are lost to property redevelopment. The reinvention of industrial lands can therefore be a significant source of economic diversification and quality job creation leading to more inclusive urban economic growth.							
DP210103865 Rosa, Prof Marcello	This project aims to investigate how the cerebral decodes visual information in order to guide sensory-guided actions. Using a high resolution technique, capable of monitoring the activity of many cells in real time, it will study how sensory signals about the motion of visual patterns interact with noise (fluctuations in neuronal activity that are not directly related to the sensation being encoded) in order to determine decisions made by an animal. Expected outcomes include new knowledge about the cellular circuits responsible for vision, and new technologies for decoding brain activity from physiological measurements, which may in the future guide the development of improved bionic devices such as brain-computer interfaces.	96,476.00	193,644.00	194,913.50	97,745.50	0.00	0.00	582,779.00
	National Interest Test Statement							
	This project will seek knowledge about how to decode ("read") brain activity using physiological measurements, in particular with respect to what the eyes are seeing, and the intention to move the eyes in specific directions. The capacity to decode brain activity is key to many emerging technologies involving brain-machine interfaces - for example, better bionic devices for restoration of brain function and for the control of external devices such as robotic arms, vehicles and computer interfaces. The immediate benefit of the project will be advancement of knowledge about the brain computations that lead to vision. It will also enrich Australian research in the neurosciences by promoting direct collaboration between biologists, physicists and engineers, and will provide multi-disciplinary training for PhD students. The project findings may also have impact in the field of neuro-technology, by providing information that will help guide the future development of improved bionic eyes and other types of brain-machine interfaces.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103881 Ferrero, Prof Richard L	This project aims to investigate how bacterial membrane vesicles transport their cargo to the nucleus of cells and its impact on host cell functions. Bacteria use membrane vesicles as a means of communication with the host, but the full extent of their effects on host cells has yet to be fully elucidated. This project expects to generate new knowledge in the field using cutting-edge imaging and molecular biology approaches. The work should provide significant benefits, particularly towards the development of membrane vesicles in gene therapy, gene editing and other applications.	74,800.00	144,850.00	140,050.00	70,000.00	0.00	0.00	429,700.00
	National Interest Test Statement The proposed research will provide new knowledge on how microorganisms interact with the host. Specifically, we hypothesise that membrane vesicles, which are naturally released by bacteria, play a crucial role in communication with host cells. To address the hypothesis, we will determine the mechanisms by which these membrane vesicles enter host cells and deliver their bioactive cargo, including DNA, to the nucleus. We know that bacterial membrane vesicles share properties with synthetic nanoparticles and viruses. By understanding the cellular entry and trafficking of bacterial vesicles, it will be possible to develop these natural nanoparticles as vectors for gene therapy, gene editing and other applications aimed at improving human health, thus potentially leading to significant commercial benefits for the Australian community. Furthermore, knowledge gained from the research may be applied to the development of strategies to control the spread of antimicrobial resistance, a huge problem with significant impacts on both the health of our communities and the economy.							
DP210104029 Polo, Prof Jose	The aim of this project is to determine how transcription factors control cellular identity, which is relevant to many biological processes including embryogenesis, cellular reprogramming and differentiation. Innovative genomic tools will be combined with various in vitro cellular conversion systems to generate fundamental mechanistic insight into how transcription factors mediate these identity changes. The knowledge gained from this work will allow us to answer standing fundamental questions in regards to cell fate control and the biochemistry of transcription factors, which in turn will aid in the development of novel gene regulation technologies applicable to a myriad of fields and industries.	88,202.50	176,405.00	176,405.00	88,202.50	0.00	0.00	529,215.00
	National Interest Test Statement This project will unveil the fundamental mechanisms by which transcription factors control cell identity (e.g. what makes a heart cell a cell of the heart or a neuron a cell of the brain?). Understanding these processes is of major importance if we want to control cell identity and in turn generate specific cell types for their use in pharmaceutical screening and regenerative medicine approaches as well as novel technologies with future applications in the biotechnology, food and farming industry. Additionally, this project will provide important mechanistic insight into the modes of action of transcription factors, which is not only essential for the basic understanding of many physiological processes including development but might further aid in the design of novel site-specific gene editing or gene regulation tools with potential applications in a myriad of fields and disciplines.							
	Monash University	5,730,190.50	11,986,587.50	11,920,038.50	5,964,579.00	300,937.50	0.00	35,902,333.00
RMIT University								
DP210100386 Wilken, A/Prof Rowan C	This project aims to examine the rollout of 5G and assess the implications of this emerging technology for public telecommunications from the perspective of multiple stakeholders (including emergency services). 5G will radically transform the role and function of the telecommunications sector, and this project will examine the evolution of public telecommunications as part of this larger transformation. It will provide an evidence base for stakeholders and chart a new role for public telecommunications during a period of structural change. It will also help scholars reconceptualise core tenets of public telecommunications policy. Benefits include the more efficient use of public resources in the telecommunications sector.	18,268.50	53,268.50	65,225.00	30,225.00	0.00	0.00	166,987.00

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement Next-generation 5G wireless technology stands to radically transform how various stakeholders interact with the telecommunications sector. If the transition to this new technology is well-managed, Australia could realise substantial economic benefits. However, this requires an appropriate regulatory mix. This project will help Australia prepare for a 5G future by outlining how existing commitments and obligations to public telecommunications should be reconceptualized following the adoption of next generation 5G wireless networks. This will assist government in understanding how to best to translate the important regulatory levers that support public aspects of the telecommunications system, from the delivery of emergency notifications to the universal service guarantee, in a changed economic and technological context. The project will directly inform and enable policymakers and provide wider benefits to the Australian public.							
DP210100743 Deng, Dr Ke	This project aims to develop a novel stream data classification model to handle the challenges in the era of 5G networks, such as the scope of the stream data, the complexity of their relationship, the diversity of contained information and the incorrect readings of numerous sensors. The project addresses a significant knowledge gap by exploring and modelling the stronger correlation between data instances in the streams. The outcome is a system that is highly efficient, accurate and corrupted-data-tolerant classification solutions for individual stream data as well as multiple stream data. The expected benefits will be far-ranging and adaptable to many domains, such as smart home, medical and healthcare, transportation and manufacturing.	47,579.50	94,179.00	97,417.50	50,818.00	0.00	0.00	289,994.00
	National Interest Test Statement "The internet provides a wealth of data that is not easily interpreted due to its size, continuously changing nature and complexity. Computer scientists seek to capture, classify and analyse this data more effectively to allow governments and companies to make more informed decisions. This project aims to create a new tool for capturing, classifying and analysing digital data from multiple sources including 5G networks. We expect the tool will enhance data driven analysis and decision-making in a range of Australian and global industries, including government agencies, emergency services, law enforcement and national security. The project outcomes will benefit Australian businesses by giving them the capability to monitor complex systems such as production lines, running machines, market changes based on various financial stream data, and shifts in customer preferences based on continuous social media data. This project will consolidate Australia's competitive advantage in this field, which could well lead to economic benefits for all Australians in the future.							
DP210101249 Robinson, Prof Stephen R	The present CIs have demonstrated that vibrational frequencies of 4-7 Hz entrain brainwaves associated with the onset of sleep. Our unpublished pilot data show that higher vibrational frequencies can restore alertness. Thus future vehicle design could dampen 3-8Hz vibrations while higher frequency vibrations could counteract drowsiness or stimulate alertness. This project aims to: i) develop novel equivalent drowsiness contours for the effects of physical vibration on driver drowsiness that will form the basis of a new industry standard for transportation safety; ii) develop an innovative vibration regime to improve alertness. This research will reduce transportation injuries and deaths by enabling the design of safer transport vehicles.	45,000.00	97,500.00	102,500.00	50,000.00	0.00	0.00	295,000.00
	National Interest Test Statement Expected outcomes of this project include a new method to predict the effects of physical vibration on driver drowsiness, and a proven regime for delivering intermittent vibration to restore alertness by brainwave entrainment. This novel method will enable the Australian transport industry to play a significant role in the development of new systems to improve transportation safety, thereby creating commercial opportunities for the Australian transportation industry. The wide-spread deployment of intermittent vibration to induce wakefulness will reduce transportation injuries and deaths, save the Australian health system significant costs, and reduce the cost spent repairing/replacing damaged transport vehicles. This reduction of injuries and deaths will also provide significant social benefits to the Australian community. This project is aligned with Sustainability Development Goal #3.6 of the United Nations 'By 2020, halve the number of global deaths and injuries from road traffic accidents', and will assist Australia to meet its international commitments to improving global health and well-being.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101668 Carter, Prof Paul H	This project aims to clarify the impact of the railway on Noongar people and Country. Rail infrastructure across south-western Western Australia exploited an older network of Aboriginal pathways; dislocated Noongar families found relocation through rail employment. Working closely with Noongar knowledge custodians the Project aims to reconstruct this hitherto overlooked history using a Noongar narrative framework - where storytelling actively maps Country and kinship relations - to plot the relationship with the emergent rail network. The Project will advance a new relational logic and a history that enhances the capacity of regional planning and development authorities in their future relationship with Indigenous people. **National Interest Test Statement** By recovering the contribution Noongar people (Western Australia) have made to the development of the Western Australian rail network, the Project establishes the role Indigenous people played and continue to play in building the nation's infrastructure. By telling this history from an Indigenous point of view, the Project contributes to a better understanding of the impact of colonial expansionism and contributes to the national project of reconciliation between Aboriginal and Torres Strait Islander peoples and Australia's non-Indigenous communities. Explaining the direct relationship between labour and land, the Project contributes to historical acceptance, greater social cohesion, improved bicultural environmental stewardship and national unity.	58,999.50	136,921.00	138,919.50	60,998.00	0.00	0.00	395,838.00
DP210101720 Yeo, Prof Leslie Y	This project aims to advance a novel platform to facilitate faster and more effective molecular transport into cells as a means for enhancing cell engineering. Besides elucidating the fundamental physicochemical and biological mechanisms underpinning this new method of intracellular transport through a combination of theoretical modelling and advanced imaging and neutron diffraction, the project aims to show the scalability of the technology for high throughput processing to handle the large cell numbers typically required for doses to be effective in practice. Given recent breakthroughs in cell therapies, it is expected that translation of the technology in the longer term will improve treatments for cancer and other infectious diseases. **National Interest Test Statement** Molecules can cross cell membranes more easily when exposed to high frequency sound. This project seeks to understand the mechanisms responsible for this phenomenon. This new knowledge could be used to enhance cell engineering technology that will benefit diverse fields such as medicine, agriculture and environmental science. Further developments to the technology beyond this project could eventually lead to improvements to treating diseases such as cancer, thus benefitting Australia's socioeconomic outcomes by providing more efficient and lower cost healthcare technologies. The technology would also be useful for engineering plant cells to develop pest, fungal or drought-resistant crops to benefit related fields such as agriculture technology and environmental sciences. The translation and commercialisation of the technology is expected to provide economic opportunities for Australian biotechnology industries to exploit in the emerging market of cell-based engineering and therapeutics, in which there is strong interest and growing demand.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00
DP210101792 Cavalieri, Dr Francesca	The project aims to develop safer materials that are sustainably sourced from sweet corn, and investigate using advanced imaging technologies, how these materials are processed in biological systems, including human and plant cells. This project expects to generate new knowledge in the optimal design of materials that can be used safely and effectively in biological applications in medicine and in agriculture. Expected outcomes of this multidisciplinary project include a library of highly biocompatible nanomaterials and expanded knowledge on imaging technologies and structure-function relationship of nanomaterials in biological cells. This should provide significant benefits, such as improved crop yields and safer transfection agents.	65,666.00	133,508.00	135,311.50	67,469.50	0.00	0.00	401,955.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement This project will develop safer and biodegradable alternatives to petroleum-based nanomaterials using phytoglycogen, a naturally occurring nanoparticle sourced from sweet corn. Corn is a significant crop in Australia and the development of added value products from this renewable and available resource will increase the profitability of Australia corn producers. The derived biodegradable nanomaterials will have applications in pharmaceuticals and agriculture, and will cement Australia's leading position in materials science. Through advance imaging and spectroscopy techniques, a deeper understanding of the interactions between biological systems and nanomaterials will be achieved towards transformative new applications in bioscience and training of multidisciplinary scientists.							
DP210101862 Wen, Prof Cuie	This project aims to develop a new class of titanium alloy biomaterials with enhanced mechanical compatibility, biocompatibility, and bio-functionality. The project expects to generate new knowledge in phase transformation mechanisms and advanced surface modification techniques for these alloys. Expected outcomes also include developments in phase transformation theories that enable high yield strength and low Young's modulus, and innovations in manufacturing techniques for new titanium alloys. This project will provide significant benefits to both Australian healthcare providers and bone-implant recipients through greater implant lifespans, improved patient outcomes and valuable savings to the healthcare system.	79,500.00	159,800.00	160,800.00	80,500.00	0.00	0.00	480,600.00
	National Interest Test Statement Australia's Medical Technologies, biotechnology and Pharmaceutical (MTP) sector comprises 1230 companies, generates employment for over 62,000 employees and delivers $4.9 billion gross value to the Australian economy. MTP is the 10th largest export sector in the Australian economy, generating 5720 additional industry jobs and a growth in exports of 29% between 2015 and 2016. The proposed project aims to develop new titanium alloys as metallic implant materials with excellent biocompatibility, mechanical compatibility, and bio-functionality. The new materials can provide load-bearing capacity and integrate with host bone tissue without causing adverse physiological responses, benefiting recipients with reduced healing times and greater implant longevity. The expected outcomes of this project can reduce costs to patients, hospitals and society at large in Australia, and further benefit the Australian MTP sector with new knowledge, new materials and advanced manufacturing technologies, assisting Australia to become an international leader in advanced biomaterials and manufacturing.							
DP210102116 Fairbrother, Prof Peter D	The project aims to investigate how unions and their peak bodies can act in beneficial ways to promote regional socio-economic development. This project expects to generate knowledge of the processes of regional renewal, including the ways unions and their peak bodies may be involved. Expected outcomes include theory development and explanations of these processes of regional engagement to enhance regional transition. It will also provide a comprehensive refinement of research methodologies for labour and regional studies. This should provide significant benefits enabling the development of engaged and inclusive transition policies at a regional level. It will benefit workers, their households and communities.	91,213.00	171,747.00	155,091.50	74,557.50	0.00	0.00	492,609.00
	National Interest Test Statement The research will make a direct policy contribution, in regions at employer and government levels. It will help realise federal and state government commitments that seek to encourage regional job creation and economic growth. There will be a direct benefit to employers in the regions, addressing recruitment challenges as well as skilling and reskilling strategies for workers and their households. Economically, it will inform employment and economic development strategies by drawing on the expertise of unions and their peak bodies. Socially, the project will inform policies that address regional communities in decline, via reports, workshops and deliberative activity. Politically, it will identify the processes of engagement and the roles that employers, workers and governments play in the process; this will allow relevant policy to be formulated. There will be a specific benefit at the regional level, via regional forms of governance. Specifically, the project will benefit those who live and work in regions.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102405 Allen, Prof Toby W	The aim of this project is to determine the mechanisms of protein-mediated potassium ion transport across cell membranes. It will combine advanced simulations, structural biology and electrophysiology to describe the detailed molecular processes underscoring calcium-activated potassium channel conduction, gating and inactivation. The expected outcome is an improved description of how ion channels recognise and respond to physiological stimuli to control electrical signalling the body. Our results will provide benefits in the form of basic understanding relevant to ion transport phenomena in biological systems, and atomic-level views of nervous system function to guide future directions in pharmacology. **National Interest Test Statement** This project aims to provide fundamental explanations for ion transport processes in the nervous system that are central to life. It will lead to new understanding of potassium ion channels that will assist in the development of improved drugs to treat a range of neurological disorders, including epilepsy, stroke and chronic pain, each representing significant social and economic burdens on the Australian public. One example, chronic pain, affects over 4 million Australians and is estimated to cost $30 billion per year. Pinpointing the molecular processes that turn on and off these channels will allow for targeted interventions in future. Moreover, improved descriptions of ion permeation will help guide developments in advanced materials, such as ion channel mimetic membranes for efficient water desalination; being a high priority for Australian agriculture and its growing cities. This project represents cutting-edge interdisciplinary and international collaboration, employing the latest experimental and computational technologies, leading to improved Australian competitiveness in biotechnological research.	70,000.00	142,750.00	149,250.00	76,500.00	0.00	0.00	438,500.00
DP210102478 Carlin, Prof David C	This project aims to enhance cultural connections between Asia-Pacific nations by defining and testing a new model for linking writers and writing. The project expects to generate new knowledge about creative writing as a collaborative artform that enables, and is enriched by, deep and sustained cultural exchange. Expected outcomes include a robust model for ethical literary encounters and exchanges and the development of a dynamic regional literary network. It seeks to provide benefits that include broadening the reach and power of Australia's diverse literary voices and stories, both Indigenous and non-Indigenous, enriching the lives of readers and viewers, and strengthening Australia's capacity for cultural diplomacy in the region. **National Interest Test Statement** Trust and cooperation flow from understanding between cultures. Writers and the national literatures they create play a vital role in expressing and communicating culture in fiction, poetry, non-fiction and on stage. This research will develop and test an innovative model for cultural exchange, built on a successful pilot that has already created a network of 49 writers across 11 countries. The new literary exchange model will enable leading and emerging writers from Australia and the Asia-Pacific to share and develop creative work and build both person-to-person and literary industry links. The project will benefit Australian and Asian writers by providing profound experiences of cultural exchange and enrich the lives of readers and audiences through the sharing of new stories from diverse voices. Knowledge gained on protocols and practices will provide arts industries and policy makers with tools to enhance approaches to intercultural development and cultural diplomacy. The research will serve to build and strengthen Australia's international reputation as a culturally rich and diverse nation.	48,111.50	135,517.00	135,559.00	48,153.50	0.00	0.00	367,341.00
DP210102761 Khalil, A/Prof Ibrahim	This project aims to address the issue of user privacy in Bio-Signal data analysis by utilizing the capabilities of differential privacy, smart contracts and blockchain technologies. This project expects to generate new knowledge in the area of privacy to develop an advanced privacy-preserving Bio-Signal data analytic framework. The expected outcomes of this project include increased privacy of user data, and the unification of standards on human-specific data analysis, saving time and money spent on privacy breaches. This should provide significant benefits in preserving the quality and integrity of the healthcare services provided by the Australian government and private sector.	75,000.00	150,000.00	150,000.00	75,000.00	0.00	0.00	450,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement Australian institutions or organisations such as healthcare need to satisfy many standards regarding information security when analysis needs to be conducted on human-specific Bio-Signal inputs such as ECG, EEG, PPG, Glucose, and DNA. Around $2.13 million needs to be spent on the countermeasures required to overcome during a single privacy breach. With the introduction of the framework proposed in this project, the entire process of data collection, privacy preservation, tracking, and analysis will be structured, allowing users such as analysts to advance knowledge reliably. Hence, the proposed framework will add a high economic and commercial value to the Australian government by saving a significant amount of time and money when analysing human-specific data. Additionally, the high security and privacy protocols enforced by the proposed framework will enhance the social vitality of the Australian community due to significantly increased security of their private data.							
DP210103278 Ding, Prof Songlin	This project aims to develop a novel approach to high speed machining of difficult-to-cut materials by resolving the contradictory surface quality and machining efficiency problem with a new theory. It is expected to advance the fundamental knowledge of electrical machining. The outcomes are new machining theories, novel methods and models of using multiple low energy sparks which occur nearly simultaneously for high speed machining of a wide range of advanced materials. It should significantly increase machining speed and thus dramatically reduce the costs of producing products such as titanium medical implants, alloyed engine components and new cutting tools which are vital for the biomaterials, aerospace and manufacturing industries.	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00
	National Interest Test Statement Nickel-based high temperature alloys, titanium alloys, ceramic composites and synthetic diamonds are important materials in the aerospace, biomedicine, defence and mining industries for the manufacturing of turbine blades, fuselages, medical implants, cutting tools, and high-performance drill bits for oil and gas drilling and rock mining. However, these materials are extremely difficult to machine due to their high strength and ultra-hardness. Their widespread application has been severely hampered by the high manufacturing costs caused by low machining efficiency. This project will address a world-wide need for high speed machining of difficult-to-cut materials by using a new theory. New knowledge and technologies of applying a large number of non-damaging sparks which can occur nearly simultaneously in the machining process will lead to significant reduction in machining time and dramatic reduction in manufacturing costs. This project will provide relevant companies with substantially increased productivity and will ensure competitive advantage for Australian businesses, domestically and internationally.							
DP210103656 Yang, Prof Jie	This project aims to develop a novel multilayer functionally graded concrete structure that is a mixture of normal strength concrete and ultra high performance concrete with the mixing ratio varying in a layer-wise manner, offering a highly cost-effective structural design solution with significantly improved safety and durability over conventional concrete structures. The expected outcomes include the innovative design, experimental data on the static and dynamic structural behaviour, development of reliable simulation techniques and optimal design procedures for the proposed structure with greatly reduced material costs. The project will have huge benefits to Australian civil engineering industry and national economy.	70,876.50	152,532.00	164,330.50	82,675.00	0.00	0.00	470,414.00
	National Interest Test Statement Concrete structures are of prime importance in buildings and infrastructure systems. As an emerging construction material, ultra-high performance concrete (UHPC) has much better mechanical properties and durability than normal strength concrete (NSC) hence can lead to economical constructions through longer service life, reduced structure size and the associated materials savings. UHPC's very high initial cost, however, has restricted its wider acceptance and practical applications in construction industry. This project will innovatively introduce the functionally graded materials concept to develop a novel multilayer structure using a mixture of UHPC and NSC with the mixing ratio varying layer-wise to enable a more cost-effective design of concrete structures with greatly enhanced safety and durability. The technology to be developed in this project will offer substantial benefits to structural engineering community with a significant knowledge advancement in composite structures and also to Australian construction industry and national economy with safer and more economical buildings and infrastructures.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103736 Foster, Dr Sarah A	This project aims to examine how to create public open space for apartment residents. It will (1) identify how apartment dwellers use public open space, including which spaces are used and why; and (2) test whether public open space use compensates for reduced apartment/building space. With less private space, apartment residents are assumed to rely on public spaces for physical, social and recreational activities. Yet little is known about which spaces they use and why, and what they would prefer. Expected outcomes include tailored, equitable evidence-based recommendations for public open space planning and apartment design guidelines. Benefits include the delivery of sustainable high-density precincts that cater to community needs. **National Interest Test Statement** This project will produce unique empirical evidence to guide future apartment design and land use decisions on communal and public open space provision. This evidence is vital to ensure the types of spaces and attributes provided meet the needs of apartment residents. The benefits of public open space for social, mental and physical health are well established. Yet, current approaches to public open space planning that apply rigid standards need to be reassessed as neighbourhoods densify and apartment living becomes increasingly common. This project has the potential to ensure apartment development, which is key to Australia's environmental sustainability agenda, also promotes social, physical and mental health outcomes in apartment residents. Anticipated benefits include the design and planning of communal and public spaces in higher-density precincts that make apartments an appealing and healthy living arrangement, and in turn contribute to environmentally sustainable development by reducing urban sprawl.	53,500.00	94,500.00	73,500.00	32,500.00	0.00	0.00	254,000.00
DP210103787 Bekessy, Prof Sarah A	This project aims to develop a novel architectural paradigm that embeds ecological science, working with nature to design cities that are more resilient to environmental upheavals. Methods aim to overcome substantial theoretical and technical challenges to embedding quantitative ecology into architectural design processes, including the development of new approaches for measuring and evaluating biodiversity benefits of alternative urban designs, from the building to landscape scale. Expected outcomes include enhanced capacity for the built form to address biodiversity considerations through nature-based solutions. The case study designs developed in this project should represent a template for more habitable, liveable, sustainable cities. **National Interest Test Statement** An emerging body of research is revealing the critical importance of nature-based solutions for the future liveability of cities. Nature in cities can deliver a remarkable range of wellbeing benefits to people while creating cities that are more resilient to changing climates. Further, nature-based solutions present opportunities to improve the outlook for many threatened species and connect people with Indigenous history and culture. Architectural and urban design practice is yet to capitalise on this potential, lacking the theory and tools to build biodiversity meaningfully into the design process. Integrating architecture with ecological science, this project seeks to develop a new design paradigm that effectively embeds nature in the urban fabric, providing the critical new knowledge needed to inform a blueprint for the development of more resilient, liveable and sustainable cities in which people and other species flourish.	67,500.00	133,000.00	146,000.00	80,500.00	0.00	0.00	427,000.00
	RMIT University	926,214.50	1,925,222.50	1,943,904.50	944,896.50	0.00	0.00	5,740,238.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
Swinburne University of Technology								
DP210100940 Hughes, A/Prof Karen E	The project aims to conduct the first transnational comparison of Indigenous community-controlled photography, exploring Indigenous peoples' ways of seeing and documenting their worlds. The project seeks to significantly advance Australian and global understanding of Indigenous vernacular photography through investigating formerly unexplored private collections of images created by Indigenous photographers during the mid 20th Century in four communities across three countries. One of the outcomes of the project is a nuanced visual history that cannot be excavated from other sources. The benefits of this project include public exhibitions, a book, symposiums, and a scholarly anthology that encourages the public's connection with the past.	92,067.50	171,465.50	150,996.50	71,598.50	0.00	0.00	486,128.00
	National Interest Test Statement In bringing forth new historical perspectives created by Indigenous people, this research is of benefit the entire Australia community as it moves towards First Peoples' Recognition. This project will be the first to use Indigenous created community photographs to compare international histories of innovation, ingenuity and strength of Indigenous people. Promoting cultural exchange between Indigenous communities internationally will benefit Australian Indigenous communities by enhancing research and heritage preservation capacities that create economic opportunities and foster cultural continuity and intergenerational knowledge transfer. The relationship between building cultural continuity and better social and emotional wellbeing health outcomes is emphasised by Indigenous communities, supported by research, and recognised by the Australian Government. This project is crucial in conserving important cultural and artistic heritage and enabling Indigenous peoples' versions of history to be told because truth-telling is a critical precondition for social justice, healing Recognition and Reconciliation.							
DP210101652 Vale, Prof Christopher J	This project aims to generate new understandings of transport and the behaviour of impurities in a gas of strongly-interacting atoms cooled to nanoKelvin temperatures. By measuring the response of a unitary Fermi gas to disturbances with well-defined momenta and energies, we will map the elementary excitations in both the superfluid and normal fluid phases. From this, the parameters that define how particles and impurities travel through the system can be determined. Our study will reveal whether the unitary Fermi gas approaches a conjectured quantum limit for perfect fluidity, examine how the properties of the gas depend on impurity concentration and establish new benchmarks for theories of strongly-correlated quantum matter.	74,500.00	143,500.00	139,500.00	70,500.00	0.00	0.00	428,000.00
	National Interest Test Statement This project will provide new insights into the way particles move through large-scale quantum systems. It should allow a deeper understanding of superfluidity, the underlying physical mechanism behind superconductivity, and guide future developments in the field of materials development. This knowledge will support ongoing research into room-temperature superfluids and superconductors, giving Australia a leading role in the new quantum revolution. Australia should reap significant benefits from the development of superfluid and superconductor technologies that could enable faster computers, ultra-sensitive sensors, high-efficiency engines and many other advanced devices. As well as the major commercial and industrial benefits for the country, Australia's economy and society will benefit from a growing technology sector that trains and employs the next generation.							
DP210101680 Sanjayan, Prof Jay G	The project aims to develop a new rheological model for 3D printable concrete for construction. 3D concrete printing is an innovative and promising construction technique, but the main impediment to progress is lack of suitable material technology. In this study, a new stress and time dependent flow model will be formulated and implemented as a computational model. The model will facilitate the study of the effect of different concrete formulations, pumping and printer parameters on the primary printing properties, namely, pumpability, extrudability and buildability. The new model will also enable active control and modification of rheological parameters on-the-fly during large-scale printing, which is not currently possible.	40,000.00	85,000.00	85,000.00	40,000.00	0.00	0.00	250,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement Construction is one of Australia's largest industry sectors, representing 8% of the country's GDP and employing more than 9% of our workforce. However, construction has shown poor productivity gains relative to other sectors, attributable to its limited use of automation and digital technologies. It is also a high-risk industry; in Australia, 52 in 1000 construction workers are injured each year, the highest rate among all sectors. 3D concrete printing provides an opportunity to introduce the digital construction technologies and automation. The benefits include waste minimisation by the elimination of formwork in construction, introduction of high-skilled work boosting productivity. The formwork, moulds for casting the concrete, are commonly temporary timber structures which contribute to 35 to 60% of the cost and form major part of the construction waste. There is also a significant community benefit, as automated 3D concrete printing should meaningfully decrease the number of injuries and deaths by replacing dangerous low-skilled construction work with safer high-skilled work.							
DP210102027 Kingshott, Prof Peter	This project aims to investigate a novel class of multifunctional surfaces that can be used to coat biomaterials with antimicrobial properties. This combines advanced polymer synthesis with a new colloidal particle self-assembly technique to modify surfaces. Expected project outcomes are generation of new knowledge of the molecular mechanisms of biofilm formation in complex microbial communities, which may facilitate future research exploring the development of biomaterials that resist attachment of infectious microbes, which is desperately needed in many biomedical application areas. This can assist entrepreneurs and researchers in the medical technologies sector, allowing them to explore how to reduce infection rates on medical devices.	80,000.00	162,500.00	167,500.00	85,000.00	0.00	0.00	495,000.00
	National Interest Test Statement The research will benefit Australia through developing anti-microbial material coating technologies. These coatings will primarily be applied to medical devices such as catheters, artificial heart values and orthopaedic implants, which are vulnerable to microbial colonisation. In Australia, over 175,000 infection due to microbial colonisation occur each year, costing $1 billion in extra care, with up to a 30% mortality rate. The research outcomes from the project will inform the further development of medical materials that prevent microorganisms from sticking and becoming infectious, providing huge social and economic benefits for Australia. Furthermore, there are potential environmental benefits from the technology, such as in water purification technology, as well as commercial and industrial benefits by opening up new manufacturing opportunities.							
DP210102050 Davis, A/Prof Jeffrey A	By applying new types of spectroscopy, this project aims to address the gaps in our understanding of how remarkable macroscopic properties, such as superconductivity, emerge from the fundamental interactions in strongly correlated electron materials. This project will combine theory and experiment to develop a pathway by which multidimensional coherent spectroscopy can disentangle the competing interactions that make these materials so complex, but also potentially useful. By delivering an understanding of the interplay between different microscopic processes, the project will make it more feasible to control them. This will allow for the design new controllable quantum materials that can be the basis for future technologies.	65,000.00	135,000.00	140,000.00	70,000.00	0.00	0.00	410,000.00
	National Interest Test Statement This project seeks to understand a class of materials that has enormous potential to be the basis of quantum electronic technologies. These technologies may include memory devices, information processors based on magnetic superconductors, or atomic switches based on quantum phases. Successful realisation of the project will place Australia at the forefront of efforts to control and harness the properties of these materials, and thus benefit economically and commercially from the development of future quantum technologies. This research will also establish Australia as a leader in the development and application of experimental techniques in condensed matter physics. The training opportunities this project provides will help ensure that Australian scientists and technicians have the skills to take advantage of these techniques.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102181 Chen, Prof Jinjun	Privacy in smart metering data on cloud is at risk because analysis of such data can reveal user privacy such as daily lifestyle. Current privacy protection approaches lack effectiveness because they omit some privacy leakage cases or cannot be applied to metering data which is collected continuously. This project aims to systematically investigate significant challenges in the effectiveness and expects to establish innovative research and solutions for enabling effective privacy protection in smart metering data on cloud. The project outcomes aims to safeguard Australian home community with pervasive deployment of smart meters and data on cloud, and benefit fast-growing privacy sensitive data hosting and applications on cloud.	80,000.00	160,000.00	160,000.00	80,000.00	0.00	0.00	480,000.00
	National Interest Test Statement This project focuses on protecting the data from smart meters, which digitally record a building's energy usage levels and save that information into the cloud. Protecting this kind of data is an Australian cybersecurity priority, as analysis of smart metering data can reveal private user information, such as lifestyle or home appliance usage. Breaches of user privacy can cause serious economic, commercial, social and cultural consequences, such as cyber bullying or fraud. As such, this project aims to develop innovative solutions for enabling effective privacy protection, leading to a significant reduction in privacy invasion incidents. In turn, this will bring significant economic, commercial, social and cultural benefits to the Australian community.							
DP210102447 Chen, Prof Tsong Y	This project aims to enhance the reliability and safety of emerging self-driving vehicles, through a framework that supports the validation and verification of autonomous driving systems. This project expects to generate new knowledge in areas of software engineering, intelligent transport, and machine learning, using a multi-disciplinary research combining expertise from various fields. Expected outcomes of this project are a family of new context-aware techniques to verify and validate complex behaviours in autonomous driving. This should provide significant benefits, such as safe autonomous driving systems and the improved journey experience and security for road users.	92,490.00	157,067.00	131,989.00	67,412.00	0.00	0.00	448,958.00
	National Interest Test Statement Autonomous driving is key to the future of Australia's automotive and transportation industries. By enhancing the reliability and safety of self-driving vehicles and their systems, this project will significantly improve the opportunities for these industries, bringing substantial commercial and economic benefits. The research is particularly focused on providing a comprehensive safety and reliability solution to autonomous driving; this will not only boost Australian knowledge and competitiveness in this emerging area, but help to protect the safety and security of road users. This project will also bring high value to Australian industries closely related to autonomous driving, such as public transportation, logistics and supply chain, insurance, and energy.							
DP210103318 Berndt, Prof Christopher C	Novel metallic alloys, termed as 'high entropy materials', will be investigated as surface coatings in order to provide improved strength, corrosion and wear performance under extreme industrial environments. This new evolution in materials engineering is created by mixing at least 5 elements in equal ratios and has recently been proven to provide excellent functionality in the bulk form. The novelty of this project is that thermal spray engineering will be employed to manufacture bespoke coatings for industries such as the mining and power generation sectors. We now need to understand the materials science for a technological tipping point that directly impacts manufacturing industries for improved performance, efficiency and reliability.	87,500.00	175,000.00	175,000.00	87,500.00	0.00	0.00	525,000.00
	National Interest Test Statement The project benefits Australia's national interest by helping to develop high-performance coatings that provide reliable wear and corrosion protection in critical industrial applications, such as mining and power generation. The intellectual property generated will strengthen Australia's global position as an innovative nation, providing economic benefits for the country. Commercial benefits exist for Australian manufacturing companies, which can develop competitive engineered products and participate in the global market. The research team's industry links will help partnering companies establish sovereign capability in coating technology. The coating technologies also have potential environmental benefits, extending the life of machinery and allowing components to be reused rather than discarded.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103323 Lu, Prof Guoxing	This research aims to propose and investigate a next generation high-energy absorbing helmet pad that will protect the Australian Defence Force soldiers against both ballistic and blast threats. New fundamental knowledge in the area of high-energy absorbing metamaterials will be obtained by using numerical modelling and experimental studies. The expected outcomes of the project include the development of a new wearable energy absorbing pad which can be used as the next generation combat helmet liners and accessories. The novel high-performance energy absorption system will have a wide range of direct applications in future personal armour, as well as sports gears and elderly healthcare products.	59,908.00	132,908.00	136,492.50	63,492.50	0.00	0.00	392,801.00
	National Interest Test Statement This project aims to develop energy-absorbing materials to be used in Australian Defence Force headgear. This will provide a significant benefit for Australian soldiers, protecting them from traumatic brain injury, and contribute to Australia's defence. The research will also further strengthen Australia's position in defence capability and military injury biomechanics, which can provide diplomatic and economic benefits on the world stage. Furthermore, the fundamental concepts of this energy absorption system are not limited to military applications. The knowledge generated can be extended to sporting bodies and the elderly healthcare sector, while the technology can be extended to sports gear and injury mitigation products, providing both social and commercial benefits for Australia.							
DP210103523 Huang, Prof Xiaodong	The aim of this project is to develop novel mechanical metamaterials through topology optimization for manipulating the propagation of elastic and acoustic waves. Mechanical metamaterials achieve exotic dynamic properties, which have many applications ranging from noise management and vibration control to defence. The computational tool and optimization algorithms to be developed will seamlessly integrate with additive manufacturing to enable the end-users to characterize, design and fabricate the next generation of mechanical metamaterials in an effective way. The outcomes of this project offer significant benefits for the long-term and sustainable development of knowledge-based economy in Australia.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00
	National Interest Test Statement This project aims to develop new techniques and solving outstanding problems in the design, fabrication and application of artificial structures called mechanical metamaterials. These metamaterials can be used to create and improve innovative engineering structures and devices, ranging from noise management and vibration mitigation tools to medical instruments and defence equipment. The findings in this project will not only significantly expand Australian researchers' knowledge base at the world-leading level, but also help Australian industries become more competitive on the world stage. The new opportunities in the design and fabrication of the next generation of metamaterials will thus provide significant industrial and economic benefits for Australia.							
	Swinburne University of Technology	736,465.50	1,452,440.50	1,416,478.00	700,503.00	0.00	0.00	4,305,887.00
The University of Melbourne								
DP210100233 Williams, Prof Spencer	This project will elucidate the molecular details of sulfoglycolysis, a group of metabolic pathways through which the sulfur-containing sugar sulfoquinovose is catabolized. The project will employ an integrated metabolomic, chemical, biochemical and structural approach to dissect how various sulfoglycolytic organisms degrade sulfoquinovose. This project will deliver a deeper understanding of this major biochemical pathway and develop new chemical and metabolic approaches to manipulate sulfur cycling in the environment. Benefits will include biotechnology applications of newly discovered proteins, and sustainable approaches to reduce our dependence on agricultural fertilisers.	58,000.00	151,000.00	186,500.00	144,000.00	50,500.00	0.00	590,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Sulfur is an essential macronutrient in the biological world. It is estimated that approximately half of all sulfur in the biosphere resides within the sulfur-containing sugar sulfoquinovose. This project will study catabolic pathways for breakdown of sulfoquinovose used for sulfur cycling in nature. Many Australian cropping and pasture areas are sulfur deficient, which is combatted through the application of sulfur-containing fertilizers (eg superphosphate). Yet paradoxically, even sulfur-deficient soils contain substantial quantities of organosulfur, which plants cannot utilise because of a lack of soil microbes to achieve its breakdown. We will study microbial pathways for sulfur cycling in soil and plant microbes to build fundamental knowledge about the natural pathways for sulfur cycling. Our results will support sustainability through bioengineering of soil microbes to enhance crop yields and reduce dependence on synthetic fertilizers. Additionally, the study of pathways of sulfur-cycling will uncover new proteins and biological catalysts with commercial value for the Australian biotechnology industry.							
DP210100235 Williams, Prof Spencer	This project aims to study immune recognition of microbial metabolites and develop reagents to control immune responses. Chemical synthesis will be used to develop new antigens for unconventional T cells and the first soluble agonists and antagonists of a glycolipid-sensing immune receptor. Expected outcomes include the discovery of new immune effectors, broadening our knowledge of the repertoire of small molecules that can be sensed by the immune system, and developing chemical approaches to promote or dampen immune responses. Major benefits include research training in chemical biology, strengthened international linkages and fundamental insights into the chemical basis of immune recognition and response.	66,000.00	153,500.00	156,500.00	69,000.00	0.00	0.00	445,000.00
	National Interest Test Statement							
	Our immune system senses an extraordinary variety of diverse molecules through recognition systems that lead to immune responses tailored to control the interaction of microbes and our body. Microbial metabolites are recognized by specific immune receptors involved in human health and disease, yet these receptors and their ligands remain poorly studied and their roles in biology are ill-defined. Using a chemical approach, this project will discover new small molecules that can enhance or dampen immune responses to expand knowledge of the repertoire of chemicals that influence immune responses. The major outcomes will be new ways to use small molecules to control our immune system – turning it on or off on-demand. This project will support advanced training for students and postdoctoral researchers in the vibrant and maturing multidisciplinary area of Chemical Biology, will foster strong international linkages, and will lead to new discoveries and intellectual property of interest to the Australian and International biotechnology industry.							
DP210100332 Hu, Dr Hangwei	The emerging spread of antibiotic resistance genes (ARGs) in the environment is a major threat to public health and food security. This project aims to develop new knowledge about the key transmission routes of ARGs across multiple trophic levels in soil food webs, and how the interactions of plant, soil and fauna contribute to the profiles of environmental ARGs. Expected outcomes include an improved understanding of the role of fauna in regulating ARGs in the soil environment and the spreading mechanisms of antibiotic resistance in soil food webs. This project will contribute to the development of evidence-based interventions to tackle environmental antibiotic resistance, which has benefits for the environment and public health.	82,500.00	165,000.00	167,500.00	85,000.00	0.00	0.00	500,000.00
	National Interest Test Statement							
	The emerging prevalence of antibiotic resistance genes in Australia represents a major threat to public health, agriculture and food production. We lack studies experimentally testing the importance of soil food web interactions for the evolution and development of antibiotic resistance, and the relationship between the biodiversity of different groups of soil organisms (e.g. bacteria, fungi, protists, and fauna) and antibiotic resistance has never been assessed. In this project, we will address this knowledge gap by quantifying the importance of soil food web interactions in shaping environmental antibiotic resistance by conducting microcosm, glasshouse and field experiments. The project outcomes will have implications for refined management strategies to reduce environmental dissemination of ARGs by manipulating their transmission pathways, and allow a critically-needed framework incorporating the environmental ARGs into risk assessment models. This project will bring environmental and health benefits the wider Australian community.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210100362 Scott, Dr Nichollas E	Protein glycosylation, the chemical addition of sugars to proteins, enables the augmentation of protein properties. Across the Burkholderia genus we have shown O-linked glycosylation is both conserved as well as essential for bacterial fitness. Yet, we have little understanding of how glycosylation modulates the proteome of this genus. This project aims to characterise the glycoproteomes of Burkholderia species and track the impact of glycosylation on both the proteome and protein stability. By understanding how glycosylation shapes the proteome we will gain a greater understanding of the role of bacterial glycosylation in Burkholderia physiology as well as how we may better utilise microbial glycosylation for glycoprotein production.	82,500.00	173,500.00	184,750.00	93,750.00	0.00	0.00	534,500.00
	National Interest Test Statement Species from the bacterial Burkholderia genus are an important part of the Australian ecosystem, yet we have little understanding of their unique physiology. A key aspect of bacterial physiology is how they add sugars to various structures, a process called glycosylation. Characterising the extent and impact of Burkholderia glycosylation will reveal new insights into the role of glycosylation in bacterial physiology. Knowledge gained from this work will be relevant to related microbial glycosylation systems. This research will strengthen Australia's research capacity in the growing field of glycosylation, informing how this process effects biological processes. This is of significant commercial interest as an improved understanding of microbial glycosylation may enhance our ability to produce new biopharmaceuticals. Researchers will be trained in novel ways to characterise future biopharmaceutical products, enhancing the profile and capability of Australian science and further strengthening our standing as world leaders in glycobiology.							
DP210100433 Narsilio, A/Prof Guillermo A	Processes involving fluid flow or heat transfer are of critical importance in engineering applications (e.g., in dams, geothermal systems, oil & gas production). Though largely overlooked, microstructural features control these processes in geomaterials. This project aims to exploit advances in high-resolution 4D imaging to extract essential microstructural information to: 1) identify new parameters that better capture pore and particle properties, connectivities and pathways, and 2) develop advanced predictive analytics tools. This will improve fundamental understanding of the link between microstructure and fluid and heat flows at the engineering scale, and provide predictive tools to reduce risk and costs to industry.	29,555.00	112,434.50	164,812.50	81,933.00	0.00	0.00	388,735.00
	National Interest Test Statement Energy demand continues to increase at an accelerated rate. To satisfy this demand, the world continues to exploit fossil fuels while developing alternative sources of energy, such as geothermal, where both fluid flow and heat transfer are the dominant physics. Australia will invest about $30 billion over the next decade in ground site investigations and reservoir exploration, and in the geotechnical design of infrastructure associated with energy supply and population growth. The hydraulic, thermal (and mechanical) properties of the ground are at the core of all these projects. Advanced data analytics tools will be developed to predict hydraulic and thermal conductivities from microstructural data extracted from very small samples (e.g., inexpensive spoil from normal drilling). These tools will have a significant impact on any design involving heat and fluid flow, such as extracting heat from geothermal systems, oil & gas from reservoirs and minimising fluid flow in dams; and thereby provide significant benefits in reducing uncertainty and costs by up to 50% for such projects in Australia and worldwide.							
DP210100445 Wyn, Prof Johanna G	This proposal for a third cohort to the Life Patterns longitudinal study aims to investigate how in a context of technological and structural change a new generation of young Australians builds livelihood-resilience, keeping the focus on those elements that have proven to be enabling for previous generations. The project aims to generate new knowledge about the influences of education, work, housing, relationships, wellbeing on positive trajectories. Expected outcomes of this project include systematic evidence and a new holistic livelihood-resilience framework for analysing youth trajectories. This project should provide significant benefits to the national response supporting positive youth transitions through education and work.	207,500.00	407,500.00	400,000.00	415,000.00	425,000.00	210,000.00	2,065,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	This project contributes to Australia's science and research priority of health by providing the most comprehensive source of evidence yet about the strategies, by individuals and institutions, that support Young Australians' well-being in the form of livelihood-resilience. It responds to calls for holistic policy frameworks that can assist young people during a period of structural transformation and deepening social and economic inequality. The study is uniquely placed to contribute to education, labour market and youth policies that bring long-term economic, social and cultural benefits to Australia. It aims to develop an internationally-relevant social model of livelihood-resilience that recognises that good health in the broadest sense requires preventive strategies that build community-level resources that promote positive outcomes for young Australians, strong engagement with the labour market and the bridging of the education/work nexus.							
DP210100505 Pask, Prof Andrew J	With significant advances in next-generation sequencing technologies we now have the genomes of hundreds vertebrate species, but understanding how the differences and similarities within these genomes control species diversity is largely unknown. The similarity in skull shape between the thylacine and dogs coupled with their deep ancestry, having last shared a common ancestor over 160 million years ago, provides an unprecedented opportunity to examine how evolution works at the DNA level. This proposal will determine if animals that develop identical skull shapes, also show identical changes in their DNA. The findings will define new developmental genes and explain how selection, adaptation and evolution works at the DNA level.	89,366.00	198,502.00	213,392.00	104,256.00	0.00	0.00	605,516.00
	National Interest Test Statement							
	Understanding the biology of marsupials, and in particular that of one of our iconic extinct marsupial species, is of significant National Interest environmentally, socially and culturally. The thylacine is an important part of our history. Our previous work on the thylacine has had enormous impact in both the scientific community and general public at an international level creating many opportunities for outreach and community engagement in science. Our research will define the regions of the genome that are the targets of natural selection and evolution and that drive species diversity in mammals. These findings have broad implications for our understanding of evolutionary processes and in measuring the adaptability of mammalian genomes to environmental change. Furthermore, these studies will underpin management strategies to ensure the preservation of our iconic marsupial fauna for generations to come.							
DP210100630 van Oppen, Prof Madeleine J	This project aims to decipher the functions of coral-associated bacteria by taking advantage of low-diversity microbiomes that are naturally found in some coral species. A further aim is to unveil the importance of bacterial genome evolution in coral adaptation to climate change. Climate warming is the biggest threat to coral reefs with half of Australia's Great Barrier Reef (GBR) corals dead due to recent summer heat waves. Expected outcomes are an increased understanding of how bacteria contribute to coral heat tolerance, and new knowledge to assist in the development of bacterial probiotics for enhancing coral thermal tolerance. This should provide significant benefits to the protection of the GBR and Australia's economy.	86,362.00	195,797.00	203,008.50	93,573.50	0.00	0.00	578,741.00
	National Interest Test Statement							
	Coral reefs are home to over a quarter of all marine species and have extraordinary economic and cultural values, with the economic value of Australia's Great Barrier Reef (GBR) estimated at $56 billion. This project will elucidate whether and how coral-associated bacteria contribute to coral health, heat tolerance, and adaptation to climate change. This information will inform the development of bacterial probiotics for corals, an approach currently being explored in Australia and overseas to enhance coral heat tolerance and to restore coral reefs. This innovative, multidisciplinary research will thus contribute to the protection of the GBR and as such Australia's economy. It will strengthen Australia's international position in coral reef conservation and restoration and provide high-quality research training and mentoring.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210100639 McFadden, Prof Geoffrey I	We aim to identify how symbiotic algae feed sugar to their coral hosts. Corals need this algal sugar to exist, but no one knows how it is transferred, so understanding this crucial mechanism is hugely significant. The first benefit of this research will be a fundamental understanding about how two organisms (algae and coral) cooperate to build habitats like the Great Barrier Reef. We also aim to explore whether coral/algal cooperation paved the way for the origin of parasitism. The second key outcome will be to identify the precise molecular mechanism that allowed parasitism to arise. This will benefit us through understanding the origins of important diseases such as human malaria and related infections of livestock and wildlife.	101,500.00	199,000.00	188,000.00	90,500.00	0.00	0.00	579,000.00
	National Interest Test Statement This project aims to unlock the molecular basis of a partnership between a microscopic plant and an animal that powers coral growth. Reefs are valuable resources for tourism, fishing and biodiversity. Australia's Great Barrier Reef underpins 66,000 jobs and its economic value is ~$7 billion. Understanding the intimate algal/ animal partnership that drives reef growth and survival will better equip us to protect this threatened resource. It will also help us understand the biological and evolutionary basis of parasitism in a very large group of parasites and hosts. This promises significant national benefits as universal scientific insights on the biological basis of parasitism have the potential to impact on the study of major human parasitic diseases such as malaria and toxoplasmosis, plus commercially important parasitic diseases of livestock such as coccidiosis in poultry, babesiosis and theileriosis of cattle, and sarcocystosis of sheep and cattle.							
DP210100720 Varney, Prof Denise J	This 3-year collaborative project aims to review the parameters of Australian Theatre and Performance Studies by reconceptualising past and present works in terms of their environmental content. The project expects to generate new knowledge of texts, scenography, attitudes to the natural world and site-specific locations of this under-recognised but vital stream of the performing arts in Australia from 1960 to 2020. Expected outcomes include an enhanced capacity to theorise and evaluate Australian Ecological Theatre and Performance. This should provide significant benefits to the discipline at the national and international level by modelling a new approach that highlights the human and environmental consciousness of the performing arts.	55,000.50	108,608.00	115,390.00	61,782.50	0.00	0.00	340,781.00
	National Interest Test Statement This research will provide lasting cultural benefits to academics, teachers, communities and students about the field of Australian Theatre and Performance Studies. They will be better equipped to apply new understandings of how the performing arts represent Australia's unique environment. This will include an increased understanding of the nation's artistic achievements in this field from 1960 to 2020, and a better capacity to take a historic view of the relationship between the arts and the environment. For the broader performing arts industry, including its writers, artists, critics and audiences, the research will provide new information about an under-recognised but vital stream of the performing arts that can be used as the basis for making or viewing new works. There are further social and cultural benefits for Australian community arts workers especially in regional areas. These benefits relate to a better understanding of the potential of the performing arts as a medium for building community, resilience and emotional well-being in an accessible way.							
DP210100795 Chantler, Prof Christopher T	New technology developed by Australia, Sweden and the United States will be applied to major questions about the application of relativistic quantum mechanics to atomic structure and dynamics and spectroscopy, especially including critical issues in quantum electro-dynamics for atomic physics and applications. Discrepancies in quantum electro-dynamics have dominated international debate for decades, with claimed explanations annually failing to reveal the cause. Also a pattern of discrepancies has been seen at X-ray energies in first row metal atoms, with a similar sign and magnitude. A combined experimental an theoretical investigation will aim to reveal new light on these anomalies and serve to develop our understanding of the universe.	81,500.00	163,000.00	167,500.00	86,000.00	0.00	0.00	498,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Microcalorimetry is a new technology for stable and well-defined calibration of radiation sources. The technology applies to high-resolution, strong and weak radiation, over large energy ranges from UV through to X-rays. Bringing the best of this technology to Australia paves the way for development of Australia's leading role in advanced fields including materials and surface science, sensitive detectors for guidance systems, materials characterisation for aerospace and solid state computing devices. Microcalorimetry technology can also be applied to fundamental questions of characteristic radiation and quantum electrodynamics. This application will help resolve major anomalies between scientific theory and experimental data identified in recent years. We will develop software, user communities and licensing for Australian IP for microcalorimetry. The project will train Australian scientists in radiation science using state-of-the art technology, not only adding to fundamental knowledge, but also supporting a broad range of practical applications.							
DP210100840 Young, Prof Ian Y	This project aims to develop a comprehensive understanding of the processes responsible for the evolution of ocean swell. It will generate new knowledge in the field by using a combination of newly available satellite data and buoys strategically located along two propagation paths across the Pacific. The expected outcomes will be a unique data set and significant advances in our ability to accurately predict ocean swell. Swell prediction remains one of the major short-comings of ocean wave prediction models. As swell conditions dominate ocean wave climate for 75% of the time, accurate prediction is critical for coastal protection, understanding air-sea interaction and maintaining ship and port operations.	86,500.00	166,000.00	148,000.00	68,500.00	0.00	0.00	469,000.00
	National Interest Test Statement							
	Maritime operations, such as ship to ship loading in the offshore oil and gas industry and the operations of ports and harbours are critically dependent on our ability to accurately predict swell conditions. This project will greatly improve swell prediction capabilities with resulting economic benefits for these industries. Ocean swell is also an important parameter in determining coastal flooding and the stability of beaches. Changes in the prevailing direction of ocean swell can result in significant realignment of beaches. Such changes can have devastating erosion impact on coastal communities. The enhanced prediction capabilities provided by this project will enable better planning of coastal communities, with resulting economic benefits. As there is evidence that ocean wave conditions in the Southern Ocean have been changing in recent decades, an understanding of the likely changes in swell impacting Australia's coastline will be critical for future planning. Better planning will result in environmental, economic and social benefits for Australians.							
DP210100870 Vervaet, A/Prof Frederik J	This proposal aims to produce novel comparative insights into the genesis of despotism in sophisticated republics and democracies. To this end, it focuses on the transformation of the public victory ritual of the triumph from a shared aristocratic privilege into a lasting imperial monopoly by Augustus, Rome's first emperor. Enhancing our knowledge of the rise and inner workings of Augustus' New Order will provide modern political science with a new archetype of creeping authoritarianism, readily applicable to some of the most notorious tyrannies of the modern era and contemporary variants. The proposal will, therefore, substantially inform the field, theorists and practitioners of government, and Australia's secondary school curriculum.	25,000.00	50,000.00	50,000.00	25,000.00	0.00	0.00	150,000.00
	National Interest Test Statement							
	This study develops a new understanding of Rome's historic transition from Republic to Empire which has the potential to inform and stimulate contemporary debates about political leadership. It also provides a framework to help discern transformative political manipulation and creeping authoritarianism that has continued relevance in the present. Ancient history is an increasingly popular school subject nationally. The project will provide foundational research that can be subsequently adapted to inform the development of curriculum resources, thereby enhancing the project's future national and social benefits. A public-facing website will showcase research findings and promote wider engagement. The analysis of Augustan triumphal policy and autocratic statecraft will yield a series of major works of reference in top-tier international venues. Outcomes from a cross-disciplinary conference on Augustan authoritarianism and modern political science will build capability and strengthen Australia's reputation for innovative scholarship in ancient history and comparative political science.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210100884 Phillips, Dr Catherine A	Urban greening is vital for sustainable, liveable and climate-adapted cities. However, conflicts over urban greening continue to cause delays and even failure of initiatives. Such disputes, and the diverse socio-cultural relations that drive them, remain poorly understood. In ground-breaking research employing innovative concepts and methods developed by the team, this project aims to generate new knowledge about how people experience urban greening in their everyday lives and how urban greening is contested in three Australian cities. Expected outcomes include new, crucial understandings of key human-plant relationships, facilitated international collaborations, and significant findings for improving urban greening policies and governance.	45,251.50	87,601.00	78,162.00	35,812.50	0.00	0.00	246,827.00
	National Interest Test Statement This project aims to generate comprehensive knowledge to help achieve more sustainable, climate-adapted cities by providing new insights into the socio-cultural aspects of urban greening. Through yielding novel understanding about how urban greening is experienced and contested in three Australian cities, the project aims to increase the likely success and beneficial outcomes of urban greening initiatives. Local and national communities will benefit through the identification of risks and opportunities that come with urban greening, so that conflicts might be better addressed in future greening programs. The project will identify innovative management and engagement directions that will allow municipalities to better integrate crucial affective dimensions of urban greening and to better ground urban greening within the communities those municipalities serve. Inventive methods integrate policy briefings, community events, and stakeholder engagement throughout the project to maximise effective knowledge translation and incorporation of findings into policy and programming outcomes.							
DP210100924 Stewart, Prof Miranda S	This project aims to address fundamental problems of injustice in taxation emerging in the transition to a slow growth economy in Australia and globally. The project applies interdisciplinary approaches to generate new knowledge that aims to update frameworks for justice in taxation, refreshing out-dated 20th century ethical and legal approaches. Collaborative legal and philosophy analysis by leading scholars in Australia and the United States will respond to contemporary conditions of slow growth, wage stagnation, wealth inequality, population aging and longevity. Project outcomes will include tax reform proposals to benefit policy makers and enrich public debate on tax justice for 21st century economic and fiscal conditions.	35,500.00	85,500.00	119,000.00	69,000.00	0.00	0.00	309,000.00
	National Interest Test Statement This project will generate significant economic and social benefits for the Australian community by developing a new theoretical framework and reform proposals for the tax system that respond to growing wealth inequality for Australia's longer-lived and aging population, as wages stagnate and economic growth slows. This project applies philosophical and legal analysis to refresh 20th century theories of tax justice for 21st century economic and political challenges. It aims to fill a gap in research about the consequence of changing economic conditions for justice and efficiency of the tax system and to develop specific recommendations to reform Australia's income, consumption and wealth taxation at federal and State levels. Comparative legal and philosophical analysis developed through collaboration with leading international researchers will identify and develop reform proposals that are just, socially desirable and politically feasible, supplying solutions tailored to problems of slow growth and tax injustice as they emerge in the Australian context.							
DP210100929 Foster, Prof Michelle T	This project aims to undertake the first comprehensive study of stateless persons in Australia. It will generate groundbreaking insights into Australia's role historically in protecting stateless persons, and identify the protection needs of stateless persons in Australia today. Expected outcomes include improving the quality of Australian administrative decision-making, and making an important scholarly contribution to an emerging area of international law. The project will improve public administration, develop Australia's reputation as a leader in statelessness law and policy, and position Australia as a core node of expertise on an important issue that has implications for the rule of law, security and social cohesion in our region.	48,309.50	114,549.50	125,657.00	59,417.00	0.00	0.00	347,933.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	This project will have multiple benefits to Australia. First, there is little knowledge about stateless persons in Australia, yet decision-makers grapple with the complexity of their cases in a wide range of contexts. By developing a Legal Practice Resource and Blueprint for Protecting Stateless Persons, this project will facilitate better decision-making and offer policy reforms based on best practice. Second, the Project will position Australia as a regional node for evidence-based policy in response to statelessness. Australia's region hosts the largest number of stateless people, and developing research tools, research capacity and expertise will enable Australian researchers to contribute to research and reform regionally, furthering efforts to address root causes of refugee flows, and contribute to the rule of law, good governance, security, development and stability in the region. Third, this project will generate knowledge and expertise that will enhance Australia's international contribution to the UNHCR #iBelong campaign, the Global Compact on Refugees and the Sustainable Development Goals.							
DP210100998 Gooley, Prof Paul R	This project aims to use viral proteins to uncover fundamental mechanisms underlying protein multifunctionality, a central but poorly understood aspect of biology. This project expects to use multidisciplinary approaches to define novel and unexpected mechanisms by which single protein sequences can generate proteins with profoundly different structures and functions. Expected outcomes include a major shift in the understanding of protein function in life, with most immediate impact in virology. This should provide significant benefits in identifying new strategies for treating viral infections, but also enhance developing multidisciplinary approaches to solve complex biological problems.	100,450.00	209,900.00	218,550.00	109,100.00	0.00	0.00	638,000.00
	National Interest Test Statement							
	This research encompasses discovery-driven science that aims to increase knowledge on fundamental mechanisms in protein biology, significant to viruses and cellular life. Immediate impacts will be in understanding of a class of viruses important to the Australian livestock industry and export markets, revealing basic mechanisms of replication and host subversion, including immune evasion. This will guide future research on antivirals and vaccine development. By revealing fundamental mechanisms in protein function, the work will also greatly advance research in the physiology and pathology of other microbes and multicellular organisms. The project will develop critical mass in Australia and major collaborations by training students, a postdoctoral scientist and research assistant in a range of state-of-the-art structural and cell biology techniques.							
DP210101097 Robinson, A/Prof Jo	This project aims to improve the safety and quality of online communication about suicide by young people. Suicide is the leading cause of death among young Australians and rates continue to rise. One commonly cited explanation for this is the way in which young people use social media to communicate about suicide. This project will directly address this by testing the impact of a set of evidence-informed guidelines and campaign materials that target young people's capacity to communicate about suicide safely on social media. Expected outcomes of this project include increased online safety for young people. This study also has national and international significance for the social media industry and the safe governance of their platforms.	81,395.00	165,361.50	145,054.00	61,087.50	0.00	0.00	452,898.00
	National Interest Test Statement							
	Suicide is a significant societal problem. Youth suicides cost the Australian government over $551m each year. Over the past ten years, suicide rates have almost doubled in those aged 15 to 19 years. One commonly cited explanation for this is the way in which young people use social media to communicate about suicide. Online safety is a cornerstone of the Morrison government agenda, and there is a call for reform of Australia's Online Safety Act. Through collaboration with industry partners and researchers in the USA, this research seeks to improve the safety and quality of online communication about suicide by young people, thus reducing rates of youth suicide, harmful online experiences, and subsequently improving online safety for all young Australians.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101107 Craig, Prof Jocelyn (Lyn) P	This project aims to investigate how and why parents and grandparents share childcare responsibilities in contemporary Australia. Using mixed methods and an innovative conceptual approach with a central focus on parent-grandparent care dyads, it expects to generate critical new knowledge of intra-family negotiations about employment and childcare provision across generations, and their relationship with social and economic policy. The project expects to identify sustainable employment-childcare practices that meet the needs of children, parents and grandparents. Significant benefits include informing new policies aimed to enhance both gender and generational equity, promote women's workforce participation, and boost national productivity.	30,896.00	85,919.50	128,296.50	73,273.00	0.00	0.00	318,385.00
	National Interest Test Statement This project will serve Australia's national interest by addressing a major barrier to achieving two primary objectives of contemporary Australian policy-making: improving national productivity and promoting gender equality by lifting women's workforce participation. In many families, parents look to grandparents to provide childcare whilst they are at work, limiting the grandparents' own workforce opportunities. This project will generate recommendations on how to improve employment participation through a more gender-equal distribution of work and childcare across all ages. The information it will provide will advance the national productivity agenda. It will inform policy aimed to improve Australia's international competitiveness, raise participation and offer better returns on the large national investment across significant policy areas including employment, early childhood education and care, education, and retirement incomes. For example, McKinsey Global Institute (2019) estimates Australia's GDP would rise 12 percent ($60 billion), if female workforce participation matched that of the US or Canada.							
DP210101135 Halgamuge, Prof Saman K	Complex data from emergencies, e.g., data acquired from an ongoing viral outbreak or actively moving bush fire are often received progressively. The analysis of such situations cannot wait until the complete data set is available at the end of the emergency. The aim of this project is to overcome this serious deficiency of current AI tools by developing innovative Neural Network based methods that can learn from continuous data streams and extract and interpret the hidden knowledge either semantically or mathematically. The expected outcomes of this project include the development of novel methods, highly trained AI researchers and a number of critical real applications that will bring significant benefits to Australia and the world.	64,500.00	130,500.00	133,500.00	67,500.00	0.00	0.00	396,000.00
	National Interest Test Statement This project will develop new data analysis methods that can generate knowledge from a broad range of applications. It will provide the opportunity to create and continually update models for complex systems using continuous data streams from various sources, such as microbial/viral communities, bushfire scenarios or market systems. Improved modelling of viral communities, for example, can be used to understand how they grow to improve our response to viral outbreaks, providing substantial epidemiological and health impacts. Furthermore, the models we produce are expected to be robust in extrapolation analysis, enabling the modelling and prediction of systems with unknown parameters, such as oceanic or atmospheric events. Extremely versatile, these novel methods will be broadly applicable to a wide range of fields from public health to naval transportation. Thus, this research has the potential to provide significant national benefits for the economy, environment, health, society and culture of Australia and beyond.							
DP210101156 Winter, Prof Stephan	Pedestrian access, flow and management are critical for urban life. However, compared to other forms of mobility pedestrian mobility is significantly more complex. Currently, various incompatible pedestrian route graphs in both outdoor and indoor environments render any analysis biased and non-transparent. This project aims to solve this problem by developing a universal and necessarily hierarchical pedestrian route graph to support critical applications such as urban walkability (health), space and asset management (guidance, flow management), and public safety (evacuation). In contrast to conventional algorithms, we will take a novel approach based on human cognition to define this universal graph and then integrate topology and geometry.	57,000.00	116,000.00	116,500.00	57,500.00	0.00	0.00	347,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	With growing urbanization and more than half of the world's population already living in urban areas, pedestrian mobility is critical to the lives of millions. Modelling pedestrian movement and flow, and how people find their way in urban areas is the first step in improving pedestrian mobility through better design and management of urban communities. This project will deliver a novel, universal model of pedestrian mobility that has many benefits for Australia and beyond. A common standard across applications, such as urban walkability, space and asset management, and public safety, will improve data availability and provide economic benefits. Commercial benefits will be gained through the model's competitive advantage for service providers involved in supplying Building Information Models or Geographic Information Systems. Social benefits will be gained through the model's improvement in quality and trust in planning and service provision. Finally, environmental benefits will be achieved by removing impediments to change in urban environments, which creates more habitable and healthy urban communities.							
DP210101204 Preston, Prof Dr Bruce	This Project studies economic policy when interest rates are zero. Low interest rate environments constrain monetary policy because central banks cannot lower rates to raise demand. We exploit recent international experience with zero rates to understand why new policies have had mixed success. We argue different outcomes across countries arise because of different degrees of credibility and familiarity with new policy initiatives. We provide empirical support for this view and study the consequences of imperfectly credible policy. We characterize how monetary policy (conventional and unconventional) and fiscal policy can be used to greatest effect in low interest rate environments and quantify the welfare implications for Australia.	15,366.00	91,251.50	149,487.00	73,601.50	0.00	0.00	329,706.00
	National Interest Test Statement							
	This Discovery Project will provide concrete policy recommendations to tackle real world policy problems that confront Australia now. Since the 1980s, Australian interest rates have moved progressively lower, with the cash rate currently 0.75 per cent. Market and Reserve Bank economists predict rates will stay at this level for years to come. In some countries, rates have been even lower at or slightly below zero for more than a decade. Because central banks cannot further lower interest rates to stimulate the economy, questions arise about how to achieve inflation targets and raise aggregate demand in the case of recession. This work builds new knowledge about how to conduct economic policy in this environment, including use of unconventional monetary policy (forward guidance and large scale asset purchases) and fiscal policy. We analyse the different experiences with new policies in the US, EU, and Japan to learn what initiatives have worked. Deep connections with domestic policy institutions uniquely place the team to recommend policy to promote the welfare of Australians in an era of zero interest rates.							
DP210101302 Davis, A/Prof Mark R	This project aims to uncover the anti-democratic threat posed by the circulation of alt-right discourse and ideology in Australia. Responding to growing concern about online hate speech and violent acts committed by extremists inspired by alt-right ideas, the project seeks to map the online spread of alt-right discourse in Australia and analyse the transnational influences, ideology, strategies and public influence of the groups that promote such discourse. The project will establish a new footing for understanding recent developments in online extremism, engage policy makers and professionals working in the field, and, through its public-facing outcomes, add a new dimension to public debate on the impact of the internet on civil society.	30,600.50	65,866.00	73,651.50	38,386.00	0.00	0.00	208,504.00
	National Interest Test Statement							
	The project will provide social and cultural benefits that contribute to Australia's national interest by expanding knowledge of the alt-right and the threat they pose to democratic norms and processes. Consistent with government priorities to address online-inspired violence, such knowledge will be of benefit to policy makers, civil society organisations and intelligence and security organisations presently grappling with the problem of how to deal with new forms of networked online extremism. A particular point of national benefit will be increased understanding of the transnational correspondences between extremist groups, which will add to knowledge of the global forces driving homegrown groups. Further national benefit will flow from dissemination of the research findings among the national and international research community through its national and international conference presentations and publications, which are intended to establish a strong international profile for the project and enhance the growing presence of Australian digital media scholarship on the international stage.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101416 Corbett, Dr Alexandra J	Cell death of naïve T cells in lymphoid organs is well-understood. However, T cells only gain their function upon activation, and how activated T cells regulate their life or death remains unclear. Mucosal-associated Invariant T (MAIT) cells are abundant in non-lymphoid tissues as key local players in immunity, and share some features of activated conventional T cells. This project aims to define how MAIT cell survival and death are controlled. It combines methods we developed to track MAIT cells in vivo with expertise in cell death analysis. This project is expected to elucidate the complex mechanisms controlling MAIT cell survival/death and increase our fundamental understanding of cell death mechanisms of activated T cells.	77,399.50	146,415.50	139,894.50	70,878.50	0.00	0.00	434,588.00
	National Interest Test Statement This proposal seeks to understand the biochemical processes that determine life and death in a unique category of immune T lymphocytes (MAIT cells) that protect mammals from bacterial infections. These cells are unusually long lived and are present in most tissues where they provide local immunity. Understanding the biochemical basis of their longevity and what finally triggers their death will unlock fundamental factors controlling cell fate. The project will expand fundamental understanding of the immune system and is potentially applicable to other immune T cells. This would open opportunities to manipulate the longevity of T cells to increase immunity when helpful or dampen immunity when harmful, knowledge applicable to improved animal production, veterinary and human health. Building on background IP, outcomes have potential translational and commercial value as well as impacting on academic research. The project will also strengthen Australia's research capacity by training of research higher degree students.							
DP210101502 Murfet, Dr Daniel	This project aims to provide the first precise mathematical statement and geometric proof of the Landau-Ginzburg/Conformal Field Theory (LG/CFT) correspondence for simple singularities, a physically motivated principle that relates hypersurface singularities in algebraic geometry to representations of vertex algebras in conformal field theory. The formalism developed here is expected to clarify the nature of the correspondence and lead directly to generalisations beyond simple singularities, as well as provide a dictionary to translate methods of CFT into singularity theory and vice versa. These results will further cement Australia's reputation as an international leader in pure mathematics and mathematical physics research.	20,354.50	111,245.00	177,301.00	86,410.50	0.00	0.00	395,311.00
	National Interest Test Statement Fundamental research in mathematics and mathematical physics contributes to Australia's national interest in ways that are hard to anticipate because they often arise through unexpected interactions between fundamental science and commercial or economic activities. A case in point is quantum computing, which relies on a wide range of advances in fundamental science and is potentially a significant future industry in Australia. In the same way, the research proposed here has long-term potential for translation into new technologies, for example machine learning or quantum computing. In another direction, the involvement of PhD and MSc students in this proposal will train young Australians to the highest international level in mathematical research. While the precise mathematics involved may not be useful in domains outside of research, the research experience nonetheless develops highly transferable skills and attracts brilliant young scientists to work and live in Australia. An additional benefit is in facilitating interdisciplinary communication and promoting Australian research strengths internationally.							
DP210101623 Spinks, Dr Jennifer S	This project aims to analyse prints in the world-class collection of the iconic Nuremberg artist, Albrecht Dürer, in Melbourne's National Gallery of Victoria, and to track their 20th-century migration as objects of civic identity from Manchester to Melbourne. A focus on Dürer's fascination with the technology and craft of objects aims to show how his creativity was rooted in the vibrant entrepreneurial climate of Nuremberg c.1500 and to provide a new scholarly path for exploring the relationship between prints and material culture. Expected outcomes include major collaborative articles, an agenda-setting book, exhibitions, website, and community masterclass. These will benefit ongoing research, museums and galleries, and the broader public.	49,519.50	99,726.00	106,321.00	56,114.50	0.00	0.00	311,681.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	An Australian-led international team aims to research Australia's world-class collection of prints by the iconic Renaissance artist Albrecht Dürer, held in the National Gallery of Victoria. Manufactured objects such as metalwork and textiles from Melbourne, Manchester and Nuremberg collections will provide new ways to understand Dürer's economic and creative success. The project will establish Australia as an agenda-setting location for research on Dürer and the history of manufacturing. Exhibitions and linked events will stimulate public engagement with Melbourne's world-class collections and contribute significantly to its international reputation as a cultural powerhouse, driving arts and heritage tourism. The story of how the Dürer prints came to Australia from Manchester in 1956 will be revealed in twinned exhibitions in Melbourne and Manchester, prompting new connections between these cities which share a Victorian heritage and vibrant arts cultures. A new interdisciplinary model for exhibition collaboration will directly shape professional museum practice and benefit Australian audiences.							
DP210101688 Dong, A/Prof Mei	Australia has one of the most concentrated banking sectors in the world, generating concerns regarding its efficiency. This project aims to develop unified frameworks to understand and evaluate quantitatively how the structure of the banking industry affects the macro-economy and provide policy recommendations for establishing a healthy and efficient banking industry. This project expects to improve understanding of the welfare trade-off between bank competition and economic well-being to enable policymakers to better determine the optimal concentration of banking sector in Australia. This will enhance the productivity and international competitiveness of Australia's financial system and the broader economy.	62,016.00	128,652.00	81,636.00	15,000.00	0.00	0.00	287,304.00
	National Interest Test Statement							
	Australian banking industry is one of the most concentrated banking sectors in the world. In 2017, the top five banks possessed nearly 94 percent of total bank assets. The lack of competition in the banking sector has raised serious concerns that the inefficiency in the financial system may reduce Australia's economic growth and long-term living standards. The government stated its intention to address this concern by introducing initiatives to strengthen the "second tier" of smaller financial institutions that provide an alternative to the larger banks. Since 2010, this has remained an objective of each successive government. The proposed project will provide a long- and short-run perspective on how the structure of and frictions within the banking industry affect the aggregate economy to derive policy implications including how monetary and macro prudential policies can be formulated to enhance aggregate welfare by establishing a stable and efficient banking sector in Australia. Our findings will strengthen the international competitiveness of Australia's financial system and the broader economy.							
DP210101787 Smith, Prof Philip L	This project aims to develop a new theory of fast decision making. In all walks of life, from the sports field to the battlefield, fast and accurate decisions are central to human performance. This project will develop and test mathematical models of the processes involved in making decisions with continuous choice sets and decisions requiring integration of multiple sources of information and decisions in which information varies over time. It is expected to contribute to our understanding of factors that characterise and limit human performance in settings in which fast and accurate decisions are required. It is expected to benefit the design of systems and environments in which safety and efficiency depend on human decision making.	50,000.00	102,500.00	106,500.00	54,000.00	0.00	0.00	313,000.00
	National Interest Test Statement							
	Human decision making and its consequences are ubiquitous in the culture and across the economy. In elite sport, the military, and occupations like air traffic control that require processing of complex visual displays in real time, the ability to make fast and accurate decisions distinguishes success from catastrophic failure. Such decisions depend on rapid matching of the elements of a perceived situation to existing knowledge rather than on deliberation or reflection. This project will develop and test mathematical models of cognitive processes common to decision making in diverse settings, including decisions made among a set of alternatives when interacting with the environment. It will consolidate Australia's leading role in an international, multidisciplinary research program into the cognitive and neural basis of decision making. It will yield national benefits by working out the factors that improve the accuracy of fact decisions. Application of this knowledge will be critical to social, economic and industrial settings.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101806 Bedoui, Prof Sammy	This project aims to test if cells can flexibly rewire their cell death pathways to ensure that the absence or inhibition of one type of cell death can be compensated through the triggering of another. The project expects to generate new knowledge in the area of programed cell death, and more specifically will address why cells have multiple programmed ways to die. Expected outcomes of this project include the provision of unprecedented insights into the molecular regulation of how cells orchestrate and integrate cell death pathways. This should provide significant benefits, such as providing the knowledge base needed to improve our abilities to manipulate cell death both in basic research and commercial applications of cell death.	104,075.00	227,815.00	236,350.00	112,610.00	0.00	0.00	680,850.00
	National Interest Test Statement The knowledge generated by the project and the high-level international training of HDR students will increase our understanding of cell death and provide new ways of manipulating cell death. Manipulation of cell death is a key component in the manufacturing of so-called 'biologicals' that are used widely as research tools and therapeutics. Biologicals make up a large share of new drug developments, with the global market for biologicals, such as monoclonal antibodies estimated worth over U$130,000,000. The intellectual property generated through this project can therefore be further developed by Australian Biotechnology companies into novel products for veterinary and health services. This will increase competitiveness of the biotechnology sector in Australia, thus leading to enhanced productivity.							
DP210101812 Young, Prof Alison C	This project focuses on legal and social regulation of city streets, including the impact on the increasing numbers of Australians experiencing public homelessness or engaging in public protest. Typical legal and policy responses tend towards criminalisation, exclusion and surveillance; the consequences for affected individuals include intensified social stratification and disadvantage along with risks of involvement in the criminal justice system. This project examines legal, social and municipal strategies regarding public homelessness and public protest and investigates their impact on individuals and groups affected. Expected benefits include proposals for ways of reforming law and policy to achieve 'spatial justice' in city streets.	23,539.00	60,254.00	74,722.00	38,007.00	0.00	0.00	196,522.00
	National Interest Test Statement This project facilitates Australian social inclusion by investigating the ways we respond to public homelessness and public protest, both of which can involve unauthorised use or occupation of city streets. The conventional responses of criminalisation, exclusion and surveillance have been shown to result in intensified social stratification and in increased numbers of individuals within the criminal justice system. Research shows that criminal justice involvement and social exclusion adversely impact on employment capacity and on individual and social well-being. With homelessness in Australian cities on the rise and increasing numbers of individuals taking part in public protest, authorities face the challenge of developing laws and policies that maintain social order without exacerbating social disadvantage. This project will make a valuable contribution to that challenge by investigating the impact of existing law and policy on affected individuals and proposing new ideas to achieve 'justice in the streets'.							
DP210101887 Downes, Prof Barbara J	This project aims to ask: does failure to disperse successfully across landscapes limit the abundances and diversity of species in habitat patches? This is a central question in ecology. The project expects to generate new knowledge about the links between dispersal success and population numbers by using recent advances in river ecology that have overcome logistical barriers to hypothesis tests. Expected outcomes include new insights into why dispersal failures occur and how they are associated with low population numbers. Benefits should include improved advice to conservation managers about extinction risks, and unique, tangible outcomes for fundamental ecological research in Australia that will spring from international collaboration.	73,500.00	189,500.00	208,000.00	92,000.00	0.00	0.00	563,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	This research will produce high-impact findings to help solve a core question in ecology, which will be of great interest to the international community. As such, a major national benefit is that the project will enhance Australia's research capability and competitiveness out on the international stage, which is a key aspect of the ARC's charter. Moreover, the project will also inject new ideas for preventing biodiversity losses. The 2016 Federal Government's State of the Environment report highlighted that Australian biodiversity continues to decline and that we lack the knowledge and tools to stop it. This research will firstly provide fresh methods for measuring ecosystem health that will provide more insightful data. Secondly, the research will focus attention onto human impacts that exacerbate population bottlenecks, which put species at risk of extinction. Such risks have been amplified immensely by recent, catastrophic bush fires, and so research of this kind is urgent. Our re-focused way of looking at human impacts should result in fresh solutions for protecting Australia's biodiversity.							
DP210101900 Urquijo, A/Prof Phillip	This project aims to perform new searches for light feebly interacting particles. The existence of these particles can address long-standing open problems within the Standard Model of Particle Physics, such as the nature of dark matter or mysteries surrounding the origin of the Higgs mass. This project aims to use the unprecedented dataset of the Belle II electron-positron collider experiment and new theoretical techniques to reveal the existence of light new particles, placing Australian researchers in a position to lead a major discovery of new physics phenomena to complete the theory of the universe at the smallest scale. Predictions for future experiments at high and low collision energies will also be developed.	77,000.00	156,000.00	160,500.00	81,500.00	0.00	0.00	475,000.00
	National Interest Test Statement							
	This project places Australian researchers at the centre of a global hunt for new light feebly interacting particles, which could provide an explanation for the particle nature of dark matter or solve puzzles surrounding the Higgs boson's mass. Resolving these questions will have historic impact comparable to the initial discovery of the Higgs boson, both in the field and to society. This research will maintain Australia's role at the forefront of particle physics research, and provides unique training in theoretical physics, big data science and particle detector technology: all of which have applications outside the field, such as medical imaging, and complex data modelling for industry and government. This program will generate new knowledge, where outcomes will be disseminated within the scientific community and to the general public, where results are expected to excite interest in fundamental science.							
DP210101915 Jones, A/Prof Theresa M	This project aims to investigate whether artificial light at night drives evolutionary change using a combination of field observations, laboratory experiments and advanced genetic techniques. This multi-disciplinary study expects to provide a significant advance in understanding of the impact of light at night for animals and will enhance our capacity to predict the outcome of future urban expansions for all species. The outcomes will have broad implications for estimating the future biodiversity and health of our urban areas and will benefit both globally and within Australia by providing much needed data regarding the likely resilience of species currently residing in our major cities.	73,580.00	141,216.00	179,694.50	112,058.50	0.00	0.00	506,549.00
	National Interest Test Statement							
	This cross-disciplinary project will aid our understanding of the long term evolutionary impact of artificial light at night and enhance international collaboration in the field. The data will be of significance, and provide much needed data, for a wide range of stakeholders involved in the areas of urban planning and biodiversity monitoring, including government agencies, the lighting industry and the wider public. It will increase the profile of Australia in the burgeoning field of ecological light pollution and create an outstanding international networking and research platform for at least three early career scientists. The outcomes will have broad implications for estimating the future biodiversity and health of our urban areas and provide much needed data regarding the likely resilience of species currently residing in our major cities.							
DP210101920 McCaw, Prof James	The spread of a pathogen (for example, a virus or bacteria) through a population is a multi-scale phenomena, influenced by factors acting at both the population and within-host scales. At the population scale, transmission is influenced by how infectious an infected host is. Infectiousness in turn depends on the balance between pathogen replication within the host and immune/drug control mechanisms. This project aims to develop new mathematical frameworks for simultaneously modelling these two scales. This will provide a platform for the rigorous study of complex biological interactions - such as the emergence and combat of drug-resistance - that shape society's ability to control infectious diseases in human, animal and plant systems.	65,000.00	130,000.00	130,000.00	65,000.00	0.00	0.00	390,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Infectious diseases - of humans, animals and plants - pose a continuing threat to Australia's health and economic prosperity. Their successful control, or maintenance of existing control (in health, agriculture and the natural environment), is crucial. Mathematical modelling is a key capability required for this control as it provides the tools necessary to predict the likely impact of interventions, interpret data and contribute to our understanding of the fundamental biological processes of infection and transmission. In particular, disease spread is a multi-scale process resulting from how a pathogen replicates within an individual host and is then able to transmit to another host. This project - by developing mathematical frameworks that allow this process to be modelled and studied - will directly contribute to an improved understanding of disease transmission and ultimately to more effective control of infectious diseases.							
DP210101965 Ooi, Prof Andrew	Smoke from bushfires transported by gravity currents, and known to occur nationwide, caused the shutdown of businesses, education and events in Canberra in 2019. Recent scientific investigations have shown that the speed of propagation and concentration of smoke in these three-dimensional gravity currents have a long term ‘memory’ of their initial configuration. In this project, high-fidelity computational and experimental techniques will be used to elucidate the fundamental mechanisms of gravity current entrainment and propagation. This knowledge will set a strong foundation to improve operational forecasts of smoke transport that will allow government agencies to better respond to the negative impact of these complicated flows.	50,000.00	90,000.00	75,000.00	35,000.00	0.00	0.00	250,000.00
	National Interest Test Statement							
	Pollution from bushfire smoke impacts community and business activities in many big Australian cities such as Sydney, Melbourne and Canberra. Gravity currents, which are the flow caused by difference in fluid density, is one of the major ways in which smoke is transported from bushfire affected areas and was the cause of smoke inundation in Canberra, 2019. Despite its common occurrence, the flow physics of gravity currents are still very poorly understood. This research will elucidate the fundamental mechanisms of gravity currents entrainment and propagation, providing a strong foundation to improve operational forecasts of smoke dispersion that will benefit fire, meteorological, and environmental agencies. The research outputs will lead to better understanding and prediction of the speed and concentration of smoke transport due to gravity currents which will directly benefit the wider community. Through our research network we will engage risk analysts and community managers within Australian state-based fire agencies to develop practical utilisation strategies as a result of this research program.							
DP210102168 Balding, Prof David	A new data structure for genome-wide datasets has allowed great improvements in the efficiency of genomic data storage and in population genomics simulations, which are crucial to developing and testing mathematical models of population history and species evolution. We will take these advances in new directions, using efficient data structures to dramatically improve inferences about: the demographic histories of populations, rates of genome change, and phylogenetic networks, and we will develop the first inference methods for the multispecies coalescent with recombination. Outcomes will include advances in understanding the evolutionary histories of humans and other species, including pathogens of importance for global health.	65,366.00	133,002.00	137,542.00	69,906.00	0.00	0.00	405,816.00
	National Interest Test Statement							
	Our research will improve computational methods for analysing genetic data to determine ancestral history applicable to animals, plants and humans. The project will develop improved statistical models for genetic processes such as the development of mutations leading to the acquisition of antibiotic resistance in microbes and insecticide resistance in pests. Understanding and predicting these forms of drug resistance are crucial to managing infections and control of pests that threaten our agricultural sector. The methods will also have applications in forensic medicine and family ancestry mapping. The helping technology will enhance analyses of how the malaria parasite evades the human immune system, to control of this major disease of humans, as well as informing control and elimination of pathogenic and insect-borne diseases. Development of these new methods will help create new knowledge while training computational scholars, enhancing Australia’s approach to global health challenges, conservation and effective management of our environment.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102172 Marusic, Prof Ivan	This project aims to progress understanding of wall-bounded turbulent flows under non-equilibrium conditions. The focus is on turbulent flows over rough surfaces where the bulk flow decelerates along the streamwise length of the surface. Such flows are regularly encountered in important practical applications, such as over the trailing edge of an airplane wing or inside a flow diffuser, which are ubiquitous in industry. Novel experiments and numerical simulations will provide the definitive data needed in order to uncover the scaling laws of these flows, thus enabling their reliable prediction.	77,500.00	155,000.00	155,000.00	77,500.00	0.00	0.00	465,000.00
	National Interest Test Statement The effects of turbulence on fluids, including air, are far-reaching. Turbulent flows near solid surfaces or wall-bounded turbulence are everywhere: they are central to skin friction drag on aircraft and ships, the flux of water vapour and CO2 from the ocean's surface, and the interchange of nutrients in river beds, to name a few. While our understanding of these flows has been limited by a lack of verified models, recent advances in experimental hardware and computers provide new tools with potential to unravel these complex interactions. This project addresses one of the most challenging of the class of wall-bounded turbulent flows, which is commonly found in practical applications. Better predictions of such flows will improve the way we operate in many areas of science and engineering that involve turbulent flows. Increased energy efficiency in transportation will provide commercial, economic and environmental benefit to all Australia. Better models of industrial flows will benefit the environment and the commercial success of many sectors throughout Australia.							
DP210102183 Erkal, Prof Nisvan	By developing state-of-the-art experimental and behavioural methodologies to study biased belief formation, this project aims to improve our understanding of the factors contributing to diversity gaps in labour market outcomes in Australia. The project investigates biases in the beliefs formed about the performance of women and minorities, and how these biases can be reduced through policy interventions and improved organisational structures. Expected outcomes include informing policy makers of appropriate interventions and expanding scholarly knowledge of the economic impact of discrimination. The insights gained will enhance Australia's economic performance by improving workplace diversity and dynamics.	38,223.50	103,111.00	100,082.00	35,194.50	0.00	0.00	276,611.00
	National Interest Test Statement As the global economy becomes increasingly competitive, there is growing recognition that greater diversity in key decision-making roles can better position organisations to respond and prosper in a competitive global market. Despite the recognised need to increase diversity in both private and public sectors, evidence suggests that differences in labour market outcomes, such as financial compensation and leadership, continue to exist along gender and ethnic lines in Australia. This project aims to investigate a key contributing factor to these outcomes by examining biases in beliefs that impact performance evaluation. The specific target groups in our study are women and Asian-Australians. An important aspect of the project is to evaluate possible interventions that reduce the biases in performance evaluation. The findings will therefore help inform policies targeted at increasing female and minority representation in decision-making roles across all levels of society within Australia.							
DP210102358 Watt, Prof Matthew J	Lipid droplets store lipids in cells and the mitochondria break down this lipid to generate energy. Both organelles are critical for energy metabolism and cell survival. This project aims to determine the proteins that regulate the interaction between mitochondria and lipid droplets, and how these proteins regulate metabolism. It is anticipated that this project will identify the essential components of lipid droplet-mitochondria interactions and their impact on regulating cellular lipid metabolism. The intended outcome of this project is to provide fundamental new knowledge in understanding how organelles interact and how lipid metabolism is regulated. This knowledge has applications for the primary industries and biotechnology sector.	106,500.00	216,928.00	232,916.50	122,488.50	0.00	0.00	678,833.00
	National Interest Test Statement The efficient metabolism of lipids (fats) is important across most living organisms and defects in lipid metabolism can lead to cell death. Unfortunately, there is a knowledge gap in our basic understanding of lipid metabolism. The project will investigate how cell compartments called lipid droplets (which store lipids) interact with the structures called mitochondria, which burn lipids to create energy. This project will build basic knowledge of how lipid metabolism is regulated. Outcomes from this research include knowledge gain, training of young Australians in cutting-edge research, enhancing Australia's international research standing and providing potential economic benefits through translation of knowledge gains into applications for the primary industries such as the dairy meat and agricultural products, creating new biotechnology opportunities.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102386 Reichardt, Dr Christian L	This project aims to measure how quickly the Universe is expanding by looking at images of the Big Bang's primordial fireball that will be made by two new astronomical surveys. These improved measurements are expected to test our current understanding of cosmology, with the potential to discover new constituents or new physics in the Universe. Answering these questions about the Universe will have far-reaching consequences for our knowledge of fundamental physics. The project will also train students and researchers in data science and petabyte-scale data processing, contributing to a highly skilled STEM workforce.	87,500.00	180,000.00	182,500.00	90,000.00	0.00	0.00	540,000.00
	National Interest Test Statement Origin stories, "Where did we come from?", are significant to all human societies as they speak to identity and purpose. By studying how the universe began, this project will contribute to understandings of our origins, providing cultural benefits to all Australians that emphasise the role of scientific inquiry in modern society. Outreach to schools and media advances the national goal of "Engaging all Australians with science"; astronomy is a gateway to STEM fields because it inspires the general public. National benefits include building Australia's scientific capability by training the next generation of scientists and engineers in advanced scientific analysis and practical skills in 'Data Science'. It will also enable the transfer of key data science technology from international partners to Australia. Experience shows that many project members will cross over to industrial, financial and technology sectors, bringing state-of-the-art data science skills to Australian industry, enhancing innovation in these critical fields.							
DP210102445 McGregor, Dr Katharine E	This project aims to investigate the recent emergence of joint Indonesian and Dutch activism to demand recognition of submerged and marginalised cases of historical violence, economic exploitation and racism. This project expects to generate new knowledge in the interdisciplinary field of memory studies by discovering the motivations, strategies and future plans of these unique forms of collaboration. Expected outcomes of this project include new insights into how these activists are affecting change in public institutions such as museums and setting trends in global social movements. This should provide significant benefits for understanding how memory activism is changing complex multi-ethnic societies.	39,591.00	57,459.50	60,943.50	58,075.00	15,000.00	0.00	231,069.00
	National Interest Test Statement The Australian nation comprises Indigenous people and people from diverse countries, some with complex experiences of historical violence that continue to shape their lives. This project explores growing calls for greater public recognition of such historical experiences and their ongoing impact upon individuals, communities and the nation. Its national and social benefits lie in providing the basis for an enhanced understanding of how Australian public and cultural institutions can enable recognition of historical experiences of violence and contribute to social cohesion. Research outcomes will be disseminated in accessible forums and lead the public conversation on historical legacies and contemporary social inclusion. The project will strengthen Australia's research profile in global memory studies, building interdisciplinary research capacity in areas critical to the public humanities. It will create strategic international research linkages by bringing together scholars of Asia, Europe and Australia to collaborate in areas of high mutual and social benefit.							
DP210102454 Shames, A/Prof Iman	The project aim is the development of a framework for the advancement of optimisation algorithms operating in real-time applications. This project expects to generate new knowledge in the area of systems theory and optimisation, and its application to time-varying problems. Expected outcomes of this project should lead to a new theoretical and practical framework that aims to ameliorate the shortcomings of the existing approaches that struggle to rapidly respond to new information. This should provide significant benefits. Specifically, this project aims to facilitate a technological leap that generates smaller, faster, and more powerful embedded systems such as broadband services, mobile phones, medical imagining, radar and avionics.	67,500.00	135,000.00	135,000.00	67,500.00	0.00	0.00	405,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	This proposal will result in a framework for developing more efficient control and signal processing algorithms, that in simple terms, enable Australian manufacturers to choose either to build smaller, lighter and more robust devices, or to build faster, better devices without increasing the weight or energy demands. As embedded systems are ubiquitous in modern society, even small efficiency gains to signal processing algorithms can have substantial economic benefits. New design principles for, and new classes of, numerical algorithms for solving real-time optimisation problems will advance the fields of control and signal processing by providing new, more efficient tools for practitioners to use when engineering devices to perform signal processing tasks. Control theory and signal processing are important factors in driving advances in multi-billion dollar industries includingbroadband services, mobile phones, medical imaging equipment, radars, avionics, and myriad other devices and systems.							
DP210102499 Ngo, Prof Tuan D	The rapidly increasing global population (projected to be 9.8 billion by 2050) and global urbanisation have created a demand for the construction industry, thereby increasing the pressure on our planet's limited resources for the construction industry. This high demand can yield detrimental effects to the environment due to the high carbon footprint of conventional construction materials, and is amplified by the threat of accidental or deliberate extreme loadings to buildings, which can trigger fatal progressive collapse events. The proposed project aims to develop an innovative structural system with that possesses superior structural resilience to extreme loads and progressive collapse using lightweight eco-friendly materials.	56,401.50	129,220.50	134,220.50	61,401.50	0.00	0.00	381,244.00
	National Interest Test Statement							
	The project addresses significant problems in the construction industry, that is environmental impacts and structural resilience under extreme loads to avoid disastrous building collapse, by proposing hybrid sustainable structural systems that can shape the future of the industry. This will reduce the environmental impact of the construction industry, which globally contributes 40% of greenhouse gas emissions. The project expects to generate new knowledge in the area of future building structures by using an innovative, holistic approach which will enhance the resilience of proposed hybrid system. The innovative design of the proposed hybrid sustainable system and standardised design guidelines will allow the new class of structures to be used for future buildings with immense potential to revolutionise the construction sector in Australia and overseas, thereby propelling Australia as a global leader in construction technologies. The project will contribute to social and economic sustainability in Australia and around the world by lifting the market share of the construction industry and creating jobs.							
DP210102540 Penman, A/Prof Trent D	Extreme and megafires result in significant damage to property and infrastructure and are associated with large suppression costs. These events form when separate fires Merge. Their increase occurrence in recent seasons highlights the importance of developing tools and technologies that better predict extreme events to aid fire response and inform strategies for greater resilience. This project combines fire field experiments with computer modelling to determine factors driving extreme fire development, and develop new knowledge and models. These enable better prediction of active fires, enhance the knowledge base of fire managers for critical decision making and to improve risk modelling and mitigation planning for fire-prone communities.	125,000.00	235,000.00	170,000.00	60,000.00	0.00	0.00	590,000.00
	National Interest Test Statement							
	Australia has recently experienced several instances of extreme fire development and megafire formation because of merging fires. Merging fires create large-scale fire fronts resulting in disproportionate risks to environmental, economic and human assets. Indeed, average costs relating to bushfire amount to over $300 million per annum, while extreme events can cause billions of dollars' worth of damage in an afternoon. Our proposed research into extreme and megafire dynamics will lead to improved risk assessment methodologies, more accurate tools to assist fire managers and fire behaviour analysts, and better understanding of societal and environmental impacts. As such, the proposed research is of significant national benefit as it provides a means to improve the way we prepare for and respond to catastrophic bushfires, and alleviate the considerable costs associated with bushfires.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102546 Allen, Prof Andrew M	Aim: To unravel the astounding complexity of the vertebrate brain by developing a completely novel method, that enables manipulation of the activity of defined nerve cells to study behaviour. Significance: Such technical advances are essential for understanding the intricate function of the brain. Expected outcomes: We will provide a technical advance of broad scope that will lead to novel neuroscience throughout the world. We will also increase understanding of body weight control through the experiments planned to validate our tool. Benefit: Our technical advance has the potential to alter experimental protocols, and the information obtained by experimental neuroscience, across all areas attempting to understand brain function. **National Interest Test Statement** Understanding how the brain functions is a frontier of International scientific research and of broad interest to humanity. Our understanding is impeded by the complexity of brain organization and requires novel experimental tools that enable selective modulation of the activity of specific brain cells. We have developed a new method for inhibiting brain cells and shown the utility of this method. Our research proposes to extend its use to become specific for different cell types in a controllable way using small molecule drugs to turn inhibition on and off. We also will adapt the technology to specifically excite cells in a controllable manner. These approaches will provide unprecedented control of neurons within brain circuits and open the way to novel understanding of many brain functions applicable to understanding cognitive processes, behavioural pyschology and neurological disease. This will benefit Australian and International researchers as they seek to understand the brain's complexity.	110,159.00	219,543.00	217,768.00	108,384.00	0.00	0.00	655,854.00
DP210102600 Nesic, Prof Dragan	The next generation of engineered systems need to perform complex tasks with precision, and be robust, resilient and adaptive to their environment enabled by the confluence of control, optimization, learning and computation Understanding the interplay between robust stability and optimization is key to this endeavor. Many techniques, such as model predictive control and reinforcement learning, rely on an intricate interplay between an optimization-based control algorithm and an optimization routine used to calculate the control law. This project aims to develop a general design framework for stability, suboptimality and robustness of such algorithms, that can be used in range of novel applications, such as driverless cars and drones. **National Interest Test Statement** Our technological world relies on the continual advancement of omnipresent engineered systems operating across our society. This project will explore the design of advanced control algorithms used in engineered systems by addressing fundamental properties of important classes of optimization-based controllers. The capabilities of these engineered systems will be enhanced considerably through artificial intelligence, which can learn about their environment, adapt to it and perform complex tasks with precision. Operating autonomously, this next generation of engineered systems will be essential for smart highways, driverless cars, swarms of drones, various types of robots and advanced manufacturing systems to name a few examples. Project outcomes will benefit transportation, environmental monitoring and defence, improve our quality of life in overpopulated cities by providing better use of our energy and water, reducing pollution and waste. Finally, it will provide economic benefits to Australia by maintaining and growing our competitive edge in the global market.	79,500.00	162,000.00	167,000.00	84,500.00	0.00	0.00	493,000.00
DP210102645 Pask, Prof Andrew J	The Australian bushfire crisis of 2020 has taken an enormous toll on our unique wildlife. With no halt in sight to rising global temperatures, more extreme weather events are predicted to increase in frequency and severity. We simply must act now to preserve our unique native mammals in Australia and safeguard against species loss and irreversible declines in genetic diversity. This project will develop methods for the generation and preservation of stem cells from a range of our most endangered and vulnerable marsupial species. These cells not only allow us to ‘bank’ species and genetic diversity but also provide a route to enabling genetic manipulation, opening up a completely new niche for conservation biology in marsupials.	97,000.00	206,100.00	212,100.00	103,000.00	0.00	0.00	618,200.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Marsupials are iconic to Australia, but we have the worst rate of mammal extinctions of any continent in the past 200 years. Many native marsupial species remain threatened due to habitat destruction and introduced pests and their vulnerability has been exemplified by the recent bush fires. While ongoing conservation management strategies are important for delaying extinction, permanent solutions would have immeasurable value for conserving biodiversity for the benefit of future generations. By developing methods for stem cell generation and preservation in marsupial, this project will not only provide valuable information on marsupial biology, it will also greatly enhance our capacity protect marsupials from further extinctions by developing new technologies for novel conservation approaches for our most iconic and precious fauna.							
DP210102672 Perry, Dr Christina J	Learning and memory are fundamental to human and animal behaviour. We identified a specific population of cells in the zona incerta of the brain, where activation inhibits expression of memory, and facilitates the acquisition of new learning. Aside from our observations, nothing is currently known about the anatomy and function of these cells. This project aims to map how they connect to the rest of the brain, to observe how these connections are recruited during learning and memory, and then to test their function experimentally. The outcomes will extend the known neural circuitry that controls learning by defining how and where these unexplored pathways fit within it; thus advancing knowledge regarding neural regulation of behaviour.	77,476.00	155,768.00	182,331.50	104,039.50	0.00	0.00	519,615.00
	National Interest Test Statement							
	This research will characterise the function of hitherto undescribed neural pathways which we know from our pilot data are necessary for the acquisition and expression of new memories. Therefore, the outcomes will develop and extend existing models that describe neural control over behaviour. This will benefit research communities in Australia and internationally because it will shift our current understanding of biological control over cognitive processes. We will identify and describe a new target that may change how we understand the contribution of environmental context in the expression of memory. Context has profound influence on behaviour selection and decision-making processes. This is an important consideration for many sectors of the Australian community, including advertising (targeting the context to guide purchasing) and education (optimising environment to facilitate memory encoding/retrieval). Through identifying this novel neural target, the outcomes of this study have the potential to precipitate rapid advances in our understanding of decision making, that may impact all these areas.							
DP210102705 Kallies, Prof Dr Axel	Regulatory T cells (Tregs) populate almost every organ of the body and play a central role in preventing inflammation and maintaining health. To exercise these functions, Tregs undergo a developmental program, the details of which are poorly known. This project will utilize newly developed biological tools and state-of-the-art technology to uncover the molecular mechanisms that govern Treg development and function. The project will generate basic scientific knowledge and new intellectual property that will afford new opportunities for research and development. The outcomes of this project will help to devise strategies to treat diseases such as autoimmunity, cancer and metabolic syndrome, and will thus benefit veterinary and human health.	87,574.00	176,745.50	172,607.50	83,436.00	0.00	0.00	520,363.00
	National Interest Test Statement							
	This project has the potential to have economic and commercial benefits to the Australian community. It will generate basic scientific knowledge and new intellectual property that will afford new opportunities for research and development. It will further build the capacity of Australian companies, institutes and universities for the development of new biological products for the treatment and prevention of chronic diseases. Such products will drive economic growth and productivity and benefit veterinary and human health services. In the long term, outcomes of this research will contribute to novel approaches to reduce the burden of chronic diseases such as autoimmunity or inflammation. The project will also provide high-level training to students and postdocs, which will increase the competitiveness of the strategic biotechnology sector in Australia and raise the skills of its human capital.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102712 Hogan, Prof Benjamin M	The brain is responsible for a quarter of the body's metabolism and is thus perfused by an extensive network of blood vessels. Pericytes surround these vessels and interact with neurons, glia, immune cells and neural stem cells of the neurovascular unit. Pericytes influence brain development, function and regeneration but remain enigmatic. This project investigates molecular control of pericyte development, functional coupling of pericytes with adjacent cells and pericyte function in tissue regeneration. We aim to produce new fundamental knowledge in brain development, structure, function and evolution. New knowledge generated here may lead to future approaches in stem cell biology, tissue engineering, regeneration and ageing of the brain.	109,180.00	222,350.00	223,220.00	110,050.00	0.00	0.00	664,800.00
	National Interest Test Statement There is a fundamental knowledge gap in understanding the cellular and molecular interactions that control neurovascular function during brain homeostasis. Reduced neurovascular function is associated with developmental defects, altered cognition and is thought to contribute to aging of the brain. This project aims to improve our fundamental understanding of key cells involved in maintaining normal blood vascular and brain function and tissue regeneration in vertebrate organisms. Project outcomes therefore include fundamental new knowledge in an area that may impact upon new technologies in tissue engineering, tissue repair and regenerative targeting of the ageing brain. Broader longer term potential outcomes include economic benefits to Australia in building new cutting-edge research directions and capacity, new knowledge and potential economic benefit by improving workplace and social participation. Importantly, this project will train future scientists in world-class molecular, developmental and cellular biology, building future capacity for Australian science.							
DP210102750 Prawer, Prof Steven	The objective of the work proposed here is to develop a new tool for investigating intercellular communication. Currently, techniques for probing cellular functions are either well-suited to controlling a limited number of individual inputs or a large number of complete cells. This projects aims to address these limitations by utilising cutting edge fabrication techniques to create an optically controlled nanoscale array of diamond electrodes, capable of modulating a large number of single cellular inputs with precision. This technology will allow researchers to manipulate cellular processes with more control than ever before, potentially gaining insights useful for understanding brain function, memory formation, or cell death.	90,000.00	160,000.00	130,000.00	60,000.00	0.00	0.00	440,000.00
	National Interest Test Statement This project has the potential to provide a triple-benefit to Australia. Firstly, it will deliver a unique device that can modulate and stimulate the signals sent by cells within the brain. This will provide a pathway to enhance the biomedical and applied research capabilities of Australian neuroscience researchers, ultimately with potential impacts in health and clinical diagnostic and treatment programs which require an understanding of how the brain works. Secondly, it will lay the fundamental scientific groundwork and development of advanced manufacturing capability to enable the future realization of devices that provide an interface between the brain and machines. Investment in the development of brain machine devices will likely attract funding to start-ups in the rapidly growing field of neural interfaces. Thirdly, this project will produce highly skilled scientists capable of navigating the complex interdisciplinary world of advanced manufacturing and advanced biotechnology industry at the intersection of nanoscience and neuroscience.							
DP210102781 O'Connor, Prof Andrea J	This project aims to understand how nanoengineered materials can be designed to kill bacteria and fungi without causing antimicrobial resistance. Resistance to antimicrobial drugs already leads to many thousands of deaths annually and costs society billions of dollars. Nanomaterials have unique abilities to attack microbes in multiple ways that could limit resistance. This project will engineer new antimicrobial nanomaterials tailored to selectively kill microbes with reduced likelihood of developing resistance by using synergies between inorganic nanoparticles and antimicrobial peptides. This technology could be used to prevent infections and biofilms on surfaces in a wide range of future applications, such as medical / veterinary devices	66,648.00	139,304.50	139,486.50	66,830.00	0.00	0.00	412,269.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Resistance to antibiotics is a major global challenge impacting human and animal health and jeopardising agricultural food production. As a vital step towards addressing this issue, this project will develop nanomaterials that can be used to create coatings that combat infections and limit the development of future antimicrobial resistance. They will have potential for impact in a broad range of fields including veterinary treatments, medical devices and implants. This project will enhance international research collaborations, generate intellectual property with significant potential economic impact, and contribute to a higher quality workforce through the training of a postdoctoral researcher, PhD and Masters students. The materials and IP generated will create opportunities for design and manufacture of new products with export potential, and thus will foster future economic growth in Australia's medical technology, food and pharmaceuticals sectors.							
DP210102782 Edmond, Prof Chris	This project aims to build a macroeconomic model to help understand the implications of heterogeneity in workers skills for wages and productivity. The research significance of this project is in its treatment of worker skills as an indivisible bundle. This bundling of skills gives rise to the possibility that a given skill is priced differently in different occupations which in turn has implications for firms' incentives to invest in technology and training and workers' incentives to invest in education. This project uses state of the art economic theory and empirical methods and expects to provide a new and better understanding of the sources of wage growth that helps guide national policy formation in innovation and training.	35,736.00	65,311.00	60,044.00	54,938.00	24,469.00	0.00	240,498.00
	National Interest Test Statement							
	The project contributes to Australia's national interest on the economic front. Growth in the living standards of Australians depends on growth in real wages which in turn depends on growth in productivity. In recent years, however, there has been a pronounced slowdown in both the growth of real wages and in productivity itself. That is, not only has productivity growth fallen, but real wage growth has fallen even further --- there has been an "excess slowdown" in real wage growth. This project will help address the slowdown in real wage growth both by addressing the productivity slowdown and by addressing the extent to which changes in productivity pass through to real wages. In particular, this project will yield a better understanding of the links between worker skills, the wages that workers earn, and productivity both at the level of individual firms and at the level of the Australian economy overall. Importantly, this project will help understand the two-way causality between (i) the availability of key skills and wages, and (ii) wages and technology adoption and innovation.							
DP210102831 Sevior, Prof Martin E	The universal matter-antimatter asymmetry and the existence of dark matter imply that new fundamental physics must exist. Recent anomalous results provide evidence that the nature of new physics can be discovered by observing B-meson decays. The project aims to do this with the Belle II experiment in Japan. Discovering new physics would be a substantial scientific discovery leading to a paradigm change in Fundamental Physics. In the process of making the measurements we will develop and enhance international collaborations, develop new techniques for machine-learning and create innovative work-flow software.This will enhance the international reputation of Australian Universities leading to increased exports of Australian education.	67,500.00	135,000.00	135,000.00	67,500.00	0.00	0.00	405,000.00
	National Interest Test Statement							
	The discovery of fundamental new physics would be a paradigm change in human knowledge, with broad benefits to Australian society through contributions to global knowledge. As with all major scientific advances, the discovery of new physics – new knowledge of the foundations of nature – has the capacity to inspire, providing socio-cultural benefits as well as strengthening the profile of Australian higher education, enlarging collaborative research networks and boosting Australia's export of education. Additionally, the project will provide physics graduates with advanced skills in quantitative analysis and data science, the cornerstone of advanced industry and the knowledge economy. These people – many of whom will transition into industry and commerce over their career – will take with them new and innovative data science techniques to improve the performance of Australian industry and government. Finally, the project will develop work-flow software that integrates people with large-scale data processing, providing an example of cyber-security done right.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102836 Nordlinger, Prof Rachel	This project aims to address the fundamental issue of how the grammatical structure of the language we speak shapes the way we plan and interpret sentences. The project will use innovative methodologies to investigate language production and comprehension in three Australian Indigenous languages that have unusually free word order, where the words in a sentence can be varied in multiple ways without changing the overall meaning. Expected outcomes include new knowledge of the relationship between language structure and human cognition, a deeper understanding of the grammatical structure of three Indigenous languages and how they differ from other languages, and important contributions to Indigenous language maintenance and education.	47,224.00	111,296.50	113,584.00	49,511.50	0.00	0.00	321,616.00
	National Interest Test Statement This project contributes to Australia's national interest in a number of ways. Firstly, it involves descriptive work on three endangered Indigenous languages, working closely with Indigenous community members, and providing training and education in their home communities. This project will increase understanding of the way these languages work and contribute knowledge for community education programs and language maintenance efforts. Research increasingly demonstrates links between language maintenance and increased well-being in Indigenous communities and thus this project has the potential to significantly benefit the communities involved. Secondly, the project brings a new approach to the fundamental question of how language-specific properties relate to how the human brain works. This has potential long-term benefits to Australian society through contributions to the development of language processing models that can cater for a diversity of languages. Such models have the potential to contribute to increasing domains of economic and commercial interest where speech processing plays a significant role.							
DP210102887 Forrester, Prof Peter J	Fundamental to random matrix theory are certain universality laws, holding in scaling limits to infinite matrix size. A basic question is to quantify the rate of convergence to the universal laws. The analysis of data for the Riemann zeros from prime number theory, and of the spectral form factor probe of chaos in black hole physics, are immediate applications. An analysis involving integrable structures holding for finite matrix size and their asymptotics is proposed, allowing the rate to be quantified for a large class of model ensembles, and providing predictions in the various applied settings. The broad project is to be networked with researchers in the Asia-Oceania region, with the aim of establishing leadership status for Australia.	79,938.00	165,746.00	173,886.00	88,078.00	0.00	0.00	507,648.00
	National Interest Test Statement Random matrix theory is a field of mathematics that has historically been driven by its applications in research areas such as quantum physics, number theory, numerical linear algebra and multivariate statistics. Stemming from that fundamental research, it is now used in modelling the macro-economy, investigating climate-change, and managing complex ecological food-webs. This project continues the tradition of fundamental mathematical research through which surprising but enabling techniques are discovered and understood. By enhancing a culture that strives to exploit mathematical structures for their rigor in providing a description of the physical world, and for their ability in making predictions, this project will contribute to Australia's computational and predictive capacity in key socio-economic sectors. It will also strengthen our reputation internationally and in the region, and contribute to building a culture of discovery which is essential for Australia to be successful in transitioning to a knowledge-based economy.							
DP210102916 Keogh, A/Prof Louise A	This project aims to critically evaluate the regulation of conscientious objection to abortion. A range of state-based laws regulate this practice in Australia, and there is evidence that all result in inequitable access, harms to women and lack clarity for providers. The project will critically evaluate the legal and regulatory options for managing conscientious objection and interview conscientious objectors to develop a conceptual model to explain their practices. A participatory process with experts will identify the optimal model for regulation and how to translate the model to practice. Expected outcomes are world first evidence on practice, progress towards effective regulation, and benefits will be reduced conflict and harms.	45,217.00	90,434.00	97,475.50	52,258.50	0.00	0.00	285,385.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Currently in Australia a patchwork of state laws regulate how health professionals practice when they hold a conscientious objection to abortion, and consequences for not adhering to the law are unclear. This leaves both consumers and doctors vulnerable. Scholars have considered how conscientious objection can be managed, from not allowing doctors to hold a conscientious objection under any circumstances, through to not imposing any constraints on how doctors define and enact an objection. However, there is little empirical work to determine the best model for the regulation of this complex area of health care and no agreement on the optimal model. This world-first project will provide an evidence base for policy, regulation and law, and will position Australia as a leader in research on and regulation of the practice of conscientious objection in healthcare. This will increase equity of access to contentious services like abortion and allow for the protection of the moral integrity of doctors. This research will be relevant to other contentious areas of medicine, like voluntary assisted dying.							
DP210102984 Hinde, Dr Elizabeth H	Heterochromatin protein 1 alpha (HP1a) is an architectural protein that decorates three-dimensional genome organisation and through self-association into HP1a dimers regulates global gene expression. While there is extensive biochemical evidence on how HP1a molecules bind DNA, dimerise and bridge nucleosomes close together, we still do not know how HP1a regulates higher order chromatin structure in the context of a living cell. Thus, by use of cutting-edge fluorescence microscopy methods, the overall aim of this research project is to determine the biophysical mechanism by which the HP1a monomer to dimer transition spatially and temporally modulates live cell chromatin network organisation to ensure faithful transmission of the genome.	68,150.00	134,450.00	133,300.00	67,000.00	0.00	0.00	402,900.00
	National Interest Test Statement							
	Genes are normally ‘silent’ and tightly packed in chromosomes like books on a library shelf. Hence, before genes can be read and expressed, they need to be unpacked and then ‘read’ to exert their functional effect. The tightly packed state is called heterochromatin, viewed as a highly stable nuclear structure that represses the reading of genes. Heterochromatin is in fact dynamic and more accessible than previously believed to nuclear proteins driving gene expression. Heterochromatin protein 1 alpha (HP1a) is central to establishing and maintaining the heterochromatin through unknown mechanisms. This project will dissect how HP1a ‘opens’ and ‘compacts’ chromatin network structure to both induce and silence genes. We will employ a technology called optogenetics and cutting-edge microscopy methods for this purpose. This research outcome would be a significant advance in scientific knowledge benefitting the Australian community through development of biotechnological applications in stem cell biology, somatic cloning and gene therapy.							
DP210103064 Godfrey, Prof Dale I	The immune system patrols our body examining molecules such as proteins and lipids that signal whether or not everything is ok. While protein recognition by the immune system is well understood, our knowledge of the fundamental features of lipid detection is poor. This project will investigate the detection of lipid molecules that are presented to the immune system in association with a molecule known as CD1c. The aims are to understand: 1. The cells that respond to these lipids; 2. The cellular receptors that bind to these lipids; 3. The types of lipids involved in this process. This work is essential for us to understand lipid-based immunology which is critical if we ultimately wish to harness this to improve human health.	92,166.00	173,251.50	152,691.50	71,606.00	0.00	0.00	489,715.00
	National Interest Test Statement							
	This project meets all the objectives of the ARC discovery project scheme with the potential to provide both social benefit and commercial benefit. In terms of social benefit, this project, while basic research in its nature, will improve our understanding of how the immune system functions, which will ultimately lead to improvements in health care. It will also support excellent fundamental research by both individuals and teams, in conditions that are proven to achieve best results and it will ensure that we can continue to train early career researchers at the highest level, also supporting and enhancing our extensive international collaborative network. In terms of commercial benefit, my research team has established a collaborative relationship with both Australian and International industry partners, such as CSL Limited and Avalia Immunotherapies. New findings from this research are likely to generate commercially viable collaborative project opportunities with these and other potential industry partners.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103072 Monty, Prof Jason M	70% of the Earth's surface is the air-sea interface. A huge amount of energy and gas is exchanged between the atmosphere and ocean; exchanges that are crucial for life on earth. Climate models, weather and wave forecasts depend on oversimplified models for these exchanges. Oversimplification limits accuracy, with outcomes ranging from inaccurate climate predictions to costly and unnecessary rerouting of ships or evacuations of oil platforms. This project promises new knowledge of the turbulent air flow above waves through innovative, ambitious experiments in our laboratory wind-wave tanks. Concurrently, novel numerical simulations will enable new models for sea drag coefficient, the most critical component in air-sea interaction models.	95,000.00	170,000.00	115,000.00	40,000.00	0.00	0.00	420,000.00
	National Interest Test Statement The effects of turbulence in the air above the ocean are critical to all life on earth. The exchanges between the ocean and air dramatically affect our climate, weather and ocean circulation. These processes are extremely complicated and must be modelled in order to perform, for example, climate or cyclone predictions. Australia is highly exposed to inaccuracies in these sorts of predictions. Infrastructure decisions are now being made on the basis of climate predictions so it is essential we have best estimates of what we are planning for. Cyclones are becoming more severe and frequent, with many rural communities exposed and in need of accurate and reliable forecasts of their tracks. This project will provide new knowledge on turbulence at the air-sea interface that will be analysed to develop new and improved models for the effects of turbulence at the interface. These models are able to be directly incorporated into advanced climate or weather forecasts for improved accuracy.							
DP210103081 Ganter, Dr Nora	We are well placed to become one of the world's leading centers in the emerging discipline of elliptic representation theory. This proposal describes our plan of establishing a cohesive research program spanning all the different aspects of this multi-disciplinary field, which applies elliptic cohomology to geometric representation theory, enumerative geometry, integrable systems and invariants of singular varieties. Our mathematically diverse team all have played key roles in the recent developments surrounding the field, and in very different capacities. This is a unique moment, where we have the chance to transform our individual research programs into a cohesive and powerful collaboration with a strong international presence.	65,000.00	132,500.00	135,000.00	67,500.00	0.00	0.00	400,000.00
	National Interest Test Statement This proposal is based on fundamental exploratory research in mathematical sciences that brings together people and ideas from traditionally separate fields. It will strengthen Australia’s standing and capabilities in science and technology, bringing long-term educational, cultural and economic benefits for Australia. The knowledge economy and ‘data science enabled’ industry such as finance, health and telecommunications all fundamentally rely on advanced mathematical and scientific expertise, to which this proposal will contribute through an enhanced mathematics environment. The project will provide many opportunities for research students and early career researchers across Australia to gain experience with contemporary research in pure mathematics through, for example, our seminar program and high-profile international visitors, growing capability and skills in areas critical to Australia’s economic future. The outcomes of these activities and the associated research will help build a mathematically literate and mature workforce essential in key data-driven sectors of Australia’s economy.							
DP210103114 Caruso, Prof Frank	Nanomaterials exposed to biological environments such as blood or lymph fluids rapidly adsorb a layer of biomolecules on their surface, forming a biomolecular corona, and profoundly altering their properties. This project aims to resolve the influence of biomolecular coronas on nanoparticle–immune cell interactions by combining particle engineering, immunology, proteomics and bioinformatic analysis. The project expected outcomes are to generate new knowledge in nanomaterial–immune cell behaviour and design principles for nanoparticles with prospective applications in the agricultural, veterinary and biomedical sectors.	116,893.50	235,311.00	221,417.50	103,000.00	0.00	0.00	676,622.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Nanotechnology-enabled materials are central to emerging applications in agriculture and healthcare. Key to enabling such applications is the development of materials with controlled properties and function. This project will develop engineered nanoparticles with specific properties to explore their interactions with immune cells. The knowledge gained will potentially lead to the development of advanced vaccine delivery nanoparticles for the benefit of the Australian agriculture, veterinary and biomedical sectors and the economy. Furthermore, the functional nanoparticle systems developed will provide strong intellectual property positioning for potential commercialisation, thus providing opportunities for start-up companies, leading to employment and investment in Australian science and industry. Additional national benefits include the training of research students and fellows with strong cross-disciplinary skills that will be of benefit to industries recruiting graduates in science, engineering and technology.							
DP210103208 Soncini, A/Prof Alessandro	The project aims to develop a new combined computational quantum chemistry and experimental X-ray diffraction protocol to extract the 4f electron wavefunction in lanthanide magnetic materials. Results will be significant for the design and screening of efficient molecule-based magnets. Expected outcomes include detailed understanding of the influence of the chemical and crystal environment on single-molecule magnet properties, and benchmarking and development of new computational methods. Significant benefits include focused strategies to design and identify commercially viable lanthanide-based molecular memories, and advance our understanding of the quantum mechanics of strongly correlated 4f electron systems.	50,000.00	115,000.00	115,000.00	50,000.00	0.00	0.00	330,000.00
	National Interest Test Statement							
	As current silicon-based computer processors, and data-storage devices, are running out of room for efficiency improvement, the information technology industry is investing more and more into the exploration of novel atom-based strategies to develop the next generation of computers. Lanthanide atoms and molecules represent promising quantum materials for a new generation of IT devices, and this project will develop and optimize a novel combined computational and experimental technique for the detailed characterization of the most efficient lanthanide materials. Investment in this project will thus not only keep Australia at the forefront of innovative research and development in information technology, but will also train a new generation of researchers who will be able to support technological commercial applications in the development of the next generation of electronic devices based on single atoms and molecules.							
DP210103239 Firestone, Dr Simon	This project aims to inform outbreak response planning by developing new models of infectious disease outbreaks. The project expects to generate new knowledge on the processes driving ongoing outbreaks including those of the novel coronavirus (COVID-19) and African swine fever by integrating the latest advances in Bayesian outbreak inference alongside unique simulation approaches. Expected outcomes should include a shift in how models are developed and used to inform the response to outbreaks as they unfold. This should enable more rapid outbreak containment in Australia and overseas, leading to reduced impacts on public and animal health, and associated industries.	40,619.50	85,601.00	87,825.00	42,843.50	0.00	0.00	256,889.00
	National Interest Test Statement							
	This interdisciplinary project aims to provide public and animal health, environmental and economic benefits by improving how outbreaks of infectious diseases of international concern are modelled, understood and controlled in Australia and overseas. Responding to the threats of the ongoing globally spreading outbreaks of novel coronavirus in China and African swine fever are costing the Australian economy millions of dollars in biosecurity, surveillance, prevention and preparedness planning. If large outbreaks of such agents occur in Australia, widespread impacts would be experienced, across multiple sectors. The new knowledge and models developed will guide how outbreak response decisions are made, leading to more effective control. The project will also benefit Australia by fostering collaborations with leading research groups in the United States, Japan, Vietnam and Europe. This will result in Australian researchers setting new standards in outbreak modelling, and demonstrating how model outputs should be used to inform outbreak responses in close collaboration with animal and public health authorities.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103242 Gell-Redman, Dr Jesse D	Singularities arise naturally in many areas of mathematics, as models of symmetry, degeneracy, and asymptotic collapse. The aim of this project is to provide powerful, generlisable tools to elucidate the interplay between modes of singularity formation and solutions to the important differential equations which arise in geometric analysis. The proposed framework builds upon the established success of microlocal analysis, initiated by Melrose in the 1980's, in the generalisation of landmark theorems like the Atiyah-Singer index theorem to more general Riemannian manifolds. This project will benefit Australia by increasing its capacity in pure mathematics in this highly active research area.	62,500.00	130,000.00	135,000.00	67,500.00	0.00	0.00	395,000.00
	National Interest Test Statement It is well within the national interest of Australia to support fundamental research in pure mathematics. Pure mathematics research has downstream impact on all aspects of the Australian science research and training system, as mathematics underlies and provides rigorous structure to phenomena arising in most areas of the natural sciences. This project in particular will provide research training at high international standards to postgraduate researchers at the masters, PhD, and postdoctoral levels, and will increase the capacity of Australia in pure mathematics research by brining top-notch pure mathematics researchers to Australia. It will raise the profile of Australian math research by producing cutting-edge research in an active area of international import. Microlocal analysis is also used in image processing and tomograrphy, and Fourier analysis in general. Those trained by this project will be in a position to find employment in medical imaging fields or any signals data field. The problems solved in this project may have downstream impact in machine learning where singular sets also arise.							
DP210103272 Cantoni, Prof Michael W	The project aim is to advance mathematical and computational tools for analyzing collections of dynamical systems that interact with each other by the digital exchange of information. The significance of this aim stems from the emergence and growing complexity and scale of such cyber-physical networks in diverse domains, including agriculture, manufacturing, transport, and infrastructure management. The expected outcomes will broaden the scope for exploring achievable performance in the design and deployment of systems that leverage networked interaction for operational gains. Beyond the technical advances, benefits will include sustaining Australia's strong reputation in systems engineering research and researcher training in this area.	55,000.00	115,000.00	120,000.00	60,000.00	0.00	0.00	350,000.00
	National Interest Test Statement Examples of numerous physical systems interacting by the digital exchange of information are emerging in advanced manufacturing, agriculture, transport, water and power distribution, building automation, tele-robotics, and other domains that involve machine-machine and human-machine co-operation. This is fuelled by the potential performance, flexibility and cost benefits of digitally networked interaction. Advances in methods for managing the growing complexity and scale of these so-called cyber-physical networks can lead to impact in both economic and social terms. It is therefore in the interest of Australia to be engaged in research that is aligned with the engineering of such systems. The expected outcomes of this project are fundamental mathematical and computational tools for use in engineering design and network deployment. With a view to sustaining Australia's strong international reputation in systems and control theory research, and the diverse applications thereof, an integral part of the project is the training of researchers and engineers with expertise in this important area.							
DP210103397 Haesemeyer, Prof Christian	This project is in pure mathematics. It aims to address gaps in our knowledge in the modern geometries and their associated algebraic structures that arise in classification problems that pervade mathematics and its applications. This project expects to generate new knowledge in modern algebra and geometry. Expected outcomes of this project include major progress in our understanding of invariants of derived categories of algebraic stacks and the relationship between algebraic and other geometries. The benefit will be to enhance the international stature of Australian science.	37,500.00	105,000.00	135,000.00	67,500.00	0.00	0.00	345,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	The primary benefits of this project to Australia are cultural and economic. The cultural aspect is that the project would enhance Australia's reputation as a center of cutting-edge research in mathematics - and mathematics is central to all of science. The project will also train young Australians to work and think as mathematicians, more specifically as modern algebraic geometers. And the economic importance is that research in pure mathematics eventually leads to unforeseen, but vital, transformative technologies. A currently relevant example is that modern algebraic geometry now underpins such vital economic interests as cybersecurity. To elaborate on the economics part - modern mathematics enters into the way we store information on computers, the way we secure this information, the way we break into other countries' secrets and the way we protect our information from spies. As it happens the branches of mathematics, algebraic geometry and moduli theory, are now particularly relevant.							
DP210103427 Preston, Prof Dr Bruce	Asset price booms and busts have broad ranging implications for households. Despite this, models used for policy analysis struggle to explain asset prices and their implications for the macroeconomy. This project will deliver frontier macro-finance research to inform academics and policymakers on how to model asset price booms and busts, to explain why equity and house price falls appear to have small versus large effects, and how to design effective policy responses. Led by internationally recognized experts in macroeconomics, this research proposal is perfectly positioned to deliver scientific peer-reviewed research and embed outcomes through evidenced partnerships with the Reserve Bank of Australia and the Federal Department of Treasury.	28,409.00	54,504.00	55,685.50	29,590.50	0.00	0.00	168,189.00
	National Interest Test Statement							
	This Discovery Project will have significant economic research and policy benefits. Booms and busts in asset markets generate large wealth effects and can have broad ranging implications for households. Yet standard models used by academics and Australian policymakers struggle to explain asset price movements and their macroeconomic effects, substantially limiting the usefulness for policy. We provide theory and evidence for a new framework that remedies the defects of standard models. While the project gives emphasis to theoretical developments and empirical implications, the ability to model asset markets properly, including house prices and exchange rates, will offer immediate benefits to policy makers. The project will develop a computer code toolbox in Matlab, a programming language extensively used by academics and policy makers, to solve, estimate, simulate and conduct policy experiments using the class of model we propose. The provision of a publicly available Matlab Toolbox will permit policy analysis of scenarios that currently confront Australia, and promote research and research training.							
DP210103428 Crozier, Prof Kenneth B	Aims: This project aims to advance optical nanoresonators and ultra-thin materials in the infrared spectral region. The project aims to use this knowledge to demonstrate an infrared spectrometer on a chip. Significance: Infrared spectroscopy is a powerful method for identifying and study matter but is carried out using instruments that are generally large, heavy, power hungry and costly. Expected outcomes: It is expected that this project will generate knowledge that will allow dramatic reductions in the size, weight, power consumption and cost of infrared spectrometers. Benefits: This should allow infrared spectrometers to be used in applications for which the size/weight/power consumption/cost of current approaches prevent their use.	64,107.00	140,819.00	137,834.00	61,122.00	0.00	0.00	403,882.00
	National Interest Test Statement							
	Infrared spectroscopy is used for numerous applications in Australia, including agriculture, defence, forensics and environmental monitoring. The equipment that is necessary is however large, heavy, power-hungry and costly. We propose to develop infrared photodetectors and spectral filters that will allow this equipment to be reduced in size, weight, power consumption and price. This will contribute to Australia's national interest. First, it will allow infrared spectroscopy to be employed for applications for which it is currently impractical. These applications include mobile monitoring devices related to fruit ripening, medical breath diagnostics and automotive exhaust monitoring, in alignment with some of Australia's Science and Research Priorities. Second, intellectual property protection will be applied for to ensure that the technologies developed in this program can be commercialised. This could lead to a specialised and high-value technology, thereby contributing towards advanced manufacturing in Australia.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103460 Wintle, Prof Brendan A	Population growth, consumption and trade are direct socio-economic drivers of land use change and climate change, which determine where species can persist. The UN Sustainable Development Goals and national policies acknowledge the dependence of people on nature and the impact of socio-economic drivers on nature. However, few analyses of impacts on nature explicitly incorporate socio-economic drivers. Utilising a novel modelling framework and high-performance computing we will integrate economic, land use and biodiversity models to evaluate: (i) policies and incentives for increasing national vegetation cover for carbon sequestration and habitat, and (ii) global risks to nature posed by land use change under future geopolitical scenarios. **National Interest Test Statement** This project will provide insights into the environmental, social and economic implication of policy options and incentives for promoting broad scale vegetation restoration, carbon sequestration, and increasing habitat for animals and plants. In collaboration with lead government and industry bodies (Greening Australia, The Nature Conservancy, CSIRO), we will utilise our predictive machinery to analyse policy options such as carbon pricing and land stewardship incentives, taking into account macroeconomic shocks such as new trade agreements or international commitments to limit carbon emissions. The assessment tools we develop could be brought to bear on a range of policy challenges such as the design of incentives to reduce sediment and nutrient run-off to the barrier reef or increase environmental flows in the Murray-Darling Basin. Our work will provide tangible benefits toward Australia's Strategy for Nature (2019-2030) which states the desire to "Share and Build Knowledge" (Goal 3) "to enable well-informed decision making and the development of targeted management strategies" (Objective 11).	125,864.00	254,856.50	259,621.50	130,629.00	0.00	0.00	770,971.00
DP210103476 Ras, Dr Charl J	This project aims to develop a new approach to designing minimum length interconnection networks by analysing their geometric structure. These networks form the basis of communication, power and transport systems. Optimising the design of such networks is a mathematically challenging problem of high computational complexity. This project will use an innovative method based on a relationship between the geometry of networks and a type of partitioning of the plane called an oriented Voronoi diagram. The outcome will be efficient new algorithms for designing physical networks, which, in practice, will ultimately lead to a reduction in network infrastructure costs for industries in Australia. **National Interest Test Statement** This project will contribute to the academic discipline of discrete geometry by producing new fundamental theory in geometric network design. In turn, this will provide a theoretical platform for further advances by researchers and engineers across the world, thereby enhancing Australia's international academic standing in this field. Ultimately, this project will improve the infrastructure networks that influence everyday life, such as electricity, transportation and communications. Optimal minimum-cost designs lead to more efficient network construction and maintenance, with the potential of saving millions of dollars in infrastructure costs. In the medium to long term, efficient network design will provide economic, environmental and social benefits throughout Australia.	62,500.00	127,500.00	130,000.00	65,000.00	0.00	0.00	385,000.00
DP210103663 Disfani, Dr Mahdi M	Globally 1.5 Billion and in Australia 56 million tyres reach their end of life with less than 5% recycled. This project aims to create new knowledge and predictive models for the behaviour of bonded soft tyre and rigid rock aggregates through a multi-scale approach from particle scale investigation to large-scale observation and modelling. This will create new knowledge into the behaviour of this unconventional three-phase granular mixes; soft, rigid aggregates bonded with polymer binders. The project will provide significant benefits in diverting millions of tyres from landfills and illegal dumps and a more competitive and environmentally sensitive infrastructure industry.	30,000.00	95,000.00	130,000.00	65,000.00	0.00	0.00	320,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement Every two seconds in Australia, three tyres are destined to landfills. With less than 5% recycled, the majority end in landfills or exported for fuel recovery. The national announcement by Federal government on ban on waste export, requires new solutions to be developed. This comes at a time of record investment in the infrastructure sector across Australia. Waste tyre aggregates carry the intrinsic characteristics of car tyres including high elasticity, supreme strength, and resilience to temperature and pressure change, highly desirable characteristics in many civil works. This project will create new knowledge on field performance of waste tyre and crushed rock aggregates bonded for use in a range of civil and geotechnical engineering applications from permeable pavements to road and rail fills. This project will provide the research and professional communities with design tools and confidence in uptake of this unique unconventional mix for the infrastructure industry leading to significant cost and energy savings, reduced waste streams by at least 30% and national economic and environmental benefits.							
DP210103715 Wallace, A/Prof Malcolm W	This project will investigate how and when the atmosphere became oxygen-rich by analyzing ancient barrier reefs and other rocks that formed between 1000 to 300 million years ago, spanning the appearance and diversification of animals and plants. The project is significant because the buildup of oxygen in the atmosphere was arguably the most important chemical process ever to have occurred on Earth and controlled the evolution of environments, climate and life. A major outcome will be an improved understanding of how the Earth's atmosphere and climate are regulated by geological processes. This project will generate new knowledge about how sedimentary zinc, lead and copper ore deposits form, which may guide exploration for these commodities.	67,500.00	137,500.00	140,000.00	70,000.00	0.00	0.00	415,000.00
	National Interest Test Statement In addition to having strong scientific goals, the project also has direct implications for Australian and global ore deposit exploration. The abundance of oxygen in seawater strongly influences the timing and distribution of base metal enrichment in sedimentary systems. A greater understanding of the oxygen content of these ancient oceans may therefore help in exploration for these ore deposit types. Australia's economy benefits enormously from mineral exports like iron and zinc ores. Any geological knowledge that improves the success rate in exploration for these commodities is likely to be of benefit to Australia's economy. In addition, this project will build research strength in environmental geology and may provide a greater understanding of how the modern atmosphere-ocean system works. This has implications for understanding Australia's modern and future climatic regime.							
DP210103740 Mazzone, Prof Stuart B	Internal body organs have a rich supply of sensory nerve fibres that serve important roles in monitoring the local environment for normal and abnormal sensory stimuli. These nerve fibres have different origins and wire into brain circuits that regulate widely diverse physiological responses. In this study we aim to study the neural circuits and responses mediated by a group of these sensory nerves which has not been investigated appreciably in the past. We believe that these sensory neural circuits will reveal important new insights into how internal organs perform their diverse and essential functions to sustain life.	73,000.00	141,250.00	135,500.00	67,250.00	0.00	0.00	417,000.00
	National Interest Test Statement Understanding how the nervous system operates is at the forefront of biological, psychological and biomedical research globally. Many fundamental questions remain unanswered. We will investigate the organisation and function of neural circuits that are instrumental in controlling and protecting our internal organs. The project is not medical as it seeks to answer basic questions relating to the wiring of the brain. The results will contribute significant new knowledge to fundamental neuroscience, advance modern technologies for studying the nervous system, produce internationally-recognized outputs, train new scientists and lead to larger national and international collaborative projects. Because we will describe neural processes that protect us from environmental harm, the project will have significant long-term societal and economic benefits for maintaining human health. For example, the work will improve our understanding of how the nervous system helps to protect us from environmental pollutants, such as poor air quality or ingested contaminants. This has far reaching impact.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103791 Fallon, A/Prof James B	Cochlear implantation, initially only provided to profoundly deaf individuals, is now routine in people with substantial residual hearing. Although stimulation via a cochlear implant and hearing aid in the same ear has been shown to improve speech understanding, particularly in noise, and to increase the aesthetic quality of sound, almost nothing is known about the physiological mechanisms underlying these benefits. The broad aim of our project is to address this deficiency by measuring the patterns of neural activity evoked by speech sounds across the tonotopic axis in the inferior colliculus and auditory cortex and assess the extent to which the pattern of neural activity allows discrimination between the different speech sounds. **National Interest Test Statement** This project will provide the first detailed knowledge of the way in which electroacoustic stimulation is processed in the central auditory system. This fundamental knowledge is critical to our understanding of the way multiple modalities are integrated by the brain and will have potential impact on a range of neuromodulation technologies. The project will also advance our understanding of neurobiology and plasticity resulting in high quality peer-reviewed publications and community and stakeholder engagement. Importantly, this project also has the potential to provide a foundation for testing future developments in speech encoding strategies that underpin cochlear implants. Australia, already a world leader in medical bionics and cochlear implant technology, will benefit from additional job creation, increased revenues and continued leadership of the field of neuromodulation technologies, an industry projected to be worth US$13+ billion in 2022.	123,550.00	242,100.00	240,100.00	234,000.00	112,450.00	0.00	952,200.00
DP210103888 Liu, A/Prof Zhe	Different types of ions with the same charge can behave distinctively in many ionic applications. This so-called ion-specific effect is essential to ion separation, ion sensing, electrochemical energy storage, chemical and biomedical processes and many other industrial applications. Confining ions in nanopores and modulating them via surface electric potential can give rise to new ion-specific effects, enabling novel applications. Capitalising on our recent experimental discoveries, this project aims to integrate new multiscale models to understand ion-specific effects in electroconductive nanoporous materials. The new models will be used to quantitatively predict ion-specific effects in supercapacitor design. **National Interest Test Statement** Specific ion effects play a significant role in applications in mining, chemical and biomedical processing and have long been an active research topic in Australia. Complementing Australia's existing world-leading research strength in this area, this project will initiate a new research direction to deal with ion-specific effects under nanoconfinement, It will not only help strengthen Australia's leading position in this research field but also will establish new theoretical models to accelerate the design of next-generation ionic technologies such as chemical/pharmaceutical production processes, water desalination, mineral extraction and capacitive energy storage devices. It will provide a multidisciplinary, contemporary environment to train highly skilled postgraduate students and postdoctoral researchers, constituting a strong workforce to bridge fundamental studies into real-world use. The new knowledge and intellectual property produced from this project as well as talents trained will support emerging Australia's knowledge-based manufacturing industry.	63,566.00	130,402.00	135,942.00	69,106.00	0.00	0.00	399,016.00
DP210103923 Buchanan, A/Prof George R	Browsing for information is an established and fundamental part of how people find the knowledge that they need. However, our current understanding of how browsing succeeds or fails is poor. This is because we have limited empirical data, and until recently, the available technologies to create detailed data on what people actually look at and when were very limited. As a result, digital browsing methods have been almost universally inferior to real-world counterparts. Given the lack of fundamental theories to inform design, this is unsurprising. After creating a detailed and systematic account of user behaviour in browsing, we will create novel designs that will accelerate the discovery of information, particularly for innovative work.	65,000.00	135,000.00	140,000.00	70,000.00	0.00	0.00	410,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement Australia's economic dependence on arriving at creative solutions and ideas is growing rapidly. Coming up with novel approaches in any profession or industry requires workers to gather information on concepts that are fundamentally hard to articulate. In these cases, browsing for information signficantly outperforms interactive search. However, while digital search tools are highly refined, digital browsing tools are manifestly ineffective. This project will create new insights into how people visually scan when browsing. That fundamental knowledge will help us design new, effective tools for digital browsing that will significantly impact all Australian information providers, and the industries that depend on innovating through information to succeed, from agriculture to banking.							
DP210103984 Haslam, Prof Nicholas H	This project aims to investigate our culture's rising preoccupation with harm and clarify its causes and consequences. It will apply innovative computational tools for understanding cultural change which will create new knowledge of how concepts of harm have broadened their meanings in recent decades. It will explore societal and cultural drivers of these changes and their effects on diverse phenomena including help-seeking, over-diagnosis and polarized moral judgment. The project will generate insight into important ongoing social changes and awareness of their positive and negative ramifications. It will provide significant benefits for our understanding of key challenges to mental health and social well-being.	60,000.00	120,000.00	120,000.00	60,000.00	0.00	0.00	360,000.00
	National Interest Test Statement Australia faces growing challenges involving rising rates of mental illness, political polarisation and social conflict. The public is increasingly concerned about the growing vulnerability of young people and how to address it. Many of these challenges are associated with changes in how members of the public understand concepts of harm such as mental disorder, trauma, bullying, prejudice and hate, and with disagreements about those definitions. The project will enable the development of strategies for enhancing the population's mental health and social cohesion in several ways. It will clarify sources of over-diagnosis of mental illness and illuminate how education campaigns can alter people's concepts of mental illness in ways that improve appropriate help-seeking among under-served groups. By revealing precisely how different ways of defining harm underlie many heated social and political conflicts between individuals and groups, it will afford a new target for designing community-level interventions that increase common ground, shared understanding and mutual respect.							
	The University of Melbourne	5,389,594.50	11,308,978.50	11,616,754.50	6,114,789.50	627,419.00	210,000.00	35,267,536.00
	Victoria	14,370,456.50	29,871,226.50	29,789,998.50	15,071,085.00	991,856.50	210,000.00	90,304,623.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
Western Australia								
Curtin University								
DP210100265 Foster, Em/Prof Neil R	This research will develop nanosystems to target delivery of drugs to the colon. Our nanosystems will permit the combination of clinically used chemotherapy drugs within a single dosage form. This will improve the efficiency of delivery to the colon while reducing unwanted side-effects. A novel supercritical microfluidics system will be developed to produce therapeutic nano-carriers in a continuous mode with lower labour requirement, higher production rate and better quality control than conventional production methods. The new process will combine benefits from both supercritical fluid technology (green process) and microfluidics (high mass & heat transfer).	35,000.00	70,000.00	70,000.00	35,000.00	0.00	0.00	210,000.00
	National Interest Test Statement The outcome from this project will be the development of a technology platform for the encapsulation of various drugs for targeted delivery to the colon. The technological development of supercritical microfluidics will focus on the principles of process intensification (PI). The concept of PI for microfluidics is based on miniaturisation, which has been widely recognised to have improved process efficiency, production output, quality and production cost while minimising the resulted wastes. New and innovative technologies that enable resources to be used more efficiently, and products to be manufactured more economically with smaller environmental footprint, will have a significant positive impact on both society and the environment. The project will stimulate new growth for Australia's pharmaceutical advanced manufacturing sector (Science and Research Priorities). The project will promote an economic and environmental benefit by reducing the amount of solvent waste compared to conventional batch processes.							
DP210100336 Benedix, Prof Gretchen K	This project aims to answer fundamental questions about the origin and evolution of the solar system by utilizing innovative machine learning techniques developed by our group. Starting with Mars, we will interrogate the highest resolution image data to automatically generate the ultimate resolution global age map. The expected outcomes of this project include determining the absolute ages of geologic processes on Mars to deliver a groundbreaking look at the geology of another planet at the centimeter scale. A major benefit of this project will be enhancing Australia's role as a leader in space and planetary science through this interdisciplinary, international collaboration across engineering, geology, computing, and chronology.	77,500.00	155,000.00	150,000.00	72,500.00	0.00	0.00	455,000.00
	National Interest Test Statement We developed an advanced machine learning tool to extract information from planetary image datasets quicker, and at higher resolutions, than ever before. This is an Australian innovation that is already materially enhancing strategic relationships with partner space agencies when Australia is expanding its global footprint in the space industry. We will apply it to a range of blue-sky research questions, but our goal is to build on our successes to address terrestrial geoscience issues with economic significance (we have already established a relationship with Industry, Fugro, through the Innovation Central Perth Internship Program), applying machine learning to advanced pattern recognition and quantitative characterisation of Earth observation and geophysical datasets. Planetary science is inspirational to young people to enter STEM fields: a clear goal for Australia. We will use the award-winning Space Science and Technology Centre (based at Curtin) resources in outreach and engagement to maximise STEM impact.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210100420 Viscarra Rossel, Prof Raphael A	Rangelands soils represent Australia’s largest carbon sink. Yet, little is known about their potential for carbon sequestration or their vulnerability to climate and environmental change. This project leverages investments in national terrestrial observation platforms and integrates previous research outputs to develop new methods to measure and build understanding of soil carbon composition and dynamics in rangeland ecosystems. Under a framework that connects detailed measurements and small-scale processes, with machine-learning, data-model assimilation and large-scale next-generation biogeochemical modelling, it’ll allow more accurate predictions of soil carbon change and better decision-making to guide sustainable rangelands management.	82,000.00	145,500.00	133,500.00	70,000.00	0.00	0.00	431,000.00
	National Interest Test Statement The rangelands occupy over 80% of Australia and hold almost 70% of the country’s soil organic carbon stock. Rangelands soils represent a persistent and more reliable carbon sink than fire-prone vegetation. This study will generate the largest, consistently analysed spatially explicit dataset on the organic carbon composition of rangelands soils. It should help inform the Commonwealth Government-funded National Environmental Prediction System and similar initiatives. Australia will gain foundational new understanding and modelling to benchmark future changes in soil carbon and to accurately predict carbon storage potential and vulnerability to climate and environmental change. This will help inform international obligations for reporting on greenhouse gas emissions, combating desertification and improving biodiversity. It will also help advance the economic viability of pastoralists, people in remote communities, tourism and mining with large footprints in the rangelands. It is a genuine opportunity to advance knowledge for the sustainable management of rangelands ecosystems in Australia and overseas.							
DP210101031 Gagne, Prof Marylene	With work teams having to undertake more critical and complex tasks, this project aims to develop and evaluate a new process model of team motivation emergence through field studies using varied samples of workers, simulation studies, and computational modelling. The project expects to generate solutions to Australia's declining work engagement by answering calls for research on how to develop team motivation. Expected outcomes include new knowledge of team motivation disseminated through scholarly and practitioner-oriented publications and presentations, as well as practical team assessment and training tools made available to organisations so they can improve team performance.	33,000.00	86,500.00	115,000.00	81,492.50	19,992.50	0.00	335,985.00
	National Interest Test Statement Understanding the factors that influence the effectiveness of work teams is crucial to organisational success and Australia's productivity and economic growth. In light of the rise in team-based work and Australia's declining levels of worker motivation, this project aims to answer calls for research on how to develop motivation in teams. New demands placed on workers are being generated through increased use of virtual teams, the integration of automated technology within teams, and a more diverse workforce. With these changes, there is growing concern that organisations are not equipped to fulfill team requirements in the future workplace, as recently noted through the consultation on cooperative workplaces by the Attorney General's Department. This project aims to advance our knowledge of work team motivation and effectiveness, and develop practical assessment and training tools that can be used by work teams to monitor and improve their effectiveness. The knowledge and tools will be developed through rigorous simulation and field research coupled with computational modelling.							
DP210101281 Love, Prof Peter E	Mega transport projects (>$1 billion) are poorly managed during their construction with significant cost and schedule overruns and benefit shortfalls regularly being experienced. Having to perform rework has been identified as a major factor that contributes to these unintended consequences. As there has been limited research that has empirically examined rework causation, an inability to develop effective rework containment and reduction strategies prevails. This research aims to develop a theoretical model that can be used to develop robust containment and reduction strategies to mitigate the adverse economic, productivity and safety consequences that materialize from performing rework during the construction of mega transport projects.	45,000.00	90,000.00	90,000.00	45,000.00	0.00	0.00	270,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Mega transport projects procured by the public sector are notoriously poorly managed during their construction with 90% experiencing significant cost and schedule overruns and benefit shortfalls. A major factor contributing to cost and schedule overruns is rework, which can increase projects by 12% or more. While it has been widely recognised that rework is a recurring problem during the construction of transport projects, worldwide, there has been limited empirical research that has examined its causes. This has hindered the ability to design and develop rework containment and reduction strategies. In addressing the serious economic, productivity and safety issues that materialise from performing rework, this significant and timely project will ensure governments and organisations involved with the delivery of mega transport projects are provided with the requisite knowledge needed to address this pervasive problem, which continues to plague the construction process and result in disruptions to businesses and inconvenience citizens.							
DP210101391 Curtis, Prof Carey A	This project will explore the rapidly changing political economy of Australia's urban transport systems as private companies deploy new technologies. Many new and existing policy instruments are available to governments to manage this difficult technological transition. In-depth case studies of emerging policy responses in Perth, Melbourne and Sydney will be set in the context of fast-moving international developments. This work will deliver new insights into the design and use of better instruments for policy, planning and governance to meet the needs of businesses and the public and to ensure that the potential benefits of the new technologies are fully realised in Australian cities.	49,875.50	113,249.50	120,060.00	56,686.00	0.00	0.00	339,871.00
	National Interest Test Statement							
	New transport technologies are reshaping urban transport systems in complex and important ways. Businesses and the public are looking to governments for a smooth transition that will allow the very significant social and commercial benefits of the new technologies to be realised at an affordable cost. There are many policy instruments available to governments to manage this transition, including: new mechanisms for pricing of road space in real-time; regulation of ride-share operators to avoid unhealthy monopolies; conditions on the use of road space for vehicles operating with new technologies; and regulation of technical specifications for safety or performance. This research will assess the potential effectiveness of these and other policy instruments - some familiar and some new to Australia. This will assist governments and planning agencies to choose the right mix to meet transport policy objectives in the short and long-term.							
DP210101866 Evans, A/Prof Katy A	Rhenium-Osmium (Re-Os) dating is used widely to infer Earth's evolution, but most samples are hydrated, with consequent mobility of Re, which is problematic for interpretation of isotope results. This project will solve this problem by determining the effects of hydration on Re and Os. Further, our knowledge of the mobility of Re and related elements will allow us to recognise rocks that once interacted with water, even after that water has gone, providing a tool to read the record of Earth's earliest oceans. Our new methods will enable Re-Os dating with clarity and confidence, with profound implications for understanding of Earth and extra-terrestrial planetary evolution.	60,000.00	125,000.00	106,000.00	41,000.00	0.00	0.00	332,000.00
	National Interest Test Statement							
	New knowledge from this project will enable us to read the geological record of Earth's formation, the separation of its core, mantle, and crust, and its evolution to form the planet we live on today. Further, our work will facilitate identification and dating of rocks that once interacted with water -- constraining the formation and extent of Earth's earliest oceans with implications for development of the earliest life. Work in these fields will support Australia's position at the forefront of such studies worldwide. The same process can be undertaken for meteorites, providing an unprecedented new understanding of the formation of the solar system and the presence or absence of ancient water, supporting the work undertaken by Australia's new Space Agency. The results are also relevant to the discovery, mining and processing of the platinum group elements, classified as critical to Australia's future prosperity. Finally, the case study for this project will be undertaken on rare samples from Macquarie Island, part of Australia, and designated a World Heritage Site for its unique and significant geology.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101959 Antoine, Prof David M	This project aims to revisit the role of ocean deserts in the global ocean primary production. Because of their extent, these areas are paradoxically responsible for about half the global ocean carbon fixation. The project will use a unique combination of optical and biogeochemical data from a research voyage in the Indian Ocean, biogeochemical models and satellite observations, expecting to generate new knowledge on the link between biogeochemical and optical quantities accessible to satellite remote sensing. Expected outcomes are improved estimates of phytoplankton carbon biomass and productivity, in particular in the Indian Ocean. A key benefit will be an improved end-user relevance of satellite monitoring of Australia's oceans.	60,000.00	131,500.00	133,500.00	62,000.00	0.00	0.00	387,000.00
	National Interest Test Statement The Indian Ocean hosts a rich biodiversity. The associated ecosystem services, however, are under major threats, such as faster warming than in other oceans. This project aims to deliver world-class research on a key component of these ecosystems: phytoplankton –-the microscopic algae inhabiting the ocean surface layers. They are the base of the food web and fuel important Australian fisheries industries. As such, this project has potential to bring environmental and economic benefits through improving quantification of ocean productivity. The project fully aligns with strategic plans of National interest, like the National Marine Science plan 2020/25, and it will contribute to developing Australia's blue economy in a region that has long been recognised of strategic importance for the country's economy. Through its connection to major space agencies, this project also helps secure Australia's access to critical foreign satellite datasets and develop the portfolio of the Australian Space Agency. It will also strengthen Australia's role and reputation in the International Indian Ocean expedition.							
DP210102103 Macquart, A/Prof Jean-Pierre R	Fast Radio Bursts are a recently discovered inexplicable astronomical phenomenon whose millisecond-timescale emission is generated by regions less than 300 kilometres across yet so luminous it is visible at cosmological distances. Using the Australian Square Kilometre Array Pathfinder we have already localised these bursts, which made the front cover of Science, and recently used them to find the missing baryonic matter in the Universe. Next, we will scrutinise these bursts at three nanosecond time resolution, reaching the timescale necessary to probe the mechanism by which their ultra-luminous radiation is generated. This project will reveal previously inaccessible properties of the radiation to unlock the secrets of how they are produced.	70,000.00	140,000.00	107,500.00	37,500.00	0.00	0.00	355,000.00
	National Interest Test Statement Research into fast radio bursts is fundamental physics. The project will develop new fast signal processing techniques and applications, which will be vital to the success of the Australian Square Kilometre Array Pathfinder radio telescope, being developed by CSIRO. It is also a key technology for 5G networks, and this project will add value to Australia's advanced manufacturing capabilities in this sector. Radioastronomy research of this nature has created a range of economic and new industry opportunities around Geraldton, WA and is supporting the growth of new technologies and applications. These include novel applications in Space Domain Awareness (including monitoring space debris) and Defence, which firmly align with the national interest. In conclusion, this project will demonstrate the nation's capacity to deliver technology for the Square Kilometre Array, while developing human capability that melds cutting-edge physics with the computational skills and technologies that sit at the core of a modern economy.							
DP210102495 Li, Prof Zheng-Xiang	The geomagnetic field, generated in Earth's liquid outer core, provides Earth's biosphere and atmosphere with a critical protective shield from the bombardment of the solar wind. However, we still know little about the evolution of the geomagnetic field or the deep-time secrets it keeps. This project aims to study the varying intensity of the geomagnetic field during Earth's middle life. The results will help decipher how the Earth's core responded to evolving tectonic and dynamic systems, including the supercontinent cycles, and when Earth's solid inner core initiated. Such knowledge will help us to better understand how the Earth System evolved as a whole, and how such an evolution has led to the present day life and environment on Earth.	82,500.00	172,500.00	180,000.00	90,000.00	0.00	0.00	525,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement Australia's socio-economic wellbeing critically relies on the discovery of new Earth resources, and a better understanding of the Earth System, including the Earth environment and the magnetic field that protects us from solar wind. In this project we will acquire cutting-edge new knowledge about how the Earth's magnetic field changed through time; how the core, mantle and crust interacted during the Earth's evolution; and how these factors might have impacted on critical points in Earth system evolution, such as oxygenation of the atmosphere, extreme climate events and the explosion of complex life. A clearer understanding of how the Earth's deep interior interacted with the tectonic plates on the surface has direct implications on what controlled the formation and modification of the Australian crust, and what caused the seemingly episodic occurrence and uneven distribution of mineral resources that our economy relies on. This research will also enhance Australia's international science standing, attract and train high-calibre researchers and strengthen our >20 billion/a international education industry.							
DP210102625 Reddy, Prof Steven M	The interfaces between mineral grains are critical in determining rock properties and behaviour, yet we know little about them. This project uses emerging nano-technologies to establish the structure, chemistry and energy characteristics of interfaces in rocks from Earth's mantle that control fundamental Earth processes such as plate tectonics and melting. The expected outcomes include a new understanding on one of the fundamental controls on rock properties and an enhanced ability to predict and model rock behaviour. The project provides research training in innovative research methodologies, will strengthen Australia's leadership in nano-geoscience and will provide new methodologies for advanced rock characterisation.	74,000.00	152,000.00	120,000.00	42,000.00	0.00	0.00	388,000.00
	National Interest Test Statement The Australian resources sector mines rocks on a huge scale. The properties and character of these rocks is critically dependent on the interfaces that separate mineral grains, but these are poorly understood. This project uses emerging nano-technologies to establish the structure, chemistry and energy characteristics of mineral interfaces and will provide fundamental science constraint on how these features affect the strength and properties of rocks. As such the results will play an important role in the future characterisation of Australia's crust and its resource development; a National Strategic Priority. The analytical workflow developed in this project will be transferable to other mineral systems, with potential applications to nuclear waste management, mining and metallurgy, minerals engineering and other industrial end-uses.							
DP210103206 Lucey, Prof Anthony D	This project seeks to deliver a definitive understanding of the behaviour of steady and pulsating fluid flow through compliant-walled channels and pipes. Novel theoretical stability-analyses and experimental investigations, complemented by targeted numerical simulations, will be developed and used to identify and categorise fluid- and wall-based wave-disturbances and their interactions. This can underpin the development of technologies that control these flows to advantage in both engineered fluid-flow and biologically occurring systems. Robust design guidelines will emerge to safeguard and enhance the use of compliant liners and flexible panels for drag and noise reductions, or to protect surfaces exposed to fluid flows.	55,000.00	105,000.00	99,000.00	49,000.00	0.00	0.00	308,000.00
	National Interest Test Statement This project will generate fundamental new knowledge of the behaviour of steady and unsteady flows through channels and pipes with flexible walls. These are widespread in engineered and natural systems conveying a fluid by a driving mechanism. The new scientific knowledge discovered has the potential to open up a vast array of future technologies in which a fluid flow interacts with its bounding flexible walls. These technologies can contribute to lower pumping costs, enhanced heat and mass transfer, self-cleaning of liquid-transport pipelines, or reduced drag in industrial and transportation applications. Of direct potential benefit to Australia are those in which wall flexibility reduces flow drag/friction and hence shipping and pipeline-pump energy usage yielding cost savings and reducing environmental impacts. New fundamental understanding of biological fluid-structure interactions, where the fluid may be air, blood, or urea, can in future also underpin improved diagnosis of mechanically-based medical conditions and thence to biomedical advances leading to improved health and bio-technology exports.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103631 Li, A/Prof Jun	This project aims to develop an advanced Artificial Intelligence (AI) assisted probabilistic structural health monitoring approach for civil engineering structures. The developed approach applies novel deep learning techniques with a large amount of data measured from uncertain and complex environment, for reliable structural condition monitoring and performance prediction. This project expects to make a step change in data mining and interpretation. Expected outcomes of the project include novel AI assisted approaches to conduct probabilistic structural condition monitoring with sensitive features and future structural performance prediction. This will provide significant benefits to infrastructure asset owners to reduce maintenance costs. **National Interest Test Statement** Austroads reported that in Australia, over 60% of bridges for local roads are over 50 years old and approximately 55% of all highway bridges are over 20 years old. There are around 22,500 bridges with a replacement value of about AUD$3 billion, and an annual maintenance expenditure of about AUD$300 million. This project has significant economic benefits in reducing operational interruptions and maintenance costs, and providing performance prediction of civil engineering structures, in Australian and international community, underpinned by the state-of-the-art artificial intelligence assisted approaches. The new knowledge advanced in the proposed project will contribute to Australian's Science and Research Priorities on 'Environmental change - Resilient urban, rural and regional infrastructure'. With the developed approaches in this project, the condition monitoring results of civil engineering structures can be used to support decision making and make infrastructure less vulnerable to natural hazards and environmental change, achieving a sustainable and resilient infrastructure network and community.	58,500.00	117,696.50	119,165.50	59,969.00	0.00	0.00	355,331.00
	Curtin University	782,375.50	1,603,946.00	1,543,725.50	742,147.50	19,992.50	0.00	4,692,187.00
Edith Cowan University								
DP210101258 Blaise, Prof Mindy	This project aims to improve the ways in which gender-based discrimination is understood and addressed in Australian universities by employing a situated, intersectional, and creative approach to researching everyday sexisms. This project expects to use an innovative approach to generate new knowledge about everyday sexisms at the individual level and across disciplinary and university contexts. Expected outcomes include new gender equity practices that will assist universities to refine current programs, strategies, and policies capable of eliminating gender-based discrimination. This should provide significant benefits for Australian society, including women and gender diverse people working in universities. **National Interest Test Statement** Despite awareness of the importance of gender equity, Australia ranks 48th in the world in terms of female political empowerment, with 1 in 2 women experiencing sexual harassment during their lifetime. Professionally, just one-quarter of ASX-listed company board members are women and retiring women's average superannuation balances are just over half of those of men. Australian universities represent an important microcosm of these broader social outcomes, where just 33% of the professoriate are women and where female academics report the highest levels of bullying and harassment, while also being the least likely to report this. Examining the everyday gender-based practices of Australian academics will provide important information on the factors impacting women's career trajectories and associated workplace cultures. The inclusion of individuals with intersecting minority identity characteristics from varying university sectors will provide significantly more nuanced understandings of this phenomenon, with important benefits which extend to broader Australian society.	20,441.00	73,542.50	86,571.00	33,469.50	0.00	0.00	214,024.00
DP210101705 Colgrave, Prof Michelle L	Wheat is a major commodity in Australia. Sprouting damage represents a major global threat to wheat production and food security. This project will explore the genetic and molecular mechanisms underpinning pre-harvest sprouting (PHS) and late-maturity amylase (LMA). This project will apply transcriptomics and proteomics to measure the expression of the biomolecules associated with PHS and LMA, generating fundamental knowledge of grain molecular physiology that addresses a significant knowledge gap. The project will deliver tools capable of differentiating these conditions, thereby minimising economic losses. A better understanding of the genetic basis of PHS and LMA will lay the foundation for advanced breeding aiming to eliminate these.	81,162.50	158,378.00	130,662.50	53,447.00	0.00	0.00	423,650.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	The Australian grain industry accounts for around 25 per cent of the total value of farm export income. However, damage to wheat grain from unwanted sprouting events, in the forms of pre-harvest sprouting (PHS) and late-maturity amylase (LMA), represents a major threat to wheat production and food security. Increasingly unpredictable weather events associated with climate change present a major challenge for Australian farmers aiming to harvest in dry conditions. This project will investigate the molecular mechanisms underpinning seed dormancy that will enable the development of tools that aim to improve wheat quality and avoid wheat losses. It will lay the foundation for breeding strategies that mitigate the negative effects of genotype and environment interactions. The project will enhance the industry's knowledge about wheat biochemistry and by extension other cereal grains. It will deliver accurate tests for grain breeders to use and potentially have multi-million-dollar benefits to growers by reducing waste and enabling the development of crops suited to both current and future climatic conditions.							
	Edith Cowan University	101,603.50	231,920.50	217,233.50	86,916.50	0.00	0.00	637,674.00
The University of Western Australia								
DP210100071 Houghton, Prof Stephen J	This project aims to develop a 3-D animated program for adolescents with neurodevelopmental disorders (NDDs) that alters the automatic biases arising from their everyday social communication difficulties (including via social media), which result in negative thought patterns and loneliness. Negative thought patterns, which are arguably the hallmarks of, and causal in, the development of emotional dysfunction are amplified by loneliness, and adolescents with NDDs experience significantly greater levels of loneliness. Altering these negative thought patterns via an engaging 3-D animated program offers great potential to improve educational and social-emotional outcomes along with generating economic benefits nationally and internationally.	26,824.00	73,905.50	76,092.50	29,011.00	0.00	0.00	205,833.00
	National Interest Test Statement							
	Adolescents with neurodevelopmental disorders (NDDs) experience significantly greater levels of loneliness because of their social communication difficulties. As a result they may be prone to interpret the ambiguities arising in their everyday peer interactions in a more negative and threatening manner, which may in turn generate greater problems in social cognition. This project aims to develop a world-first innovative 3-D animation program which uses Cognitive Bias Modification (CBM) to alter negative interpretive bias and cognitive distortions. A 3-D animation format is highly engaging, while CBM methods offer a high gain, low cost treatment option because they can circumvent many of the practical and psychological requirements that disadvantage competing psychological interventions, especially in schools. The program, specifically developed for adolescents with NDDs, will place us in a position to improve the lives of adolescents with NDDs, their families and educators and will result in improved educational and social-emotional outcomes and economic benefits to Australia and international communities.							
DP210100104 Broomhall, Prof Susan M	This project aims to analyse how early modern Europeans managed two key assets, water and forests. It expects to generate detailed knowledge of their practices and mindsets that still shape present responses to environmental challenges. It will use an innovative cultural history approach to identify and compare evidence drawn from legal, economic, scientific, literary and artistic sources. Expected outcomes include broadening how we think about managing resources. Significant benefits include improving how we can analyse different management systems across different times and places, and high-quality early career training.	24,108.50	65,737.00	71,733.00	30,104.50	0.00	0.00	191,683.00
	National Interest Test Statement							
	This project will provide economic, commercial, social and cultural benefits by producing detailed knowledge of how past societies managed key resource assets such as water and forests and how much those practices and mindsets still shape present Australian responses to environmental challenges. This project will improve how we analyse resource management systems across different times and places by broadening our ideas about what management means and looks like for past societies. We need to understand this so that Australia can make decisions that are right for our own environmental contexts and needs. These decisions should be uncoupled from the legacy of the pre-modern European models and contexts which shaped the settlement of Australia, and which still influence, to some extent, our thinking about natural resource management. As such, this new knowledge will make a direct contribution to today's discussions about how we best manage limited resources in Australia.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210100296 Batley, Prof Jacqueline	Pan genomes represent the diversity of a species, including structural and sequence variation, which cannot be provided by a reference genome alone. In this project we will characterise resistance gene diversity across the Brassicaceae pan genomes. Through comparison with resistance gene diversity in cultivated Brassica species we will understand selection underlying resistance gene evolution in wild species and subsequent domestication and breeding. Knowledge on how variation affects disease susceptibility, especially to the devastating fungal pathogen blackleg, and contributes to phenotypic variation, will lead to improved plant protection strategies and increased crop resilience.	126,376.00	236,632.00	204,112.00	93,856.00	0.00	0.00	660,976.00
	National Interest Test Statement Genome sequencing is changing our understanding of biology and evolution, with implications for agriculture. However, a reference genome does not represent a species' diversity. Through sequence analysis of many individuals of a species (pan genomics) we can identify genes that are conserved or different within and between species. Brassicas constitute the world's main vegetable and oil crops; however pathogens lead to substantial yield loss, and the cultivated species contain little diversity for identification of novel resistance sources. This project will build on the CIs experience in characterisation of resistance genes in cultivated Brassica species for crop improvement. We will focus on characterising resistance genes across wild Brassica species and study their evolution and selection. An understanding of the diversity of the genes and how they affect disease resistance will help in the design of novel plant protection strategies and significantly increase crop yields. This project will accelerate the breeding of canola, a major Australian export crop, enhancing food security and rural economies							
DP210100337 Cortese, Dr Luca	This project aims to use the most powerful radio and optical telescopes in the world to identify the mechanisms driving the quenching of star formation in the most massive structures in the Universe. This research expects to answer some of the fundamental questions identified by the international astronomy community regarding how galaxies form and evolve, how star formation proceeds and why nearly half of the galaxies in the local Universe have stopped forming stars. It will forge strong links with international partners, strengthen Australian expertise in a critical area of astronomical research, offer an ideal platform for accelerating the training of students in STEM and contribute to public outreach work.	67,500.00	132,500.00	130,000.00	65,000.00	0.00	0.00	395,000.00
	National Interest Test Statement This project will constitute major progress against two of the six fundamental science questions highlighted in the Decadal plan for Australian astronomy. It will enhance Australia's international standing as a leading country in fundamental research and capitalise on the investments by the Federal Government in the field of astronomy (e.g., the Square Kilometer Array and the European Southern Observatory, ESO). By exploiting data collected by the most powerful telescopes in the world, this project will help prepare our community for a future full membership of ESO, a key milestone for securing industry involvement in the construction of next-generation astronomy facilities. Moreover, it will provide a unique training ground for HDR students and young researchers in the field of STEM, who are set to drive Australia's future economic growth across academia, industry and finance. Lastly, this project is designed to produce unique outreach material that will be disseminated to the general public, and will be key for inspiring and encouraging future generations in pursuing an education in science and technology.							
DP210100468 Evans, Prof Jonathan P	This project aims to unravel the evolutionary importance of ejaculate-mediated paternal effects, through which paternal lifestyle factors, such as diet and exposure to toxicants, influence offspring growth and health independently of genes. By identifying the molecular mechanisms underlying these non-genetic sources of inheritance, their adaptive value, and their potential to fuel evolutionary change, the project expects to generate new knowledge that will be relevant across the biological, medical and agricultural sectors. Expected outcomes and benefits include building institutional and interdisciplinary collaborations and the development of tools to understand the evolutionary impacts of paternal lifestyle choices for offspring traits.	76,500.00	154,000.00	149,000.00	71,500.00	0.00	0.00	451,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	This research will address both fundamental and practical challenges that will have significant benefits to the environmental, agricultural and health sectors. The project aims to use a vertebrate (fish) model to understand how paternal lifestyle factors, such as nutrition and health, influence the growth and fitness of offspring. The evolutionary insights gained from this project will be of particular interest to the biomedical, clinical and animal production industries, where an understanding of the evolutionary impacts of non-genetic inheritance has numerous potential applications. The choice of model means short-term translational opportunities are most likely in relation to animal health (e.g. in finfish aquaculture), but all of these industries will benefit from improved understanding of the factors that impact organismal performance across successive generations. Finally, the research is aligned with the Australian Academy of Science's decadal plan for nutrition science in Australia, which aims to provide broad benefits for social, cultural, economic and health outcomes in the region.							
DP210100868 Tomkins, A/Prof Joseph L	This project aims to increase our understanding of the phenotypic, genetic and genomic outcomes of evolution, by both enhancing, and reversing, sexual selection in laboratory fruit flies. In doing so, this project expects to separate the entangled effects of female choice and male competition, generating new knowledge in evolutionary ecology and genetics. Expected outcomes of this project include identifying the separate molecular effects on the genome of selection through male competition and female choice. This should provide significant benefits in understanding the role of different forms of sexual selection in removing mutations and maintaining population fitness: vital factors in securing the long term viability of vulnerable species.	63,241.50	124,445.00	125,802.00	64,598.50	0.00	0.00	378,087.00
	National Interest Test Statement							
	It is clear that sexual selection, where one sex competes and the other chooses, has evolved as a biological filter: a filter that helps to sift-out the mutations that continually arise in the DNA of all species and that negatively impact survival and reproduction. Researchers are on the cusp of being able to detect these mutations at a molecular level through genome sequencing, this proposal uses genomics to provide a breakthrough in understanding what it is in the sexual selection process that removes mutations from a population. This is an important goal that has profound relevance to health, food security and conservation. There is increasing the need for the micro-management of small populations, wild and domestic, due to global insect declines that threaten the collapse of ecosystems and pollination services and the fragmentation of natural habitats by human land-use. This research, by revealing the mechanisms that sift-out mutations, has the potential to increase Australia's resilience to threats against its biodiversity and agriculture, yielding environmental, social and economic benefit.							
DP210101166 Slack-Smith, Prof Linda S	The aim of the study is to explore "social practices" of oral health in Australian (Aboriginal and non-Aboriginal) preschool children. We use this emerging theory to move away from focusing on individuals and individual behaviour (and blame) to identify and map social practices: actions, materials and meanings families attribute to child's oral health. Expected project outcomes include identifying practices promoting or undermining children's oral health that can inform upstream and downstream policy directions and practices to improve health outcomes. This offers a new approach to "wicked" problems such as oral health where extensive effort has not reduced morbidity and cost despite rhetoric that oral health is preventable.	97,500.00	237,500.00	232,500.00	92,500.00	0.00	0.00	660,000.00
	National Interest Test Statement							
	Oral disease is one of the most common and costly diseases of early childhood (with even higher rates in Aboriginal children), impacting across the life-course leading to pain, infections, lost productivity, delayed growth and cognitive development, interfering with nutrition, concentration and school participation. It is a major cause of preventable hospital admissions in children. Dental services in Australia cost over $10 billion per annum. This project will investigate the social practices (routine activities and interactions in families) to understand which factors in daily activities and interactions support or undermine oral health in preschoolers. Providing a more comprehensive understanding of the complexity of decision making around preschool children's oral health will inform new Australian policy and oral health promotion interventions to better meet the oral health needs of these children. This in turn will impact on Australians' life-long health and reduce economic burden on the national and local health systems.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210101682 Bennamoun, Prof Dr Mohammed	This research aims to develop intelligent virtual human companions that can seemingly integrate our immediate physical environment and understand their surroundings including people's emotions, behaviours, actions and interactions. Such a technology will be enabled by leveraging recent advances in mixed/augmented reality technologies, and by developing innovative artificial intelligence and computer vision and graphics algorithms for dynamic real-world environments. Unlike robots, the proposed technology will be low cost, readily deployable and customisable, and will not have any physical limitations or maintenance requirements. It will thus have a wide range of applications from elderly care, healthcare care to educational training.	90,136.50	187,411.00	189,038.50	185,423.50	93,659.50	0.00	745,669.00
	National Interest Test Statement Australia's rapidly ageing population poses major socio-economic challenges from reduced workforce to unprecedented pressure on health and social services with spending projected to surge by $16 billions over the next decade. This project aims to tackle these challenges by developing virtual humans capable of real-time perception, cognition, emotion, and interaction. Leveraging recent advances in mixed/augmented reality head-mounted see-through displays, these intelligent virtual humans will seamlessly integrate our immediate physical environment and behave as if they were integral part of the real-world. Unlike robots, they will not have any physical limitations or maintenance requirements. The proposed technology will thus be low cost and readily deployable in a variety of sectors to support workers and improve productivity. Potential applications include 24/7 remote human-like personalised support and monitoring of patients, reducing the social isolation of the elderly and sick, prevention and early diagnosis of medical conditions or promotion of healthy lifestyle and diet through motivational coaching.							
DP210101932 Kendrick, Prof Gary A	This research aims to test whether seagrass ecosystems can be safeguarded from climate change impacts by enhancing genetic connectivity in range edge populations using novel genetic rescue approaches. We will use the range edge seagrass meadows of the UNESCO World Heritage Site of Shark Bay as our model, which was significantly impacted by a marine heat wave in 2010/2011. The project will generate new knowledge on how seagrasses can adapt and survive in situ. Expected outcomes are improved conservation, management and restoration practices for seagrass meadows. This should provide significant benefits for long-term resilience of this economically and culturally significant ecosystem.	89,500.00	174,500.00	169,000.00	84,000.00	0.00	0.00	517,000.00
	National Interest Test Statement This project will allow Australia to improve the management of the ecological foundation species, seagrasses, in the UNESCO World Heritage Site, Shark Bay. By pioneering novel genetic rescue approaches, this work would help conserve and restore the economically and culturally significant fisheries and biodiversity that depend on healthy seagrass meadows. These meadows are at great risk of collapse due to extreme climate events, which have already had dramatic impacts on this ecosystem. This research would develop long-term and practical sustainability improvements in partnership with local Traditional Owners and environmental managers. More generally, this research tests landscape scale genetic rescue as a practical and widely applicable contribution to increasing the resilience of populations most at threat from climate change.							
DP210101945 Lagos, Dr Claudia D	How dark matter influences the formation and evolution of galaxies is to this day an outstanding question in astrophysics. To answer it, world-class facilities and a unique combination of observations and theory are required. This DP team, a world-class team of observers and theorists, will tackle this question by leveraging on two multi-million dollar projects: the MAGPI galaxy survey and the hydrodynamical simulations suite EAGLE-XL. MAGPI will deliver exquisite kinematics for hundreds of galaxies in the middle ages of the Universe, providing a view to the effect of dark matter on galaxies at this critical time, while EAGLE-XL represents the technological frontier in simulations and provides the best interpretative framework for MAGPI.	130,000.00	260,000.00	192,500.00	62,500.00	0.00	0.00	645,000.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement This Discovery Project (DP) will exploit the first and so far only large program granted within the Australia-European Southern Observatory (ESO) $129m (10 years) partnership. Australia and ESO (a consortium of 15 countries) entered a 'big science' strategic partnership in 2018 to provide Australia with long-term access to the world's best telescopes, and pave the way to build advanced instrumentation and technologies for ESO. This DP's research will demonstrate Australia is capable of fully exploiting state-of-the-art instruments, galvanizing the profile required to gain technological investment from ESO to Australia (typically €8m/project) in Australian-made instruments and turn the partnership into a long term commitment. In addition, the DP simulations will be run on the new $70m federally funded supercomputer and will be a demonstrator for exascale computing in Australia, providing a testbed for the next generation of national supercomputers. The DP's high-performance computing techniques and tools developed will have potential commercial applications in geoscience and genetics industries ($100+b/yr).							
DP210101960 Balme, Prof Jane M	This project will identify more precisely the time of the entry of dingoes into Australia and will investigate their impact on the lives of Indigenous Australians. Archaeological and anthropological evidence suggests that Indigenous people rapidly incorporated dingoes into their lives. Dingoes were used for a variety of purposes and were particularly valued as hunters by women, effectively increasing their access to meat. Impact would include a re-organisation of gender roles and an associated improvement in women's fecundity. By examining evidence for such changes, this project will significantly contribute to knowledge about implications of the arrival of a living technology in Australia and, more generally, the human/dog relationship.	62,735.50	128,864.00	130,728.00	104,904.00	40,304.50	0.00	467,536.00
	National Interest Test Statement By providing knowledge about the social impacts of the arrival of one of Australia's most iconic animals, the dingo, this research will potentially have substantial social and cultural benefits. Dogs were the first animal to be domesticated and are the species that form the closest bonds with humans, e.g. there are about 5 million pet dogs in Australia. In our modern society they are used as working dogs on farms, as companions and hunting assistants. As such, there is an enormous interest in dog behaviours and of the development of the human/dog relationship. Research on the impact of the arrival of the dingo on Indigenous Australian societies will not only provide a new narrative about the role of dingoes in Indigenous people's lives but will add substantially to understandings of this relationship The results of the research will also have wider implications for the scientific community, particularly in environmental science where the detailed analysis of Holocene palaeontological sites will provide information on the effect of dingoes on the natural environment including its role in past extinctions.							
DP210102044 Collins, Dr Sarah S	This project will trace how debates about labour automation have been shaped by cultural depictions of work, from the eighteenth century to today. It will produce new knowledge about how people have viewed industrial transformation, from the steam engine to modern forms of labour saving - electronic, digital, biological, and artificial intelligence. The project will combine historical study with an examination of the way artists and writers have responded to labour automation. Expected benefits include informing public debate about the future of work, and shaping policy in arts-science museums and laboratories. Outcomes will include publications, public forums, conferences, training of research students and international collaboration.	46,195.50	113,891.00	128,891.00	61,195.50	0.00	0.00	350,173.00
	National Interest Test Statement A key concern in Australian public debate about the future of work is the impact of automation technologies. A recent Australian Government report suggested that up to 40 percent of jobs in Australia would be transformed by automation technologies over the next decade. This Discovery Project will show how public hopes and fears about automation technologies - such as machine learning, artificial intelligence and bio technologies - are shaped by cultural depictions of automated labour. The project will improve understanding of the factors that shape the experience of labour automation in the public imagination, leading to social benefit. It will also show how representations of automated labour impact our perceptions of human-machine interactions in everyday life. In addition to this social benefit, the project will have cultural and commercial benefit by charting the historical impact of automation in the creative industries.							

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102119 Atkin, Prof Rob	This project will produce new, high performance, surface active ionic liquids. Surface active ionic liquids are pure salts in which one of the ions is based on a surfactant molecule. Surface active ionic liquids are much more effective than conventional electrolytes for some applications, but only at elevated temperature; at low temperature, ion dynamics are too slow. We will use cutting edge techniques to probe ion dynamics in surface active ionic liquids in the bulk and at electrode surfaces, and use this to elucidate rules for the rational design of new surface active ionic liquids with fast dynamics at low temperature, towards their use at room temperature in diverse areas; this project will target capacitors and gas sensors.	85,000.00	172,500.00	175,000.00	87,500.00	0.00	0.00	520,000.00
	National Interest Test Statement For renewable energy to be viable in Australia for baseline power and transport, much more efficient electrical energy storage devices, with higher energy densities, must be developed. The two main types of devices for storing electrical energy are batteries and capacitors. Batteries recharge slowly and need to be replaced every few years. Capacitors can absorb and release charge much more quickly, can be cycled a vast number of times without degrading, but currently have low energy storage volumes. In order to overcome this impediment this project will produce new surface active ionic liquids as electrolytes with fast dynamics for use in high-performance capacitors. The new surface active ionic liquids will also be used in electrochemical sensors for the detection and monitoring of such as O2, and H2. This is highly significant for personal safety applications in Australia, e.g. enclosed space and hazard monitoring. The surface active ionic liquids prepared have potential for wide impact and uptake in both large scale operations and specialist industries.							
DP210102178 Considine, Dr Michael J	This project aims to make a step-change in understanding how the growth of woody perennial crops is regulated. The study of herbaceous annual plants has established that the antioxidants, ascorbate and glutathione, are important in regulating every step of plant development. However, this cannot readily translate to perennial life cycles. This project will develop novel genetic tools in grapevine that enable functional studies of these antioxidants in a perennial plant for the first time. It will investigate how ascorbate and glutathione regulate the development of grapevine, and how these functions integrate with hormone and energy metabolism. The outcomes will advance our ability to manage perennial crops in current and future climates.	27,479.50	64,248.50	81,373.00	70,903.50	26,299.50	0.00	270,304.00
	National Interest Test Statement Grapevine is the most economically important fruit crop in Australia, one of its top export commodities, and a major contributor to rural economies. Grapevine is highly responsive to changes in climate, and managing the impact of short and long term climate change is a major strategic priority of the wine and table grape industries. Our current understanding of perennial crop growth is critically lagging behind annual species such as cereals, due to the lack of genetic resources and time required to develop these. Australia has a world-leading capacity to genetically manipulate grapevine for the advancement of science and productivity. This project will exploit this capacity to investigate the functions of ascorbate and glutathione - key regulators of annual plant growth - in regulating the perennial life cycle. Because more than 95% of fruit and nut crops are woody perennials, an improved understanding of the growth and development of grapevine will guide new strategies to manage perennial crops in current and future Australian climates.							
DP210102180 Chooi, Dr Yit-Heng	Fungi produce an incredible array of unique bioactive molecules, many of which have contributed greatly to humanity (e.g. the antibiotic penicillin, which has saved millions of lives since its discovery). DNA sequencing has revealed many fungi contain the genetic instructions to produce new molecules that have not been seen previously. However, these genes are “switched off" by default and cannot be accessed. This project will develop innovative new methods to "hot-wire" these genes, allowing them to turn on and produce a treasure trove of new bioactive molecules. The outcomes of this project will transform our abilities to tap into the hidden potential of fungi to generate new lead molecules for the agricultural and medical industries.	91,150.50	184,732.00	180,718.50	87,137.00	0.00	0.00	543,738.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	Penicillin and statins are two classic examples of fungal molecules that have saved millions of human lives and have impacted the course of human history. Fungi have an extraordinary ability to produce these molecules, called secondary metabolites (SMs), which display a wide array of useful biological activities. Genome sequencing and SM research have shown that we have only explored a tip of an iceberg of the true potential of fungi, as many genes for the synthesis of SMs in fungi have been switched-off conditionally. This points to a hidden treasure trove of bioactive SMs in fungi waiting to be unlocked. This proposal aims to build a scalable platform technology, based on the revolutionary CRISPR genome editing tools, for "hot-wiring" the SM synthesis genes from "off" to "on" mode to unearth the hidden novel bioactive SMs in fungi. Achieving these outcomes could provide significant economic benefits to Australia through the generation of pharmaceutical, veterinary products, and agrichemicals, such as antibiotics to combat antimicrobial resistance and new pesticides desperately needed by Australian farmers.							
DP210102745 Jones, A/Prof Nicole L	This project aims to quantify the intensity and location of ocean currents at unprecedented fine spatial scales by using data from a new generation of high-resolution satellites. These fine scales dominate the lateral and vertical transport of ocean-borne material, including heat, larvae and pollutants like oil and plastics, yet are poorly understood. New algorithms for processing satellite data will be developed and tested using in situ data in the significant North West Shelf region. Expected outcomes will be novel methods to identify ocean currents and a paradigm shift in quantification of fine-scale ocean dynamics. This will benefit operational oceanography in the areas of maritime safety, defence, fisheries and the offshore industry.	160,299.50	285,955.00	225,716.00	100,060.50	0.00	0.00	772,031.00
	National Interest Test Statement							
	Describing the lateral transport and spread of ocean-borne materials, such as heat, coral larvae, pollutants like oil and plastics and floating objects, is currently restricted by our inability to identify ocean fronts and eddies at horizontal scales less than 10 km. By using observations from a new generation of high-resolution satellites, this project will develop novel and robust methods to identify and describe ocean features and currents at unprecedented fine scales. This novel high-resolution ocean current information is directly applicable for use by search and rescue, offshore oil and gas operations, defence, ship routing, pollution response and ecosystem assessments in Australian waters. The project will therefore bring economic, human safety and environmental benefits to the nation. The research training provided in this project will also build Australian capacity in utilising remotely-sensed environmental data and more generally in the space technology sector.							
DP210102896 McCulloch, Prof Malcolm M	Deep-sea coral and seawater nutrient profiles collected from the Southern Ocean (SO) facing submarine canyons of south-west Australia will be used to provide new insights into the role of the SO overturning circulation in modulating global climate as well as supplying the essential nutrients that make these canyons biodiversity hot-spots for seasonal aggregations of killer and blue whales. This frontier project made possible by samples collected using Remote Operated Vehicle (ROV) technology rarely available in Australia, will also help to understand how SO circulation has influenced past changes in global climate and its future role in controlling ocean productivity in a warming world with rapidly increasing atmospheric carbon dioxide.	90,000.00	177,500.00	137,500.00	50,000.00	0.00	0.00	455,000.00
	National Interest Test Statement							
	This research will focus on the biodiversity hotspots found within the virtually unknown submarine canyons of sw-Australia, providing new insights into their links with the all-important Southern Ocean (SO). The project will provide a baseline to assess the trajectories of climate and environmental changes within the SO which is at the heart of the global ocean-climate system. The outcomes will help resolve major uncertainties in how our SO region has responded in the past and how it is likely to respond in the future to ongoing climate and environmental changes in this key region. This is central to determining optimum local and national response strategies to better ensure the sustainability of our marine environment and the peoples that it supports. The project will also address one of the most critical problems currently facing society; the impacts of carbon dioxide driven ocean acidification and warming on the economies along coastal zones, on aqua-culture and agriculture, as well as the intrinsic ecotourism value of our natural marine treasures of southern Australia.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210102954 Wilson, Prof Robert A	This project aims to contribute to a better understanding of the study of kinship by drawing on recent research from the philosophy of mind and the philosophy of science. It will incorporate this understanding into a more general international, collaborative network in the philosophy of anthropology. Kinship has been central to anthropology as a discipline, with disagreement over the relationships between biological and cultural dimensions to kinship structuring much of that history. Keeping Kinship in Mind will extend into the philosophy of the social sciences the productive interactions between philosophers and scientists that are an internationally recognized research strength of Australian philosophy of science.	36,689.00	95,676.50	127,975.00	68,987.50	0.00	0.00	329,328.00
	National Interest Test Statement Kinship is central to all cultures, including that of Australia. Conceptions of kinship and family change with the growth of scientific knowledge and biotechnology. This project (1) provides a better understanding of the integrated nature of biological and cultural dimensions to kinship. That understanding (2) informs social policies and public discussions of the place of emerging biotechnologies in family life. Australian indigenous kinship systems have also played an important role in the history of the study of kinship. This history has often underestimated the depth of cultural knowledge built into those systems. This project also (3) enhances community knowledge of the relationship between indigenous and other kinship systems. Finally, the project (4) makes available to the Australian public insights about the relationship between contemporary kinship and family life in Australia and in other parts of the world.							
DP210103078 Waters, Dr Mark T	This project will use molecular tools to detect and identify new chemical signals, known as butenolides, that regulate the growth and development of bacteria and plants. This project will use innovative, interdisciplinary techniques to discover where these butenolide signals come from, and how both bacteria and plants detect them. Expected outcomes of this project include a greater understanding of how plants use butenolides to cope with stress such as drought or salinity, and the design of new technologies for manipulating the growth of both plants and bacteria. The long-term benefits of this work should include fresh approaches for enhancing plant performance under sub-optimal conditions.	75,251.50	154,728.00	155,978.00	76,501.50	0.00	0.00	462,459.00
	National Interest Test Statement The processes of plant growth and development underpin one of Australia’s primary export industries, namely agriculture. Although yield gains have kept pace with demand to date, the prevalence of stresses like drought and salinity mean that new technologies will be needed to maintain plant performance into the future. This project seeks to discover new chemical compounds that regulate the growth response of plants to stress signals from the environment. It will use innovative techniques in the biological and chemical sciences to generate knowledge that will translate into new tools for farmers, plant breeders and the agri-biotechnology industry. Ultimately these tools will support improved efficiency in food production, with accompanied environmental and economic benefits for the nation.							
DP210103091 Martins Sequeira, Dr Ana M	This project aims to develop a global approach to synthesise global tracking datasets and deliver near real-time diagnostics on risks for marine megafauna at a global scale pushing forward a new frontier in dynamic marine spatial management to improve conservation. This project expects to increase our understanding of how marine megafauna movements vary with environmental changes and how much they overlap with threatening global human activities. Expected outcomes will demonstrate how big data in marine telemetry can be synthesised and translated into ecologically significant behaviours. This should provide significant benefits to address global scientific and societal problems highlighted in the Australian science and research priorities.	82,672.00	151,071.50	139,227.00	70,827.50	0.00	0.00	443,798.00
	National Interest Test Statement This project aims to capitalise on the first opportunity to develop a global approach to deliver near real-time assessments of cumulative impacts on marine species, leading to a new frontier in dynamic marine spatial management and conservation. The project aims to leverage a range of national and international investments on animal tracking to enhance capacity in the analyses of existing large datasets and to provide highly sought-after information to improve management and conservation of species that are key to the functioning of marine ecosystems. Results will likely be of significant financial and social benefits to Australia, with the potential to improve the lucrative eco-tourism industry and promote Australia’s reputation as having a leading role in the conservation of economically important, charismatic and threatened species.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103131 Ghisalberti, Dr Marco	This project aims to develop a new framework to accurately predict how macro-roughness controls flow, turbulence and transport in environmental systems. Exemplar systems range from flows over seagrass meadows, coral reefs and permeable beds in aquatic environments to flows over urban roughness in atmospheric environments. The overall health and function of these systems is intimately linked to how they modify the incoming flow and the transport of nutrients, contaminants, heat and biota. Expected outcomes include novel theory and new predictive models to quantify the flow and transport 'climate' in these complex roughness systems. This will transform best practice in our understanding, management and protection of these critical ecosystems.	75,000.00	150,000.00	110,000.00	35,000.00	0.00	0.00	370,000.00
	National Interest Test Statement The significance of this research to Australia is unparalleled, as the roughness systems considered here are iconic parts of the Australian environment. The coastal ecosystems alone (coral, seagrass, kelp) provide a range of ecosystem services such as carbon sequestration, coastal protection and enhanced biodiversity. Through tourism, recreation and these ecosystem services, they contribute tens of billions of dollars annually to the Australian economy. Project outcomes will provide fundamental predictive capacity that will inform environmental policy by helping provide managers & regulatory agencies with answers to such questions as: How do we design successful restoration programs for seagrass meadows? When do elevated ocean temperatures create irreversible coral bleaching? How do we employ urban design to promote healthier cities? This project will help position Australia to develop world-leading, transformative solutions for the sustainable management, preservation and restoration of these systems, while optimising the ecosystem services and economic benefits that they provide.							
DP210103629 Small, Prof Ian D	Energy from sunlight is captured by photosynthesis in plants, providing the basis for the terrestrial food chain. This process takes place in chloroplasts, subcellular structures that derived from photosynthetic bacteria a billion years ago. Chloroplasts have their own DNA, containing genes encoding the most important photosynthetic proteins. This project aims to provide the world's best resources for the study of chloroplast genes. In the process, we will discover how these important genes are regulated to provide photosynthetic proteins in the right amounts, in the right cells, at the right time. The knowledge and resources gained will facilitate improvement of photosynthetic function in future agricultural crops.	81,500.00	163,000.00	163,000.00	81,500.00	0.00	0.00	489,000.00
	National Interest Test Statement Photosynthesis drives crop production — a $20 billion industry in Australia — and is entirely dependent on a small number of key components made inside leaf chloroplasts. This project will provide tools and resources for better understanding how these key components are made, and in particular, how their synthesis is controlled in response to developmental or environmental cues. This knowledge is particularly important at a time when the factors affecting photosynthetic rates (carbon dioxide levels, temperature, drought) are changing rapidly, and is crucial for the development of plants better adapted to future growth conditions. In addition, outputs from the project will include validated DNA parts suitable for synthetic biology. These will facilitate biotechnological production of high-value products such as drugs or vaccines.							
DP210103766 Zhang, Mr Dongke	A mature commodity that can be readily made from renewable resources, ammonia (NH_3) offers an environmentally sustainable and low-cost means of transition from fossil fuels to a clean, low-carbon and renewable energy future. The technical challenge is to combust NH_3 efficiently with low nitrogen oxides (NO_x) emissions. This project will advance the science of NH_3 combustion and NO_x formation. By applying innovative fixed-bed and fluidised-bed reactor techniques and kinetic modelling, the research will unravel fundamental characteristics and mechanisms of NH_3 combustion, NO_x formation and in-situ destruction that underpin the development and deployment of practical combustion systems for power generation using NH_3 as a carbon-free fuel.	99,696.50	192,793.00	184,093.00	90,996.50	0.00	0.00	567,579.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement This research advances the science that underpins the development of practical combustion systems for the use of ammonia (NH3) as a carbon-free fuel, which can be readily made from Australia's abundant renewable energy resources and thus has important ramifications for Australia's environmental sustainability, energy security and affordability and long-term economic prosperity. About 90% of Australia's electricity is generated from coal and natural gas, emitting ~200 million tonnes CO2 annually. Using NH3 as a renewable fuel will significantly reduce the nation's carbon footprint. NH3 synthesised from hydrogen generated from solar and wind energy also offers a practical means for large-scale storage of excess renewable electricity, allowing Australia's renewable energy industry to play a more significant role in powering the nation. Effective use of NH3 will also support Australia's renewable energy export industry and assist with the global effort to reduce CO2 emission. This presents an opportunity for Australia to establish itself as a global leader in renewable energy export in the form of renewable NH3.							
DP210103816 Filipovska, Prof Aleksandra	Advances in genome editing have enabled the targeted modulation of gene expression in cells and provided new tools for biotechnology. This project will combine computational design and genetic selection to deliver the next generation of precision gene editing tools. These new technologies can be used for modification of genes in any cellular compartment and will be useful for understanding and improving energy metabolism. Increased cellular energy production can be harnessed to make valuable biological products, with unprecedented efficiency.	81,462.00	162,924.00	162,924.00	81,462.00	0.00	0.00	488,772.00
	National Interest Test Statement This project will generate new biotechnological tools to expand the current set of gene editing systems. This will be of significant national interest through commercialisation of these technologies as well as the resulting engineered cells and chemical products as valuable commodities that will enhance the agricultural, mining, health and defence industries, which are the core strengths of Australia. These developments will make Australia economically stronger and significantly more competitive in the international markets while improving our security and well-being. The innovative technologies that will be generated by this project will enhance the bioprocessing industry in Australia and position it to be internationally leading to generate increased income and employment. Trainees and researchers from this project will be the next generation of multidisciplinary scientists, able to apply powerful new technologies to future challenges facing Australia.							
DP210103825 Jorgensen, Dr Darren	Literature Production Centres at Papunya and Strelley (WA) published hundreds of illustrated books during the 1970s, 1980s and 1990s. They tell stories of the first contact, the Dreaming, bush plants, animals and life on pastoral stations, missions, government settlements and communities. This project will trace the histories of two key centres and the communities in which they were and are embedded, their authors and illustrators, to build a dynamic picture of Indigenous Australia that contributes another dimension to the history of art and literature in Australia. It will produce scholarly papers, a monograph and an exhibition that brings this story to the Australian public.	58,517.50	120,072.00	133,389.50	71,835.00	0.00	0.00	383,814.00
	National Interest Test Statement At a time of renewed interest in Indigenous Australian languages, little is known of the development of Aboriginal literature in Aboriginal languages. This project aims to give insight into remote Australia in a time of profound change through exhibiting and publishing on the illustrated books of bi-lingual literature production centres in Papunya and Strelley. These places are important in Australia's history. The Western Desert art movement began at Papunya, while Strelley was a community founded by those who were part of the Pilbara Strike of 1946, and went on to develop their own pastoral and mining enterprises. These books were written and illustrated by artists and strikers who played a role in these histories, Indigenous authors and artists writing for their own community of readers. Through this project these books and the stories they represent will find a wider appreciation as this research brings these books out of their local sites of production to contribute to the wider history of Australian art and literature.							

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
DP210103954 Lister, Prof Ryan	Plants can sense diverse internal and external conditions and integrate them to appropriately tune their response and maximize fitness. Plant biotechnology relies heavily on manipulating gene activity to change cell functions and confer advantageous agronomic traits. However, our ability to control plant gene activity remains rudimentary, limiting our biotechnology capabilities. This project aims to develop synthetic gene logic gates in plants, to enable the construction of programmable genetically-encoded computational functions that can sense and process customizable inputs to drive desired changes in plant function. This advance will underpin useful applications in plant biotechnology such as improved crop stress tolerance and yield.	120,000.00	200,000.00	155,000.00	75,000.00	0.00	0.00	550,000.00
	National Interest Test Statement Modern plant biotechnology relies heavily on controlling gene activity to change plant functions and confer valuable agronomic traits. However, our ability to manipulate plant gene activity remains rudimentary, limiting our capability to deliberately change and improve plant performance. This project aims to develop a biological form of computation operating at the level of DNA, that is fully programmable and can be added to plant genomes to allow customisable and highly sophisticated control of gene activity. This technology would be a major advance in plant synthetic biology and biotechnology, allowing deliberate programming of advanced and valuable functions in plants that are not currently possible. This would deliver diverse benefits for plant biotechnology and agriculture, for example improving crop yield and stress resilience, and be of significant commercial and economic benefit to Australia. This research will also strengthen Australia's investment in synthetic biology, which is poised to transform existing agricultural industries and provide valuable opportunities for Australian food production.							
DP210104058 Lister, Prof Ryan	Plant genomics has moved to the single cell resolution, allowing precise investigations of previously hidden cell types and cell states that respond to environmental stress and that vary among differentially adapted plant populations. Here, we will extend our pioneering efforts that have mapped and discovered novel root cell types, to determine their salt and nutrient stress responses, and to elegantly dissect the underling causal genetic variation. The unique cell markers and regulatory networks will be validated with tissue specific and transgenic tools that can work across a host of plant species to reveal adaptive cellular responses to harsh environmental conditions.	113,500.00	221,000.00	165,500.00	58,000.00	0.00	0.00	558,000.00
	National Interest Test Statement This project will develop critical new molecular, genomic, and computational tools to analyze individual cells of an essential plant tissue, and through this generate new discoveries that will underpin future improvements to crop performance in Australia. Plant roots probe the largely-invisible, below-ground world, with delicate sensing pathways that seek out water and nutrients, and avoid stress. Moreover, different plants have adapted to their unique soil environments by modification of these cellular signaling networks, which can now be revealed and understood at single cell resolution for the first time. The transformational methods developed in this proposal will allow Australian and international researchers to assay these key plant developmental responses in order to better select and enhance high performing plants for ever more challenging conditions. The technical skills and training to perform this analysis will give Australian researchers a key head start in research, development, and ultimately deployment of enhanced plant varieties able to withstand and improve their below ground environment.							
DP210104074 Cense, A/Prof Barry	Can we project a movie on a human retina, and measure the response of photoreceptor cells and connected nerve tissue? This project aims to investigate a new method for visualization of the quickest responses in human cone photoreceptors and nerve cells after a visible stimulus. Expected outcomes of this project include a better understanding of the origins of responses to a stimulus and how cells in the retina communicate. The scientific results will be helpful in a better understanding of the development of vision in the infant eye, to study peripheral vision in elite athletes and to quantify performance of virtual reality equipment for the military. The IP on the technology can be licensed or used for start-up company.	65,500.00	96,250.00	30,750.00	0.00	0.00	0.00	192,500.00

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

Minister's Approval for Discovery Projects for Funding Commencing in 2021 Schedule

Approved Organisation, Leader of Approved Research Program	Approved Research Program	Estimated and Approved Expenditure ($)			Indicative Funding ($)			Total ($)
(Columns 1 and 2)	(Column 3)	2020-21 (Column 4)	2021-22 (Column 5)	2022-23 (Column 6)	2023-24* (Column 7)	2024-25* (Column 8)	2025-26* (Column 9)	(Column 10)
	National Interest Test Statement							
	This research will enable us to understand accurately and objectively what a person sees when faced with a stimulus, non-invasively and without any subjective input from the subject. It has enormous potential for a wide range of industries and applications including the training of pilots and military personnel, the design of displays for operators of heavy machinery and visual interfaces of robot-assisted surgery. Not only does this technology have the potential to assist and protect our Australian community through applications such as these, but the commercial and economic benefits of this technology are estimated at hundreds of millions of dollars per year, and the creation of substantial numbers of jobs in the Australian technology sector. This research will also enable us to understand how vision develops through childhood and declines among the elderly, and can be enhanced or optimised through training, such as happens among elite athletes.							
	The University of Western Australia	2,244,335.50	4,481,836.00	4,127,541.00	2,050,304.00	160,263.50	0.00	13,064,280.00
	Western Australia	3,128,314.50	6,317,702.50	5,888,500.00	2,879,368.00	180,256.00	0.00	18,394,141.00
		42,333,076.50	**86,418,119.50**	**84,622,911.50**	**42,958,778.00**	**3,061,051.50**	**640,142.00**	**260,034,079.00**

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