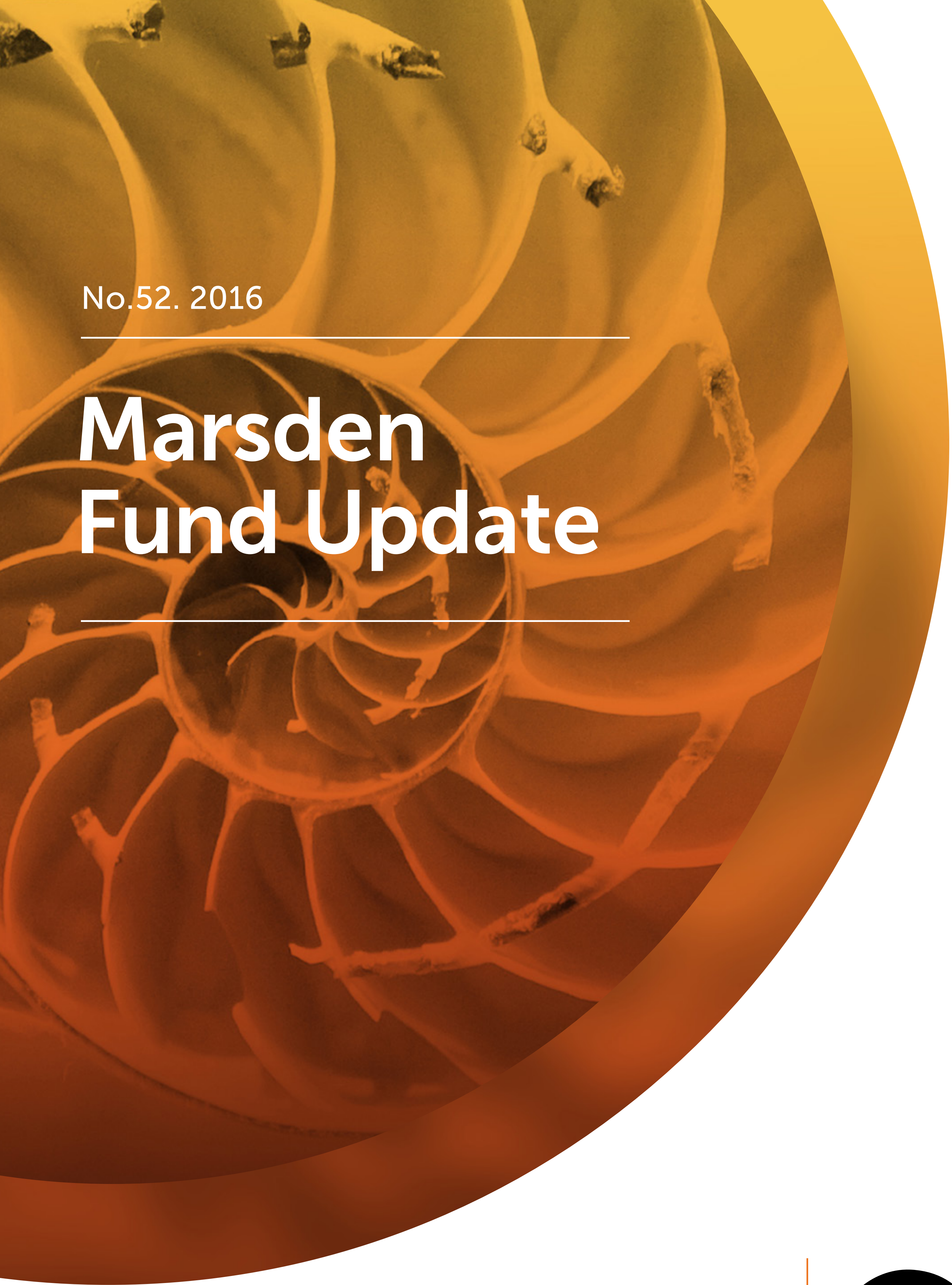


No.52. 2016

Marsden Fund Update

MARSDEN FUND
TE PŪTEA RANGAHAU A MARSDEN

ROYAL SOCIETY TE APĀRANGI

About the Marsden Fund

The Marsden Fund Council manages the Marsden Fund on behalf of the Minister of Research, Science and Innovation. It is administered by the Royal Society Te Apārangi and funded by the New Zealand Government.

The Marsden Fund invests in excellent, investigator-led research aimed at generating new knowledge, with long-term benefit to New Zealand. It supports excellent research projects that advance and expand the knowledge base and contributes to the development of people with advanced skills in New Zealand. The research is not subject to government's socio-economic priorities.

The Marsden Fund encourages New Zealand's leading researchers to explore new ideas that may not be funded through other funding streams and fosters creativity and innovation within the research, science and technology system.

Projects are selected annually in a rigorous process by ten panels who are guided by the opinions of world-leading, international researchers. There are two types of grants: Fast-Start grants worth $300K (excl. GST) over three years for early career researchers, and Standard grants that can be worth up to $960K (excl. GST) for three years. Grants pay for salaries and overheads, students and postdoctoral positions, and consumables.

The Fund is named after physicist Sir Ernest Marsden. It was established by the government in 1994. The Marsden Fund is regarded as a hallmark of excellence, allowing New Zealand's best researchers to explore their best ideas.

The Marsden Fund Council's mission statement is:

"To drive world-class research in New Zealand by supporting and incentivising excellent researchers to work on their best and boldest ideas and to connect internationally, leading to new knowledge and skills with the potential for significant downstream impact for New Zealand"

Increased number of projects funded and strong support for early career researchers in 2016 Marsden funding round

A total of 117 research projects have been allocated $65.2 million (excl. GST) of funding in this year's Marsden Fund grants, which support New Zealand's best investigator-initiated research in the areas of science, engineering, maths, social sciences and the humanities.

This is an increase on the $54 million (excl. GST) awarded to 92 projects last year, due to the unprecedented increase of $66 million (excl. GST) over four years announced by the Government in Budget 2016.

The grants are distributed over three years, paying for salaries, students and postdoctoral positions, institutional overheads and research consumables.

There is strong support for early career researchers this year, with 49 Fast Start grants awarded, compared with 29 last year, says Marsden Fund Council Chair, Professor Juliet Gerrard FRSNZ.

"The Fast Start grants are designed to allow early career researchers to establish their independent research areas and create research momentum for these individuals.

"The assessment panels were really impressed with the quality of the Fast Start proposals this year and so we are pleased to be able to use some of the extra funding to support more of them."

Many of the Fast Start researchers are looking at issues very much at the forefront of public interest today such as climate change, nitrogen run off, immigration and New Zealand's native plants and animals.

The number of grants to established researchers is also up from 63 last year to 68 in 2016, thanks to the increase in funding. Topics under investigation by those receiving a Standard grant also cover a range of topics of great interest to New Zealand, including slow moving landslides, ancient Māori social networks, and how melanin acts as a sunscreen.

Overall the Marsden Fund is a long term investment in New Zealand, says Professor Gerrard. "By supporting our smartest New Zealand researchers to work on their best ideas, including an understanding of how things work at a fundamental level, the Marsden Fund helps to build a strong research base for New Zealand, which will benefit us all in the future. The increased success of our emerging researchers this year gives us confidence that our long term future is in great shape."

The Marsden Fund is managed by the Royal Society of New Zealand on behalf of the government.

Kua piki te maha o ngā kaupapa kua whiwhi pūtea, tautoko hoki mō ngā kairangahau hou mai i te tahua pūtea a Marsden 2016

E $65.2 miriona te pūtea (GST kore) i tohaina e te Tahua Marsden ki ngā kaupapa rangahau 117 i tēnei tau, e tautoko ana i ngā rangahau a ngā kaitūhura pai rawa o Aotearoa i roto i ngā wāhanga o te pūtaiao, pūkahatanga, pangarau, mātauranga ā-iwi me te tikanga tangata.

He pikitanga o te $54 miriona (GST kore) tēnei i whakawhiwhia ki ngā kaupapa 92 i tērā tau, nā te whakapikitanga o te $66 miriona (GST kore) i roto i te whā tau i te whakaputaina e te Kāwanatanga i te Tahua 2016.

Ka tohaina ngā takuhe i roto i ngā tau e toru, hei utu i ngā utu ā-tau, ngā ākonga me ngā tūranga kairangi, ngā whakapaunga whakahaere me ngā taputapu rangahau.

He kaha ngā tautoko mō ngā kairangahau hou i tēnei tau, e 49 ngā takuhe Fast Start i tohua, ā, e 29 i tohua i tērā tau, te kī a te Tlamana o te Kaunihera Pūtea Marsden a Ahorangi Juliet Gerrard FRSNZ.

"He mea waihanga ngā takuhe Fast Start kia taea e ngā kairangahau hou te whakatū ō rātau wāhanga motuhake me te whakarite ka anga whakamua ngā rangahau a ēnei tāngata.

"I tino mīharo ngā rōpū whiriwhiri ki te kounga o ngā tono Fast Start i tēnei tau nō reira kei te whakamahia e mātau ngā pūtea tāpiri kia nui atu ngā kaupapa e tautokohia ana e mātau."

He maha ngā kairangahau Fast Start kei te tirotiro i ngā take kei mua tonu i te aroaro o te iwi whānui i tēnei wā tonu, pēnei i te huri o te āhuarangi, ngā pokenga hauota, te hekenga me ngā tipu me ngā kararehe tūturu o Aotearoa.

Kua piki te maha o ngā takuhe ki ngā kairangahau pūmau mai i te 63 i tērā tau ki te 68 i te tau 2016, nā te pikitanga o ngā pūtea. He whānui ngā kaupapa e tūhurahia ana e rātau i whiwhi takuhe Aro Whānui, ā, he whai pānga nui ēnei ki a Aotearoa pēnei i ngā horo pūtumu, ngā kōtuinga ā-iwi Māori o nehe me te āhua o te mahi a te melanin hei ārai tīkākā.

Hei tā Ahorangi Gerrard he haumi wā roa te Tahua Marsden ki Aotearoa. "Mā te tautoko i ngā kairangahau mātau rawa o Aotearoa ki te kōkiri i ō rātau whakaaro rawe rawa, tae atu ki ngā mōhiotanga o ngā whakanekeneke o te āhua o ngā mahi i te taumata taketake, ka āwhina te Tahua Marsden ki te waihanga i te tūāpapa rangahau kaha mō Aotearoa, e whai hua ai tātau āpōpō. Nā te momoho o ngā kairangahau manu hou i tēnei tau ka tau ō mātau whakaaro mō te pakari o tō tātau anamata a muri ake."

E whakahaerehia ana te Tahua Pūtea e Te Apārangi mā te kāwanatanga.

Funding highlights for 2016

Journey to the Earth beyond Earth…

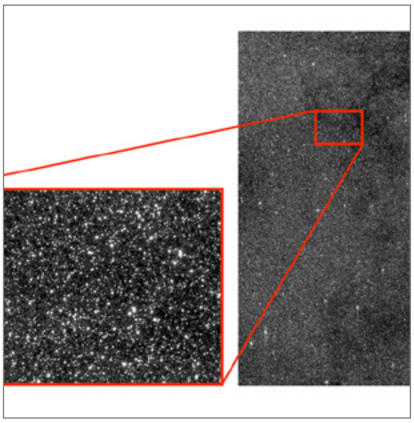
Since the ground-breaking discovery of the first planet outside our solar system (extrasolar planet) in 1995, the quest to explain the origin and evolution of planets and life has intensified. However, traditional methods used to locate extrasolar planets suffer from biases that mean they mostly detect planets that are located at distances from their parent star that are much less than the distance of the Earth from the Sun.

A new project funded by the Marsden Fund and led by Associate Professor Michael Albrow from the University of Canterbury's Physics and Astronomy Department, will use a network of state-of the-art telescopes (KMTNet) located around the Southern Hemisphere to discover just how many planets there are in our Milky Way galaxy.

Together with Professor Andrew Gould from Ohio State University, Associate Professor Albrow will develop advanced image processing and computational analysis techniques that will enable high-resolution data of tens of millions of stars to be collected every 10 minutes. In contrast to previous techniques, this new system will be able to detect planets with masses less than that of Earth.

Ultimately, Associate Professor Albrow hopes to discover planets of similar size to Earth that could potentially support life.

This study will enhance our knowledge on planetary formation and the evolution of life, and contribute significantly to our understanding of the prospects for life outside planet Earth.



A region of the sky towards the centre of our galaxy imaged by one of the KMTNet telescopes in Chile. The 65 megapixel image was taken on 20 March 2016 using a 75-second exposure time. The image measures about 1 degree across, corresponding to about 400 light-years at the Galactic Centre distance. As can be seen in the zoom on the left, the region is densely filled with stars, and around a million can be detected and have their brightness measured from this image. *Credit: Michael albrow.*

Hearing the difference: new strategies for listening in contemporary politics

One of the cornerstones of modern democracies is the right to speak, but rarely do we ask the inverse and essential question of how to listen. What are the conditions and practices of good listening, and what are the challenges that make it so difficult? More importantly, what might encourage listening in political life when it is required but sorely lacking? Particularly in conditions of inequality and across profound social differences, the capacity to listen to the voices democracy gathers cannot be assumed, but must be actively fostered.

Dr Emily Beausoleil, a Lecturer of Politics at Massey University, has been awarded a Marsden Fund Fast-Start grant to look at how people listen, and how to make listening easier. The project will draw upon interdisciplinary expertise from practitioners in therapy, education, performance and conflict mediation, four fields where listening comprises an essential skill and yet are currently written out of political theorising. The expertise of these "master listeners" will be a source of information, but also partners in the study. The first part of the project will observe these experts as they work, then bring them together to share their listening and communicating strategies, and explore how these might be brought to bear on the design of forms of public engagement regarding difficult political issues.

With new strategies for listening in place, the project's next phase is to connect this expertise to organisations already actively working across the country to stimulate and deepen conversation among the general public about socio-economic inequality. Working in community, it will tailor recommendations to the particular challenges and opportunities of engaging publics and politicians about this political issue, running and evaluating these novel designs of public engagement.

With socioeconomic inequality growing in New Zealand faster than other OECD countries, the need to listen to experiences and claims from the margins has never been greater. This interdisciplinary and experimental approach to the question of listening can shed light on how we can achieve this crucial dimension of democratc politics. When academic and practical worlds often work in isolation, this project aims to 'close the loop' of research so that practical sectors inform current democratic scholarship, while research recommendations can find their way back into practical application where they are needed most. These findings would ideally serve current efforts to stimulate and deepen civic dialogue in New Zealand about socioeconomic inequality, but they might also show us how, in more general terms, we might facilitate listening in unequal societies.

Dr Emily Beausoleil.

Earthquake monitoring using fibre optic

New Zealanders are no strangers to earthquakes. Most of us are profoundly aware of the large Alpine Fault that runs the length of the South Island and produces a magnitude 8 earthquake every few hundred years.

Dr Neil Broderick from The University of Auckland's Department of Physics, along with colleagues from Victoria University of Wellington, has received Marsden funding to develop a new generation of optical fibre sensors and improve our understanding of the Alpine Fault.

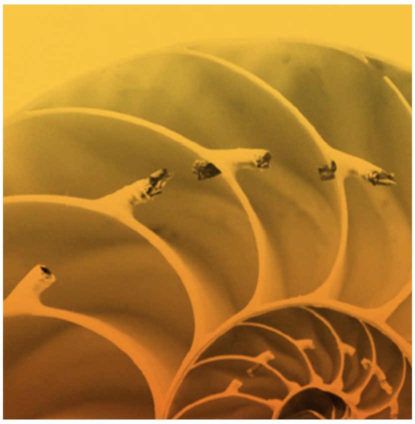
During a recent international study, the Deep Fault Drilling Project (DFDP), a borehole 900m deep was drilled into the Alpine Fault and an optical fibre sensor installed to collect physical information.

These sensors work by detecting changes in the way light – sent down the length of the fibre – scatters with changes in temperature and vibration.

However, these sensors were not designed to continuously measure natural low-frequency seismic activity over long periods of time, and as such are unable to capture the whole range of fault movement.

Dr Broderick and his team will improve the capability of existing optic fibre sensors by developing a novel tool that uses broadband frequency to perform continuous, long-term monitoring of temperature and ground movement. This new system will be capable of measuring events that last from milliseconds to months – allowing the monitoring of the recently discovered "slow slip" events that act to relieve stress on major fault lines.

The newly developed system will be used along with the optical fibre sensor currently installed in the DFDP borehole to provide a better understanding of earthquake dynamics on the Alpine fault.



Beyond earthquake study, the instrument developed could be used to monitor the structural integrity of buildings, dams and bridges over time, and in particular, on "dark" optical fibres – fibres that are already in place but are not currently being used.

Dr Jennifer Cattermole.

Early Moriori and Māori Musical Instruments

What does the development of musical instruments of the Moriori and Māori tell us about the cultural changes that occurred amongst the earliest ancestral settlers of Aotearoa and the Chatham Islands? What musical instruments did they bring with them from the tropical Pacific and what instruments did they invent or adapt themselves?

Dr Jennifer Cattermole from the Music Department of Otago University and Maui Solomon from the Hokotehi Moriori Trust, and their research team, will work with musicians of traditional instruments, and with contemporary makers of musical instruments, to undertake an in-depth anaylsis of Moriori musicial instruments.

The team will use a range of innovative and multidisciplinary methods to study the origins and development of the taonga pūoro as an iconic Māori and Morori instrument.

This impressively interdisciplinary project and its multi-talented team will collect oral histories, use CT scans, and make digital 3D models that they will archive in a online repository, all funded by a Marsden Fund grant. The research will produce mātauranga and new knowledge of the Moriori musical instruments and will help reveal greater understanding of the patterns of Polynesian migration, their innovations in new environments, and their music.

Mum, you are what your babies make you

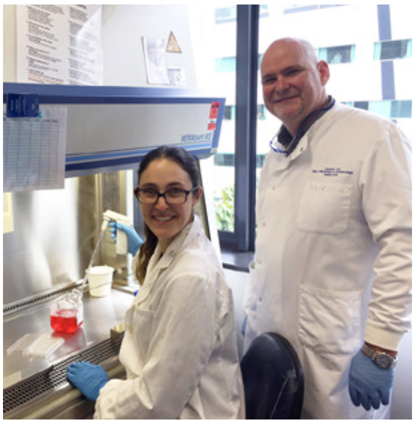
A human fetus produces large amounts of genetic material (e.g. DNA). In normal pregnancy, the placenta releases 'cell free' fetal DNA into the mother's blood via vesicles – tiny fluid-filled sacs – every day until the baby is born.

Although this genetic association was thought to end at birth, researchers at The University of Auckland believe otherwise. Professor Larry Chamley and Dr Cherie Blenkiron suspect that some of this fetal DNA is transferred permanently into the maternal cells. If so, then mothers may start to produce proteins encoded by the fetal DNA.

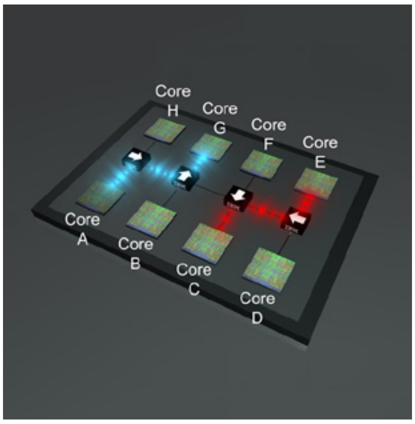
In this new Marsden-Funded study, Professor Chamley and Dr Blenkiron will define the DNA content of the extracellular vesicles released from the placenta. They will determine whether this DNA is stably transferred to maternal cells, how long it can remain there, and whether it can alter characteristics of the recipient cells – possibly affecting mothers over the long-term.

Previous work has shown that in some mothers, fetal cells protect them from breast or thyroid cancer. However, in other women, the fetal cells seem to promote the development of colon cancer and autoimmune diseases.

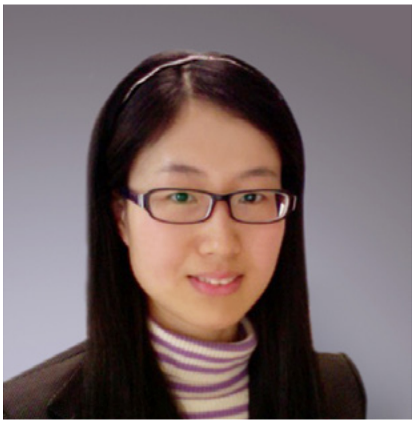
If the researchers find that fetal DNA is permanently taken up by the mother's cells, they will investigate whether fetal DNA, like fetal cells, could cause some mothers to develop, or be protected from, diseases later in life. Thus, the results of this research will have implications for the long-term health of mothers everywhere.



Dr Cherie Blenkiron and Professor Larry Chamley.



IBM's on-chip optical networks. *Credit: IBM. Website: www.thefutureofthings.com/3518-worlds-tiniest-nanophotonic-switch/*



Yawen Chen. *Photo credit: University of Otago.*

Energy efficient super chips for computers

A microprocessor is like the brain of a computer. In the past microprocessors usually had a single core (a processing unit). Nowadays, to speed up computing time, the latest microprocessors can have tens, hundreds, or even thousands of cores within a single chip.

However, the current bandwidth and limited power budgets of such chips restrict their performance. This results in bottlenecks, not just for supercomputers and large-scale data centres, but for everyday smartphone users – we're all familiar with the after-school slowdown!

Dr Yawen Chen from the University of Otago has received a Marsden Fund Fast-Start grant to tackle this problem. With colleagues from the Department of Computer Science and from Xidian University in China, she will develop new, efficient architectures and communication paths for a light-based microprocessor.

A recent ground-breaking ONoC (optical network-on-chip) based microprocessor has a bandwidth up to 50 times greater than state-of-the-art electrical processors, and uses only 1.3 watts of power to transmit a terabit of data per second.

However, most existing ONoC designs don't take full advantage of optical communication to maximise performance and save energy. It is this area that this study will focus on.

This project will advance the current state-of-the-art network theories and techniques for microprocessor design, and foster new knowledge about high-performance, more energy-efficient computing.

Your eyes: more than just windows to your soul

When you read, the lens of your eye must maintain both clarity and the correct shape to focus on the text and refract the light to the back of your eye. If you get distracted and glance outside, your eye performs an amazing feat of physics to refocus on objects that are further away.

But the lens of your eye is made of living cells. So how do they stay clear and maintain their shape to precisely focus light from both near and far? Professor Paul Donaldson from The University of Auckland's School of Medical Sciences, and colleagues from both The University of Auckland and the State University of New York, are working on an answer.

They have already used high-tech measurements and molecular biology to show that water and sodium ions are pumped around the lens of the eye, which helps maintain a hydrostatic pressure in tune with the shape and clarity requirements of the lens.

Professor Donaldson's Marsden-funded research will build on their earlier discovery to determine exactly how the cells of the eye regulate the water pressure to maintain clarity and change the focal length of the lens. They will also investigate whether applying mechanical tension to the lens, to mimic lens refocusing, alters water transport and lens power. This research will also provide clues as to why the process sometimes goes wrong, for example in cataract formation in the ageing eye.

Professor Paul Donaldson.

The ultimate goal is to come up with non-invasive, early intervention methods of improving vision and delaying the onset of cataracts. Ageing and diabetes are two causes of cataracts, and so this research will have increasing significance as our population ages and the incidence of diabetes continues to rise.

Professor Steven Galbraith.

Advanced cryptography for software protection

Cryptography is the art of hiding information without interrupting the flow of communication. Once the domain of spies and armies, cryptography is now fundamentally important to all of us – for internet banking and shopping or app downloads, for example.

Modern-day cyberlife requires that software developers constantly try to keep ahead of the hackers. In seeking to protect their code against piracy, software developers 'obfuscate' their code to make it difficult for someone to see how it works. However, obfuscated code is the perfect place to hide malicious software (malware) – so how can we be sure that there are no demons lurking?

Professor Steven Galbraith and Associate Professor Giovanni Russello from The University of Auckland's Mathematics Department have received a Marsden Fund grant to address the dilemma of being able to obfuscate code while providing assurance that it isn't malware. They aim to develop mathematical and cryptographical tools that can satisfy both requirements simultaneously.

One challenge will be to develop practical obfuscation tools for mobile and web apps. Most reputable app stores inspect each app before it's published, but the check can't be used on obfuscated code. Also, code obfuscation hampers anti-virus software, meaning legitimate code can be wrongly flagged as malware.

The ultimate goals of this project are to develop obfuscation techniques to protect code in critical systems (like transport, banking, healthcare) from being tampered with, and to develop 'verifiable' obfuscation. This would allow an authorised party to verify that a code is safe, without having to view the original source code.

New nanotechnology to clean up waterways

Nitrate pollution of New Zealand's waterways has become a serious problem over the past few decades due to agricultural intensification and overuse of fertilisers. Nitrate promotes algae growth, leading to oxygen depletion and loss of biodiversity. It is also harmful to human health, reducing the ability of blood cells to transport oxygen around the body.

Nitrate can be removed from contaminated water by converting it to oxygen and nitrogen gas, which are harmless. However, this is impractical without smart catalytic conversion technologies to speed up the process and reduce the high energy requirement.

Dr Anna Garden from the University of Otago's Chemistry Department has been awarded a Marsden-funded Fast-Start grant to help solve this problem. She will collaborate with Associate Professor Egill Skúlason from the University of Iceland to design new nanoparticle catalysts that can selectively convert nitrate to nitrogen without generating harmful by-products.

Nanoparticles have a high surface to volume ratio, diverse chemical environments and unique reactivity patterns – all good traits for their development into highly efficient catalysts. Unfortunately, the number of possible nanoparticles of different structure and/or composition is virtually limitless.

Dr Garden plans to use computational techniques to come up with an efficient screening process to eliminate nanoparticles that will not be catalytically active. The project's ultimate goal is to identify optimum nanoparticle catalysts for quick and safe removal of nitrate from drinking water.

Top: The supercomputer used for research (the Pan cluster, at the centre for eResearch at the University of Auckland). *Photo credit: NeSI.*

Left: Stephanie Lambie, Mingrui Yang, Dr Anna Garden, Robert Tucker and Caitlin Casey-Stevens.

How do parasites brainwash their hosts?

Many parasites can change the behaviour of their hosts. For example, malaria parasites may make mosquitoes more attracted to humans, increasing the chance of transmission, and toxoplasma parasites make rats more likely to hang out around cats, increasing their chance of being eaten (which passes the parasite to the cat where it can reproduce).

One of the most extraordinary manipulations is the water-seeking behaviour that some parasitic worms induce in their hosts. These worms hijack the host's central nervous system, forcing them to seek water for the worm to reproduce in. Once water is found the adult worm explodes out of the host, killing it.

The mechanisms behind such amazing host manipulations are not well understood, but one possibility is through alteration of the host's DNA (epigenetics). However, water-seeking behaviour is induced by several distantly related worms in a variety of hosts, meaning that a common and conserved mechanism may be utilised by these parasites.

A Marsden Fund grant will support Professor Neil Gemmell from the University of Otago's Department of Anatomy to investigate such parasitism. Along with his Otago-based team, Professor Gemmell will use cutting-edge molecular and bioinformatics tools to study two distantly-related parasitic

Hairworm coming out of weta. *Credit: Frederic Thomas.*

Professor Neil Gemmell.

worms and their hosts – one affecting cave weta, the other affecting earwigs. They will attempt to discover the trigger and genetic cascade through which these parasites elicit this behaviour.

Results of this study will increase our understanding of how parasites can brainwash their victims. Although the project will look at parasites that affect insects, the findings will be broadly relevant to many other parasite systems, including those that affect humans and livestock.

Why fly when you can walk?

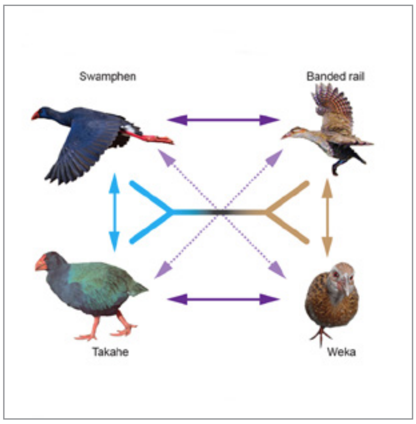
Birds are the quintessential flying machines. But flying costs energy. Flying also constrains body size, weight, reproduction and shape. So if you don't have to fly, why bother?

Not surprisingly, some birds have given up flight altogether. However, some lineages appear more prone to flight loss than others. This might be because physiological and/or ecological traits are limiting. For example, there are no flightless hummingbirds!

Dr Gillian Gibb, from Massey University in Palmerston North, has been awarded a Marsden Fast-Start grant to investigate the genetic mechanisms underlying the pathways to flightlessness. She will use genetic techniques to explore the well-studied ecological and physical differences between related flightless and flighted birds.

Many of New Zealand's endemic birds have evolved flightlessness, sometimes independently, but this research will focus on birds in the rail family. Rails are an ecologically and culturally significant part of New Zealand's bird fauna, and contain the flightless weka and takahē. Dr Gibb plans to compare pairs of two closely-related species of rails – in each pair, one can fly and the other cannot. The flightless weka will be compared to the flighted buff-banded rail, and the flightless takahē to the pukeko.

Dr Gibb will use comparative genomics analyses to reveal whether a conserved set of genes are implicated in the development of flightlessness, and will also investigate what order, timing and degree of variability there is in the combination of genes operating in different birds.



Possible comparisons between flighted and flightless New Zealand rails. *Credit: Steve Trewick.*

This research will enhance our understanding of many important genetic pathways, including limb development, reproductive capacity, immunology and metabolism. The knowledge gained will have application in many other species and provide new insights into the molecular foundation of a profound ecological and evolutionary shift.

The origin of UV photoprotection in melanin

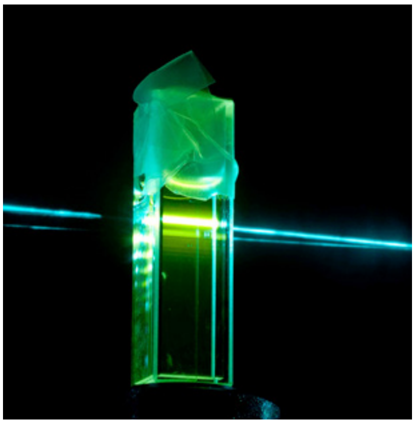
Eumelanin (a type of melanin) is the natural brown skin pigment that protects us from sunburn. It forms 'nano-assemblies' that efficiently absorb UV radiation and disperse the energy as heat, protecting our skin from the damaging effects of sunlight.

So how does eumelanin do this so efficiently? We don't yet know, because these nano-assembly mechanisms are so chemically and physically complex.

Associate Professor Justin Hodgkiss from the School of Chemical and Physical Sciences at Victoria University of Wellington and Professor Paul Meredith from University of Queensland have received a Marsden Fund grant to explore how eumelanin works.

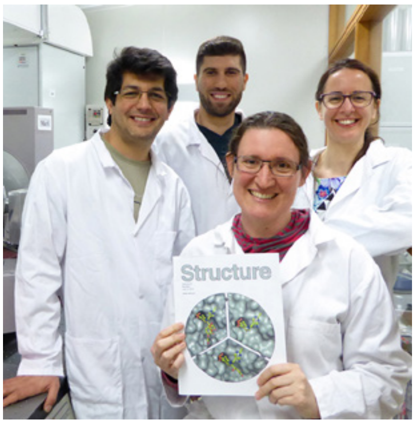
The researchers will use a combination of three ultrafast broadband methods, using sophisticated high-speed lasers, to watch how eumelanin absorbs and dissipates energy. This happens on timescales as short as femtoseconds (one millionth of a billionth of a second).

Beyond answering the main question of how eumelanin protects us from UV light, they will gain insight into how it regulates other photobiological processes. For example, sunburn, melanoma, wrinkling, and vitamin D production all have slightly different UV responses, and are thus affected by different parts of eumelanin's absorption spectrum.



Fluorescent sample being excited by ultrafast laser.
Photo credit: VUW image services.

This knowledge may guide the design of new optical components and sunscreens, and may later be applied to a host of other biomaterials that undergo UV photochemistry.



From left to right; Dr Ghadar Bashiri, Ehad Jirgis, Dr Jodie Johnston, and Laura Nigion.

Using TB to understand communication within proteins

Tuberculosis (TB) is a major worldwide health issue. It kills approximately 1.3 million people each year, despite TB vaccines and drug treatments having existed for over 45 years. Limitations in current TB treatments, along with drug resistance, suggest the need for new anti-TB treatments. In New Zealand, TB has a long history of being a significant health burden on Māori, who make up over 50% of the New Zealand-borne cases.

Dr Jodie Johnston and Dr Ghader Bashiri, along with a team of young researchers at The Universities of Auckland and Canterbury, are investigating a key enzyme vital to the survival of Mycobacterium tuberculosis, the bacterium that causes TB. The enzyme (MenD), is essential to many bacteria and displays protein cooperativity. Cooperativity (where molecules bind to a protein, affecting its activity at a different site) offers ways for proteins to alter their functions and influence how organisms adapt to environmental changes, and is therefore a crucial phenomenon that underpins life.

The research team will investigate the cooperative behaviour of MenD as a model system to unravel the underlying communication networks. They will use a multidisciplinary approach including molecular biology, biophysics, structural biology, and computer simulations, to build a picture of the different factors that underlie communication.

This project will enhance understanding of protein cooperativity and provide insight into how a vital enzyme from a human pathogen is regulated. It will also build a knowledge base for future drug design and protein engineering efforts.

Counting our tūpuna in Aotearoa New Zealand

Demographic survival is the bedrock of peoplehood. For many indigenous peoples, colonisation threatened their survival. Scholars agree that the size and health of most indigenous populations declined after European contact. But the timing, magnitude, and causes of decline are topics of ongoing debate.

A newly funded Marsden project will use innovative strategy to address this debate. The project starts with the premise that there has been a failure to engage indigenous peoples and their narratives in indigenous population histories. Working alongside a Waikato hapū (sub-tribe), Associate Professor Tahu Kukutai from the University of Waikato and her research team plan to invert the usual 'top down' focus of indigenous demography.

Although iwi research has flourished in recent decades, hapū-focused scholarship is sparse. Yet hapū were the primary social and political unit for 19th century Māori. This project will combine family reconstitution methods, oral traditions and Bayesian statistics to reconstruct three generations of their tūpuna (ancestors) during these peak decades of colonisation.

Such a reconstruction will enable the researchers to model the impacts of land alienation and settlement on population size, structure and survivorship. They will also explore the strategies that tūpuna used to resist and adapt to colonisation, thus countering narratives of passive victimhood with illustrations of active intervention.

Associate Professor Tahu Kukutai.

This is the first attempt at full population reconstruction in Aotearoa New Zealand. It offers a potential model for other iwi, Māori and indigenous populations to use. It will also contribute to an understanding of how contemporary health inequities have evolved throughout the country.

Te tatau i ō tātau tūpuna i Aoteroa

Ko te ora ā-tatauranga taupori te tūāpapa o te iwi whānui. Mō te maha o ngā iwi taketake, i noho mōrearea rātau ki te tāmitanga. E whakaae ana ngā tohunga mātauranga i tino heke te ora me te rahi o te nuinga o ngā taupori iwi taketake i muri i te tūtakitanga i a Tauiwi. Engari kei te tohetohetia tonutia te wā, te whānui me ngā pūtake o te pāheketanga.

Ka whakamātauhia e tētahi kaupapa rangahau whai pūtea i te Tahua Marsden tētahi rautaki auaha hei whakatūtaki i tēnei take. Ka tīmata te kaupapa nei i runga i te whakaaro i hē te whakauru mai i ngā iwi taketake me ā rātau kōrero ki ngā hītori taupori iwi taketake. Mā te mahi me tētahi hapū o Waikato, ka whakarite a Ahorangi Tuarua Tahu Kukutai o Te Whare Wānanga o Waikato, me tōna rōpū, tae atu ki a Tākuta Nēpia Mahuika, ki te huri kōaro i te aronga 'mai i runga ki raro' i te titiro ki te tatauranga taupori iwi taketake.

Ahakoa kua puāwai ngā rangahau a ngā iwi i roto i ngā tau tino maha, he itiiti noa ngā rangahau ā-hapū. Engari ko ngā hapū te iho pāpori, tōrangapū hoki o te Māori i te rau tau 19. Ka whakakotahi tēnei kaupapa i ngā tikanga hanga hou a te whānau, ngā tikanga ā-waha me ngā tatauranga Bayesian hei hanga hou anō i ngā reanga e toru o ō rātau tūpuna i te tiketiketanga o te wā tāmitanga.

Mā aua hanga hou anō ka taea e ngā kairangahau te whakatauira i ngā pānga o te muru whenua me te urunga mai o Tauiwi ki te rahinga taupori, hanganga hoki me tō rātau oranga. Ka tirohia anō ngā rautaki i whakamahia e ngā tūpuna ki te ārai me te urutau ki te tāmitanga, hei papare atu i te āhuatanga pārurenga ngoikore mā ngā whakaaturanga o ngā mahi i āta whakaritea ake e rātau.

Koinei te whakamātauhanga tuatahi ki te hanga hou anō i te taupori whānui i Aotearoa. He tuku tauira mā ētahi atu iwi, taupori Māori, iwi taketake hoki hei whakamahi. Ka tautoko hoki i te whai māramatanga o te āhua o te kunenga mai o ngā rerekētanga ā-hauora onāianei puta noa i te motu.

The making of Māori society: an archaeological analysis of social networks

No culture is socially static. Over several centuries, the Polynesian colonists who settled New Zealand began to create a new type of society. Relatively autonomous village-based groups transformed into larger territorial hapū lineages, which later formed even larger iwi associations.

Traditionally, information passed down through the generations by word of mouth has provided the best evidence of these complex, dynamic changes in social organisation. However, a novel Marsden-funded project will use archaeological evidence to examine how social networks beyond the village changed as Māori society developed.

Professor Thegn Ladefoged from Auckland's Anthropology department will work with colleagues from Auckland and the USA to reconstruct ancient systems of inter-iwi trade and contact by looking at the physical evidence of everyday life – tracing when and where ancient tools made from obsidian moved throughout New Zealand.

By combining traditional archaeological techniques, sophisticated Geographical Information System analyses and social network analysis modelling with local iwi input, Professor Ladefoged's team will gain new insights into how Māori society emerged and flourished in the past.

Proposed experiments will use obsidian hydration dating as a method for determining the age of New Zealand artefacts. This collaborative research will also connect or reconnect Māori with their taonga held in museums and university archaeology collections.

The integration of science, archaeology and local knowledge on a rarely seen scale, makes this one of the most unique and exciting Marsden-funded projects in recent years.

Top: Obsidian and dog bone that was recovered during excavation on Ahuahu (Great Mercury Island).

Left: Fieldwork on Ahuahu (Great Mercury Island) working with Ngati Hei.

New Zealand's new Chinese migrants and their multi-generational families

After three decades of immigration, a substantial new Chinese community has established in New Zealand. A significant proportion of these migrants are multi-generational families renowned for their transnational connections and mobility.

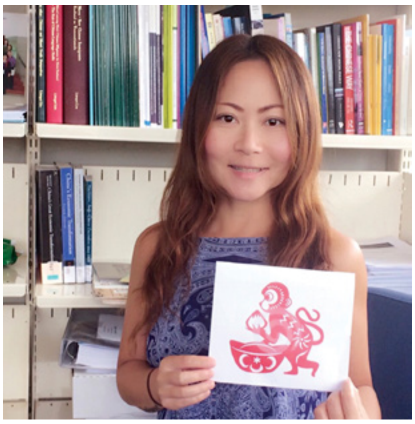
Dr Liangni Liu, from Massey University's Auckland campus, has been awarded a Marsden Fast-Start grant to explore family unification in a migration context. Dr Liu will use a three-generation framework encompassing migrants, their children, and parents, to study the intersection between transnational migration and the inter-generational experiences of migrants.

The building of multi-generational family units is a long-established and well recognised pattern of Chinese migration.

However, the ability to maintain an extended family structure is shaped both by migrants' ability to move freely between home and host countries, and by immigration policy.

As New Zealand immigration policy increasingly prioritises 'talent', older and less educated migrants are finding it difficult to gain entry to be with their children and grandchildren. At the same time, the New Zealand-born children of Chinese migrants may leave for educational and employment opportunities in other countries.

So what are the implications for forming strong, committed, and settled communities? Through interviews with migrant families and analysis of Immigration and Statistics NZ data,



Dr Liangni Liu.

Dr Liu will explore how migrant families deal with the challenges of living between two cultures.

This research will provide the first understanding of how Chinese migrants and their extended families adapt to New Zealand society. It will also add new insights into the discussion on cultural diversity.

Nano-containers for cell signalling

Human tissue has a remarkable ability to heal and renew. To achieve this, lots of different stimuli act on our cells to ensure their survival, proliferation and migration. Stem cells in particular, offer unprecedented potential for treating degenerative diseases, such as Alzheimer's, Parkinson's, and osteoarthritis – if they can be controlled.

Dr Jenny Malmstrom from the Department of Chemical and Material Engineering at The University of Auckland will use Marsden Fast-Start funding to study how these cells behave in artificial environments, and the specific interactions between the cells and their surroundings.

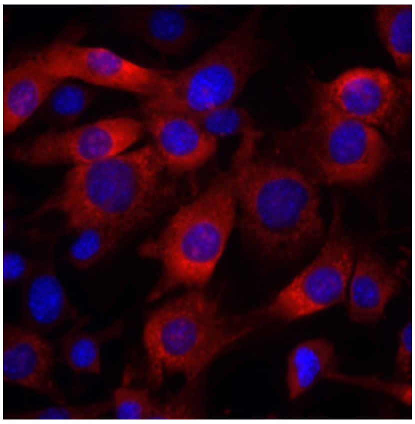
Many cell responses are controlled by complex chemicals called growth factors. In living tissue, growth factors are released in a tightly regulated response to mechanical changes in the cell environment.

In traditional laboratory studies, growth factor molecules are added to the fluid surrounding the artificially-cultured cells. This is in contrast to the situation in living tissues where the release of growth factor molecules is tightly regulated. Dr Malmstrom's project will create a novel responsive interface to deliver growth factors to cells, mimicking what happens in living tissue.

Growth factors will be stored in tiny polymer capsules with polymer 'lids' that have a 'handle'. When stimulated, structures on the cell surface will pull the handle, releasing the growth factor and ensuring delivery of the molecules when and where they are needed.

The same approach can then be applied to a range of cell types. The results of this research will have many implications for drug delivery, biocide release and cancer therapy.

Dr Jenny Malmstrom.



Reactive oxygen species (red) produced by muscle cells. *Credit for image and photo: Troy Merry.*

How diet and exercise affect our cells

Two major diseases affecting New Zealanders, obesity and type 2 diabetes, are known to respond positively to exercise and a calorie-restricted diet. The positive benefits of these interventions are a reduction in the incidence of the disease and extended lifespan.

A new Marsden-funded Fast-Start project, led by Dr Troy Merry of Molecular Medicine and Pathology at The University of Auckland, will investigate how diet and exercise affect mitochondria, the energy generating machinery in our cells.

Dr Merry and colleagues from the University of Otago and ETH Zurich in Switzerland will focus on recently identified mitochondrial-derived peptides such as humanin, which have been linked with protective effects in age-related neurological damage. They will focus also on how these molecules may protect us from metabolic stress and oxidative stress.

Dr Merry and his team are interested in the effects of short-term (acute) and long-term (chronic) changes of diet or exercise on peptide levels in blood and muscle tissue. Specifically, they will investigate how these interventions, and the resultant changes in peptide levels, contribute to restoring metabolic balance, focussing on obesity.

They theorise that acute increases in metabolic activity (e.g. short bursts of exercise, change in diet) raise peptide levels to protect against metabolic stress and oxidative stress. In contrast, chronic metabolic stress (e.g. obesity) may result in a drop in peptide levels and a loss of protection.

This project will pioneer an exciting new field of metabolic research and provide a better understanding of the biological processes underlying diseases like diabetes and obesity.

Submarine landslides on the move

Some of the largest tsunamis on Earth have been generated by submarine landslides. But not all landslides generate tsunamis. Their potential to do so depends primarily on their speed – the faster the landslide the greater the likelihood of generating a tsunami.

The most widely known trigger of submarine landslides is the violent movement of the seafloor as a result of an earthquake. However, Dr Joshu Mountjoy from NIWA and Dr Gareth Crutchley from GNS Science believe that other short-lived processes may affect where and how submarine landslides occur.

This duo and their research team, which includes scientists from New Zealand and Germany, have received a Marsden Fund grant to determine whether pockets of pressurised gas trapped beneath a submarine landslide, or liquefaction within the landslide, can trigger slope failure and cause the landslide to keep moving.

Off the northeast coast of New Zealand lies the Tuaheni landslide complex, one of the few global examples of an active slow-moving submarine landslide – and the perfect opportunity to study an active landslide on the sea floor.

Dr Mountjoy will use 3D seismic data collected on the RV Tangaroa, as well as sediment core samples collected on the RV Sonne, to look for evidence of pressurised gas and liquefaction in the Tuaheni landslide complex.

Cutting-edge laboratory experiments on sediment samples will be carried out to determine how the landslides respond to gas pressure build-up and earthquake motions.

Joshu Mountjoy on NIWAs research Vessel. *Credit: Dave Allen, NIWA.*

The resulting data will be used to model various scenarios by which landslides are initiated and move slowly, or alternatively, fail catastrophically under the influence of both gas pressure and earthquake shaking. This work will help to determine the tsunami hazard potential of such features.

Ngā ngarue ohorere, nekenga pōturi rānei? Kua neke ngā horo raro moana

Ko ngā horo raro moana te pūtake o ētahi o ngā ngaru taitoko tino nui rawa i te ao. Engari, ehara ko ngā horo katoa te pūtake o ngā ngaru taitoko. Kei te āhua kē o te tere – ko te tere atu o te horo, ko te nui ake o te tūpono ka puta he ngaru taitoko.

Ko tētahi o ngā pūtake o ngā horo raro whenua e mōhiotia ana ko te tino kaha o te neke o te papa moana nā tētahi rū. Engari, e whakapono ana a Tākuta Joshu Mountjoy o Taihoro Nukurangi me Tākuta Gareth Crutchley o Te Pū Ao, he pānga anō pea o ētahi atu hātepe wā poto ki te wāhi me te āhua o te puta o ngā horo raro whenua.

Kua whiwhi i tēnei tokorua me tō rāua rōpū, kei roto ko ngā mātanga pūtaiao o Aotearoa me Tiamana, i tētahi takuhe Tahua Marsden hei whakatau mēnā ka taea e ngā pūkoro pēhanga haurehu e mau ana i raro i tētahi horo raro whenua, he whakawaiwhenua rānei i roto i te horo, te horo puke me te neke haere tonu o te horo.

Kei te whakarua e tūtata ana i te takutai o Aotearoa ko te horo Tuaheni, tētahi o ngā tauira itiiti o te ao o tētahi horo raro whenua e āta ngōki haere ana – he whai wāhitanga tino rawe hei rangahau i tētahi horo kei te papa moana.

Ka whakamahia e Tākuta Mountjoy ngā raraunga rū o ngā waka i tere ki runga ake o te horo Tuaheni, tae atu ki ngā tīpako para nō ngā karihi i wiria atu ki roto, hei kimi taunakitanga o ngā pēhanga haurehu me te whakawaiwhenua.

Ka whakamahia ngā toka me ngā para i tangohia mai i te papa moana i ngā whakamātautau taiwhanga tino hou rawa, tae atu ki ngā whakatauiratanga hei whakatau ka pēhea tā rātau urupare ki ngā huinga pēhanga haurehu me ngā nekenga rū.

Ko ngā raraunga ka puta ka whakamahia ki te whakatauira i ngā wheako whakaari e tīmataria ai ngā horo, te neke, te tino pakaru mai rānei, i raro i whakaawetanga o te pēhanga haurehu me te rū whenua. Ka āwhina ēnei mahi ki te whakatau i te tūpono mōrearea o te ngaru taitoko o aua āhuatanga.

Mountjoy in Kaikoura operating a seismic streamer used for the 3D survey. *Credit: Dave Allen, NIWA.*

Understanding *Legionella* in the plumbing

Legionella pneumophila is a bacterium that causes significant harm in the form of Legionnaires' disease, a severe form of pneumonia with up to 30% mortality in humans. The bacteria can lurk in man-made water systems such as plumbing, for a long time. They travel through common filters and are chlorine resistant, making them both dangerous and difficult to eradicate.

So how do these bacteria remain so potent despite efforts to kill them, and how do you study them? You can't just infect water systems to study how they persist there for so long. Dr Liping Pang from ESR in Christchurch thinks she may have the answer, and has received a Marsden Fund grant to investigate further.

Dr Pang, along with Dr Craig Billington (also from ESR) and two Canadian experts will develop an inert, harmless, non-living surrogate for *Legionella* bacteria. It will be specially designed to mimic the adherence and persistence of the bacteria in engineered water systems.

The surrogate, consisting of surface-engineered microspheres, will be made out of a food-grade biopolymer. Their surfaces will be modified to change how the particles stick, combine with one another, and physically resist disinfectant processes. They will even have their own DNA, so that researchers can detect when the disinfectant has 'worked' to 'kill' them.

The end result will be a fundamental understanding of how *Legionella* bacteria stick and persist in our water systems. This new method will be cheaper, less labour intensive, and less risky than current analyses, and more accurate than the traditionally used *E. coli* indicator.

Dr Liping Pang.

This inert surrogate approach will also be useful for other bacterial pathogens in water systems, with the ultimate goal of reducing human infections.

Sampling Ice Age moa bones, Gradungula Passage, Honeycomb Hill, Oparara Valley near Karamea. *Photo credit Nic Rawlence, Jamie Wood, and Jeremy Austin.*

Do glaciers drive biodiversity?

Dr Nicolas Rawlence from the University of Otago's Zoology Department is one of several researchers to receive Marsden funding that is utilising the rapidly growing field of ancient-DNA technology.

Dr Rawlence will use his Fast-Start grant to explore the effects of the last glacial period on the distribution of bird and plant species in the Southern Alps, using a combination of ancient-DNA, carbon-dating, and stable isotope analyses.

Glaciers have traditionally been seen as causing great damage to ecosystems, with previous genetic studies indicating reduced biodiversity in many glaciated regions of the world.

However, new evidence from mountain ranges in temperate regions, such as the Andes, Himalayas, Pyrenees and New Zealand's Southern Alps, suggests the opposite. Glaciation may actually be a key force in structuring biodiversity along mountain chains by isolating populations which in turn encourages new species to emerge.

Using DNA extracted from fossil bones, and organic material and pollen preserved in sediments, Dr Rawlence will investigate 'real-time' changes in family history and geographic distribution of iconic alpine bird species (moa, rock wren, and kea) and plant species in the Southern Alps, following the last glacial period.

In contrast to traditional genetic methods, ancient-DNA analysis, along with a combination of other tools, will allow exploration of what was happening at precisely dated times in the past, thus robustly reconstructing the recent evolutionary history of New Zealand's animal and plant life.

Snapper DNA to shed light on fishing-induced evolution

Marsden funding has been awarded to Dr Peter Ritchie from Victoria University of Wellington's School of Biological Sciences and Dr Bastiaan Star from the University of Oslo, Norway, who lead one of several research projects in the rapidly growing field of ancient-DNA technology.

Dr Ritchie and Dr Star's project will use DNA extracted from snapper bones in ancient Māori middens (dating back to the 15th century) to show how the genetic diversity of these fish populations has changed over time.

Snapper is New Zealand's most important fisheries species and has been exploited since Māori first arrived around 700 years ago. Industrialisation of fishing during the last century nearly caused snapper stocks to collapse in the 1980s, until controls were introduced to halt their decline.

Today, snapper continues to be caught in large numbers by both recreational and commercial fishers.

Fishing typically targets larger individuals, which may increase the reproductive success of small fish that mature early. Indeed, many studies have reported a decrease in the average size of fish, the age at which they mature, and significant loss of genetic variation. However, it is not known whether these changes are an evolutionary adaptation or a direct response to over-fishing.

By comparing DNA from ancient snapper bones with DNA samples from heavily-fished modern stocks, Dr Ritchie will establish whether there is a link between over-fishing and genetic selection. They will also test whether genetic diversity has been depleted in current populations, and compare their findings to studies in Atlantic cod, another fish that has suffered from commercial over-fishing.

Photo credit: Meredith Lowe; Crispin Middleton NIWA.

This research will make a significant contribution to our understanding of human impacts on the environment, and could help preserve the long-term future of fish stocks.

Mā te pītauira tāmure e hura mārama mō te kunenga i ahu mai i te hao ika

Kua whakawhiwhia he pūtea Marsden ki a Tākuta Peter Ritchie o Te Kura Pūtaiao Koiora o Te Whare Wānanga o Te Ūpoko o Te Ika me Tākuta Bastiaan Star o Te Whare Wānanga o Oslo, Norowe, e ārahi nei rāua i tētahi o ngā kaupapa rangahau maha o te rāngai hangarau pītauira onamata e tere nei te tipu haere.

Ka whakamahia e te kaupapa rangahau a Tākuta Ritchie rāua ko Tākuta Star i ngā pītauira i tangohia mai i ngā kōiwi tāmure nō ngā ahu otaota (ka hoki atu ki te rau tau 15) hei whakaatu i te huringa o te kanorau iranga o ēnei taupori ika i roto i te wā.

Ko te tāmure te momo ika hira rawa o Aotearoa, ā, kua roa e hīia ana mai i te taenga tuatahi mai o te Māori i ngā tau e 700 ki mua. I tino raruraru te ora o te kāhui tāmure nā te tikanga hī ika arumoni i ngā tau o te 1980, ā, nā te whakaurunga mai o ngā ture i aukati i tōna pāheketanga. I ēnei rā, e hīia nuitia tonutia ana te tāmure e ngā kaihī pārekareka, arumoni hoki.

I te nuinga o te wā ko ngā ika nunui ake ka hīia, ā, e piki ai pea te momoho whakaputa uri o ngā ika paku e tōmua ana te pakeke. Otirā, he maha ngā mātai e pūrongo ana i te heke o te rahi toharite o te ika, te tau e pakeke ana, me te tino ngaro o te iranga taurangi. Engari, kāore i te mōhiotia mēnā he urutaunga kunenga ēnei huringa, nā te kaha rawa o te haohia o te ika rānei.

Mā te whakataurite i ngā pītauira o ngā kōiwi tāmure onamata me ngā tīpako pītauira o ngā ika e kaha rawa te haohia, ka whakatau a Tākuta Ritchie mēnā he hono kei reira i waenga i te kaha rawa o te hao me te whiringa iranga. Ka aromatawaitia anō mēnā kua pau te kanorau iranga i roto i ngā taupori onāianei, me te whakataurite i ā rāua kitenga ki ngā rangahau o tētahi atu ika, te Atlantic cod, i mate nā te kaha rawa o te hao arumoni.

He whai wāhitanga tino nui tēnei rangahau ki tō tātau mōhio ki ngā pānga ā-tangata ki te taiao, ā, ka taea hoki te āwhina ki te tiaki i te ora anamata o ngā kāhui ika.

Bones under pressure

As anyone who keeps fit knows, the more we use our muscles the stronger they get. The same applies to our bones. However, although scientists have a good understanding of how muscles are strengthened, they are unclear how this happens with bones.

Repetitive stress on bone leads to increased strength and higher bone density, whereas disuse or weightlessness cause the bones to thin. This suggests the existence of a bone biosensor that registers mechanical stress and activates an appropriate response.

Professor Stephen Robertson from the Dunedin School of Medicine and Dr Sujay Ithychanda from the Lerner Research Institute in the United States have discovered mutations in two different human genes that result in excessive bone density, or hyperostosis, where bones are denser and stronger than normal. Their Marsden-funded project will investigate whether the proteins encoded by these genes represent the long-sought sensor of mechanical stress in bone-forming cells.

Professor Robertson's project has great medical significance. Finding out how our bones sense mechanical stress and how this leads to increased bone density and strength, could lead to new therapies being developed for treating bone loss in osteoporosis or during immobilisation of fractures.

This project will also study how our bones sense environmental signals. How our skeleton interacts with gravity may even shed light on ways to combat the effects of weightlessness on bones during space travel.

Professor Stephen Robertson.

Sleeping to remember or sleeping to forget?

In human adults, sophisticated memory processes take place during sleep. These are vital for our everyday functioning. For instance, we consolidate recently learned information and connect existing knowledge. Sleep even regulates how our memory processes facts and emotions.

Although both memory and sleep undergo dramatic changes during infancy, little is known about their relationship during this important period of development. A new Marsden Fast-Start project will test if sleep makes effective processing of emotional stimuli and experiences easier for 6 to 18-month old infants.

Dr Sabine Seehagen from the University of Waikato, along with colleagues from Australia and Germany, will focus on sleep-dependent processing of different types of emotional memories and whether being well-rested versus tired affects the ability of 6-month-old infants to recognise emotional faces. First, they will determine the effect of timing of sleep; does being well-rested or tired affect the ability of 6-month-olds to recognize emotional faces?

Next, the researchers will aim to discover if taking a nap versus staying awake after learning makes it easier for 6 to 18-month old infants to selectively consolidate memories for emotional faces (sleeping to remember), or lessen the effects associated with recalling emotional episodes (sleeping to forget).

Researchers predict that previous sleep prepares the infant brain to accurately encode emotional stimuli. They also predict that post-learning sleep promotes selective retention of emotional information and reduces the emotional 'tone' associated with recalling an emotional event.

Dr Sabine Seehagen, her partner and daughter.
Credit: RUB, Lutz Leitmann.

Knowing more about how sleep shapes emotional memory and thus regulates which experiences are likely to stick with an infant and in which form, will contribute to a deeper understanding of adaptive and maladaptive development.

Associate Professor Jeff Sissons.

The mysterious disappearance of tūāhu

One of the great mysteries of Maori cultural history is the absence of tūāhu (shrines) from New Zealand's archaeological record. Tūāhu were the closest equivalents to the temples and marae of Eastern Polynesia.

In a newly funded Marsden project, Associate Professor Jeff Sissons of Victoria University of Wellington will determine if this gap in Māori historical knowledge is due to the removal of tapu by rites that were performed in the mid-nineteenth century.

Associate Professor Sissons suggests that during this time Māori chiefs and priests sought to realise new political and personal visions within a now Christianised society. While tapu was understood as foundational to the pre-Christian political and economic life, it became a threat to post-Christian life.

In his recently published Marsden-funded book "The Polynesian Iconoclasm: Religious Revolution and the Seasonality of Power", Associate Professor Sissons shows that widespread destruction of images, temples and marae preceded mass conversions of Maori to Christianity in the 1840s.

At the heart of tapu-removing events lie the activities of the Taranaki priest, Tamati Te Ito, the leader of a Christian movement that came to be known as Kaingarara (Reptile-eaters). During the 1850s, Te Ito performed public rites to remove tapu in wāhi tapu (sacred groves), where tūāhu were often located. Such rites spread to other regions, including Northland and the lower South Island.

Associate Professor Sissons will document more fully the development and influence of Tamati Te Ito's tapu-removal movement and its impact on the sacred and political landscape of Māori throughout Aotearoa.

This project will contribute towards Māori knowledge of sacred sites and help explain contemporary relationships between iwi and wāhi tapu.

Stretching the celluloid ceiling: women in the Pacific film industry

The creative economy – which includes industries such as music, film, and fashion – was glamorised in the late 1990s and is now backed by governments, think-tanks and donors as a development strategy. In the Pacific, development donors and regional organisations are currently working to build the creative economy, with the film industry as a key sector.

However, fundamental tensions exist in high-level support for this economy in the world's poorer regions. Globally the film industry – known for its 'celluloid ceiling' – is marked by severe gender inequality. Women are paid less and struggle to access funding, resources and professional networks. They are also vastly underrepresented in key roles like directing, screenwriting, cinematography and production.

Dr Polly Stupples from Victoria University of Wellington has received a Marsden Fast-Start grant to study the influence of women in the emergent Pacific film industry. Her project will map the involvement of women in key behind-camera roles, and investigates their aspirations, challenges, and opportunities as film-makers through personal interviews.

The creative economy's strong focus on 'commercial' outcomes can also obscure cultural or political influences derived from creative practice. Dr Stupples and her Australian colleagues will interview donors and industry personnel, analysing these perspectives in relation to policy debate.

Dr Polly Stupples.

This project will bring the voices of Pacific women film-makers into closer dialogue with each other, and with the bureaucratic process of 'developing a creative economy'. As a result, it seeks to make the global debate more responsive to context, culture and gender.

Why do inbred males fire blanks?

Two important outcomes of inbreeding are reduced fertility and the reduced health of offspring. It follows that inbreeding would be particularly detrimental to threatened species, of which New Zealand has many – especially birds.

Dr Helen Taylor from the University of Otago's Anatomy Department has received a Marsden Fund Fast-Start grant for a world-first study of male inbreeding infertility in wild birds.

Infertility in birds has been studied before, but captive and laboratory populations of a single species were used. Dr Taylor has selected four bird species – blackbirds, South Island robins, dunnocks and hihi/stitchbirds – for genetic assessment.

Dr Taylor's study aims to identify general trends across species as well as trends within species, for example, comparisons between the sperm of inbred versus outbred birds.

The team will conduct computer-assisted sperm analysis and DNA fragmentation assessment to clarify the relationship between inbreeding and sperm quality. They aim to identify genes that might be responsible for infertility in inbred males.

Results will aid in the management of threatened species, improve captive breeding programs and be of interest worldwide to people working on biodiversity. This research also has the potential to inform agricultural practice.

Dr Helen Taylor with South Island robin.
Image credit: Robyn White.

Exploring Māori social justice concepts

What makes a just society? What would it take for humanity to live together justly on a global scale? Crucially for us as New Zealanders, how can we ensure that Māori and other indigenous perspectives get an equal share in discussions about social and global justice?

Dr Krushil Watene of Massey University Auckland has received a Marsden Fast-Start grant for her innovative project in political philosophy that will explore a Māori approach to these vital questions.

Dr Watene will introduce into international scholarly discussion an understanding of social justice with whakapapa, mana and manaakitanga at its core. She will then relate this approach to other indigenous concepts and to 'mainstream' theories of justice in western philosophy.

At present there is little recognition of social or global justice from the perspectives of non-western philosophical traditions. Instead, interest has largely centred on how western theories of justice accommodate and can be applied to indigenous peoples; failing to take seriously how their values, needs and aspirations shape our ideas about social justice.

Plato provided a framework for discussion which we generally accept as the precursor to our modern society. But what would Plato's Republic have sounded like if he had taken ideas that are basic to Māori society as his starting point?

Dr Krushil Watene.

This project breaks new ground by explicitly bringing Māori and other indigenous perspectives into the global conversation. Thus, it has strong potential to enrich and develop our thinking about social justice and initiate a new framework for global justice theorising.

Te hōpara i ngā ariā ture pāpori Māori

He aha ngā āhuatanga o te pāpori tika? Me pēhea e noho tahi ai te iwi whānui i runga i te tika puta noa i te ao? Otirā mō tātau o Aotearoa, me pēhea tā tātau whakaū ka ōrite te whai wāhi o ngā tirohanga a te Māori me ētahi atu iwi taketake ki roto i ngā matapaki mō te ture pāpori, ā-ao hoki?

Kua whakawhiwhia a Tākuta Krushil Wātene o Te Kunenga ki Pūrehuroa Tāmaki Makaurau ki tētahi takuhe Fast-Grant a Marsden mō tana kaupapa rangahau auaha e pā ana ki te mātauranga whakaaro tōrangapū ka hōpara i tētahi aronga Māori ki ēnei tino pātai.

Ka whakaurua e Tākuta Wātene ki ngā matapaki mātauranga ā-ao he māramatanga o te ture pāpori ko tōna iho ko te whakapapa, te mana me te manaakitanga. Ka whakahāngai anō e ia tēnei aronga ki ētahi atu ariā iwi taketake me ngā kaupapa whakaaro 'auraki' o te ture i roto i te mātauranga whakaaro tauiwi.

I tēnei wā he tino iti te whakamana i te ture pāpori, ā-ao rānei mai i ngā tirohanga o ngā tikanga mātauranga whakaaro o ngā iwi tūturu. Engari, ka aro kē ngā kōrero ki te āhua o te whakarite i ngā kaupapa whakaaro ture tauiwi ki ngā iwi taketake; me te kore whakapono ki te āhua o ā rātau uara, hiahia, tūmanako e waihanga nei i ō tātau whakaaro mō te ture pāpori.

I whakatakotohia e Plato he pou tarāwaho matapaki e whakaaehia whānuitia ana koinei te tīmatanga o tō tātau ao hou. Engari ka pēhea te āhua o te Whenua Manapori o Plato mēnā i whai ia i ētahi āhuatanga taketake o te ao Māori hei wāhi tīmatanga mōna?

He āhuatanga hou tēnei rangahau nā te heri i ngā tirohanga Māori me ētahi atu tirohanga iwi taketake ki te matapaki ā-ao. Nō reira, he āheinga tōna hei whakarangatira, hei whakawhanake hoki i ō tātau whakaaro mō te ture pāpori me te tīmata i tētahi pou tarāwaho hou mō te waihanga kaupapa whakaaro ture ā-ao.

Pacific rat coprolite (preserved dung).

DNA from dung – reconstructing prehistoric ecosystems

Ancient-DNA technology is a rapidly growing field worldwide, driven by new analytical techniques (next generation sequencing) and more precise extraction. In New Zealand, recently set up laboratories are powering an explosion of investigations into the past.

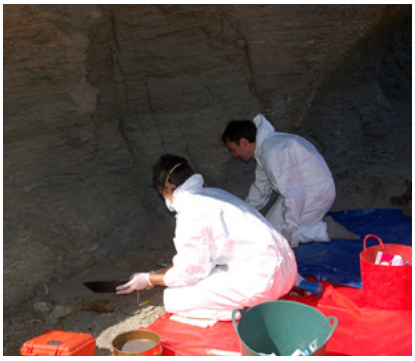
Associate Professor Janet Wilmshurst from Manaaki Whenua Landcare Research and The University of Auckland is one of several researchers in this field to receive Marsden funding. Associate Professor Wilmshurst and her team will study DNA, pollen, seeds, feathers and parts of invertebrates and plants from newly discovered kiore (Pacific rat) coprolites (preserved dung) found in rock crevices in Central Otago. The team will also seek out other sites of kiore coprolites in the North and South Islands.

The kiore was the first and only exotic mammal to naturalise in New Zealand in the 500 years before European settlement. With the discovery of these coprolites the complete history of a rat invasion can be reconstructed, right back to the kiore's arrival with Māori in the 13th century.

By analysing DNA in ancient kiore dung, Associate Professor Wilmshurst will find out what these invasive rats were feeding on (e.g. birds, reptiles, amphibians, invertebrates, plants). Radiocarbon dating will reveal how the diet of these rats, and their impact on vulnerable animals and plants, changed over time.

Other questions the project will address are the role kiore played in seed predation and dispersal, and whether rat predation contributed to the extinction of much larger animals such as the moa, more than is currently believed.

This project will provide a global benchmark for understanding prehistoric island invasions and rat impacts on a pristine island ecosystem.



Janet Wilmshurst (left) and Jamie Wood (right).

He pītauira mai i te tūtae – te hanga hou anō i ngā pūnaha rauropi onamata

Ko ngā hangarau pītauira tētahi rāngai e tere ana te tipu i te ao whānui, e kōkirihia ana e ngā tikanga tātari hou (whakaraupapa reanga hou) me ngā tangohanga tino hāngai ake. I Aotearoa nei, kei te kōkirihia e ngā taiwhanga hou ngā tūhuratanga nui ki ngā rā ō nehe.

Ko Ahorangi Tuarua Janet Wilmshurst o Manaaki Whenua tētahi o ngā kairangahau maha o tēnei rāngai i whiwhi pūtea Marsden. Ka rangahau a Ahorangi Tuarua Wilmshurst i ngā pītauira mai i ngā tūtae ukauka o te kiore o Te Moananui a Kiwa i kitea i ngā pōhatu matata i Te Pū o Ōtākou.

Ko te kiore anake te kararehe o tāwāhi i noho tūturu mai ki Aotearoa i ngā tau e 500 i mua i te taenga mai o tauiwi ki Aotearoa noho ai. Nā te kitenga o ēnei tūtae ukauka, ka taea te hanga hou anō te hītori whānui o te urutomotanga o te kiore, tae noa ki te taenga mai o te kiore me te Māori i te rau tau 13.

Mā te tātari i te pītauira i roto i ngā tūtae kiore o nehe, ka kitea e Ahorangi Tuarua Wilmshurst he aha ngā kai a ēnei kiore (hei tauira, he manu, moko, nukuwai, hātaretare, tipu hoki). Mā te tatau ā-waro i te tawhito ka whakaatu i pēhea te pānga o te kai a ēnei kiore ki ngā kararehe me ngā tipu i noho mōrea i roto i te wā.

Ko ētahi atu pātai ka tirohia e te kaupapa rangahau ko te wāhanga o te kiore i roto i te konihitanga me te whakakorara kākano, ā, mēnā ko te konihitanga kiore anō tētahi pūtake i ngaro ai ngā kararehe nui ake, pēnei i te moa, kāore nei i te tino whakaarohia i tēnei wā.

Ka whakatakoto e tēnei kaupapa rangahau tētahi taumata ā-ao mō te whai māramatanga ki ngā urutomo motu onamata me ngā pānga o te kiore ki tētahi pūnaha rauropi motu urutapu.

Determining the potential of the corneal transition zone for corneal transplants

Disease, damage or loss of the innermost layer of the cornea (the corneal endothelium), can result in blindness. Current methods to repair the affected cornea involve corneal transplantation using donor endothelium. However, there isn't a sufficient supply of donor cornea, limiting the number of patients that can be treated. And there is an increasing demand for corneal donors in New Zealand, partly driven by an ageing population and increased life expectancy.

Dr Jie Zhang, from the Department of Ophthalmology at The University of Auckland, has been awarded a Marsden Fast-Start grant, with the ultimate aim of increasing the number of patients who can be treated from a single donor.

Dr Zhang will investigate a particular type of adult stem cell that has recently been found in a specific area of the cornea called the transition zone. This type of cell looks to have the potential to regenerate the corneal endothelium. The purpose of this research is to understand and manipulate these corneal cells, with the goal of treating corneal disease. If successful, each donor cornea could be a source for several transplants.

Dr Jie Zhang.

2016 Marsden Fund recipients

FAST-START GRANTS

CONTRACT	TITLE	PRINCIPAL INVESTIGATORS	FUNDS
CAW1601	**Blooming buddies: Explaining the co-existence of toxic and non-toxic strains in algal blooms**	Dr J Puddick (Cawthron Institute)	$300,000
CTM1601	**Early birds: insights from the fossil record into the evolutionary and ecological histories of shorebirds**	Dr VL De Pietri (Canterbury Museum)	$300,000
GNS1601	**Methanotroph's dirty little secret: they are not metabolically monogamous!**	Dr CR Carere (GNS Science)	$300,000
GNS1602	**Exposing New Zealand's hidden faults: Strain distribution across the South Island's faulted crust**	Dr IJ Hamling (GNS Science)	$300,000
LIU1601	**Reindigenising the Biosecurity System**	Dr A Black (Lincoln University)	$300,000
MAU1601	**Why fly when you can walk? Genetic pathways to flightlessness**	Dr GC Gibb (Massey University Manawatu)	$300,000
MAU1602	**'A Union of Hearts and Wills'? Second World War Conscription and New Zealand Society**	Dr DC Littlewood (Massey University Manawatu)	$300,000
MAU1603	**Exploring Māori Social Justice Concepts**	Dr KPM Watene (Massey University Auckland)	$300,000
MAU1606	**Floating families? New Chinese migrants in New Zealand and their multi-generational families**	Dr LS Liu (Massey University Auckland)	$300,000
MAU1607	**Hearing the Difference: New Strategies for Listening in Contemporary Politics**	Dr EJ Beausoleil (Massey University Manawatu)	$300,000
NIW1601	**The ocean vacuum-cleaner: Salp effects on the marine carbon cycle**	Dr MR Decima (NIWA)	$300,000
UOA1603	**Measuring in vivo activity in the prefrontal cortex and its link to Autism Spectrum Disorders**	Dr JE Cheyne (Netherlands Institute for Neuroscience)	$300,000
UOA1604	**Determining the potential of the corneal Transition Zone as corneal endothelial transplants**	Dr J Zhang (The University of Auckland)	$300,000
UOA1605	**The mechanics of mitochondrial derived peptides (MDP)**	Dr TL Merry (The University of Auckland)	$300,000
UOA1607	**Naturally biased? Exploring neuropeptide signal pathway bias in neurons**	Dr CS Walker (The University of Auckland)	$300,000
UOA1612	**Why don't orchid pollinators go extinct? A new mechanism for the maintenance of coevolutionary relationships**	Dr AC Gaskett (The University of Auckland)	$300,000
UOA1613	**Melt inclusions as a 'window' through the crust: What drives the most productive region of silicic volcanism on Earth?**	Dr SJ Barker (The University of Auckland)	$300,000
UOA1616	**Implicit Language Aptitude: How to Learn a Second Language Unconsciously**	Dr S Li (The University of Auckland)	$300,000
UOA1621	**Nano-containers for signals to cells – when and where they are needed**	Dr J Malmstrom (The University of Auckland)	$300,000
UOA1623	**New Phosphors for White Light Emitting Diodes (LEDs)**	Dr SF Huang (The University of Auckland)	$300,000
UOA1624	**A Law Beyond Democracy: The Insulation of Private Law from Democratic Change**	Dr A Rosen (The University of Auckland)	$300,000
UOA1628	**Dependence Logic and Its Applications**	Dr MJ Hannula (The University of Auckland)	$300,000
UOA1629	**Novel Decomposition Techniques for Multiobjective Optimisation**	Dr A Raith (The University of Auckland)	$300,000
UOA1632	**Semiconductor Catenation using Catalysis**	Dr EM Leitao (The University of Auckland)	$300,000

CONTRACT	TITLE	PRINCIPAL INVESTIGATORS	FUNDS
UOA1634	**Welfare capital and the new welfare state: A comparative study of privately financed welfare services in the Anglophone world**	Dr T Baker (The University of Auckland)	$300,000
UOA1635	**A fire in the belly of Hineāmaru – Ngāpuhi distinctiveness**	Associate Professor MJ Webber (The University of Auckland)	$300,000
UOA1637	**Power to the People? Investigating the Politics and Resilience of Community Energy Initiatives in New Zealand, the UK, and Denmark**	Dr JL MacArthur (The University of Auckland)	$300,000
UOC1604	**Brain inspired on-chip computation using self-assembled nanoparticles**	Dr SK Bose (University of Canterbury)	$300,000
UOC1606	**Unique Acoustic Signatures to Diagnose Impending DOOM (Dysfunction Of Osteo-Mechanics)**	Associate Professor GW Rodgers (University of Canterbury)	$300,000
UOO1608	**Uncovering the physiological roles of the multiple NDH2 in bacterial genomes**	Dr Y Nakatani (University of Otago)	$300,000
UOO1611	**Do glaciers drive diversity? Using ancient DNA to retrace the history of New Zealand's biodiversity**	Dr NJ Rawlence (University of Otago)	$300,000
UOO1614	**Why do inbred males fire blanks? Unravelling the relationship between inbreeding and infertility**	Dr HR Taylor (University of Otago)	$300,000
UOO1615	**How does the Earth stop Global Warming? Testing climate stabilisation during 'hyperthermal' events.**	Dr MO Clarkson (ETH Zürich)	$300,000
UOO1618	**Remembering together: Collective memory and collective intentionality**	Dr KH Michaelian (University of Otago)	$300,000
UOO1619	**Splitting up the farm? A cross-cultural history of land and inheritance in Aotearoa**	Dr JM McCabe (University of Otago)	$300,000
UOO1620	**Optical Network-on-Chips (ONoCs): Architectures and Routing Algorithms for Ultra High-Throughput and Energy-Efficient On-Chip Communications**	Dr YC Chen (The University of Otago)	$300,000
UOO1621	**A green approach to denitrification of water**	Dr AL Garden (University of Otago)	$300,000
UOO1623	**Acute Mental Health Wards: Therapeutic Spaces or Stigmatising Places?**	Dr GLS Jenkin (University of Otago, Wellington)	$300,000
UOW1602	**While you were sleeping: Nap-dependent emotional memory processing in infants**	Dr S Seehagen (University of Waikato)	$300,000
UOW1603	**The dating game of loanwords: linguistic and sociolinguistic characteristics influencing loanword usage**	Dr AS Calude (University of Waikato)	$300,000
VUW1604	**Finding the needle by removing the haystack: modeling diffuse foregrounds to detect the Epoch of Reionization**	Dr QC Zheng (Victoria University of Wellington)	$300,000
VUW1605	**Establishing natural baselines of glacier variability in a warm world**	Dr SR Eaves (Victoria University of Wellington)	$300,000
VUW1606	**Fractionating face blindness: Creating a taxonomy for developmental prosopagnosia**	Dr T Susilo (Victoria University of Wellington)	$300,000
VUW1607	**Children's understanding of shared knowledge and its importance for effective communication**	Dr A Martin (Victoria University of Wellington)	$300,000
VUW1614	**Automatic Design of Heuristics for Dynamic Arc Routing Problem with Genetic Programming**	Dr Y Mei (Victoria University of Wellington)	$300,000
VUW1615	**Large-scale Evolutionary Feature Selection for Classification**	Dr B Xue (Victoria University of Wellington)	$300,000
VUW1621	**East Side Orchestras: Music, Poverty, and Social Change**	Dr L Gibson (Victoria University of Wellington)	$300,000
VUW1622	**Citizenship in Aotearoa New Zealand: Young people, belonging and changing times**	Dr BE Wood (Victoria University of Wellington)	$300,000
VUW1625	**Stretching the celluloid ceiling: women's creative agency in the emergent Pacific film industry.**	Dr PT Stupples (Victoria University of Wellington)	$300,000

STANDARD GRANTS

CONTRACT	TITLE	PRINCIPAL INVESTIGATORS	FUNDS
ESR1601	**A new approach to studying Legionella mobility and persistence in engineered water systems**	Dr L Pang (Institute of Environmental Science & Research Ltd)	$830,000
LCR1601	**In one end out the other: using ancient dung to reconstruct the transformation of prehistoric island ecosystems by invasive rats**	Associate Professor JM Wilmshurst (Manaaki Whenua – Landcare Research)	$830,000
MAU1604	**Playing dice with Fermi: Full configuration interaction quantum Monte Carlo for fermionic superfluids**	Professor J Brand (Massey University Albany)	$870,000
MAU1605	**"The land has eyes and teeth": customary landowners' entanglements with economic systems in the Pacific**	Professor RA Scheyvens (Massey University Manawatu)	$735,000
NIW1602	**Corals, currents, and phytoplankton: Reconstructing 3000 years of circulation and marine productivity in the world's largest ocean gyre**	Dr HL Neil (NIWA)	$850,000
NIW1603	**Active submarine landslides ride on gas pockets**	Dr JJ Mountjoy (NIWA), Dr GJ Crutchley (GNS Science)	$870,000
UOA1601	**PilVax: a novel peptide delivery strategy for the development of vaccines**	Associate Professor TK Proft (The University of Auckland)	$825,000
UOA1602	**Stop or go? Unravelling the mechanisms behind lymphatic vessel patterning.**	Dr JW Astin (The University of Auckland)	$820,000
UOA1606	**Mum, you are what your babies make you!**	Professor LW Chamley (The University of Auckland)	$800,000
UOA1608	**Making receptors fly: using mass spectrometry to reveal mechanisms of G protein-coupled receptor function**	Professor DL Hay (The University of Auckland)	$810,000
UOA1609	**Spectacles in a bottle: Pharmacological regulation of the physiological optics of the ocular lens**	Professor PJ Donaldson (The University of Auckland)	$810,000
UOA1610	**Does rapid evolutionary adaptation to temperature heat up the role of consumer body size in ecosystems?**	Dr KS Simon (The University of Auckland)	$675,000
UOA1611	**Genomes, phenotypes and fossils: integrative models of species evolution**	Dr D Welch (The University of Auckland), Professor AJ Drummond (The University of Auckland)	$830,000
UOA1614	**Opening Nature's vaults: speleothem archives of volcanic eruptions**	Professor JA Baker (The University of Auckland)	$870,000
UOA1615	**Sight unseen: penetrating the enigma of unconscious vision.**	Associate Professor AJ Lambert (The University of Auckland)	$675,000
UOA1617	**Beyond the Jury Paradox: Collective Decision-Making without Common Priors**	Dr S Lippert (The University of Auckland), Dr S Fabrizi (Massey University Auckland)	$705,000
UOA1618	**New Methods of Panel Data Forecasting Applied to New Zealand's Property Market**	Dr RT Greenaway-McGrevy (The University of Auckland), Distinguished Professor PCB Phillips (The University of Auckland)	$705,000
UOA1619	**The making of Maori society: an archaeological analysis of social networks and geo-political interaction.**	Professor TN Ladefoged (The University of Auckland)	$705,000
UOA1620	**Coronary blood flow survives the heartbeat: How?**	Professor NP Smith (The University of Auckland)	$830,000
UOA1622	**New Optical Sensors for Geophysical Applications**	Professor NGR Broderick (The University of Auckland)	$830,000
UOA1625	**Ancient Futures: Late 18th and early 19th century Tongan arts and their legacies**	Dr PS Herda (The University of Auckland)	$530,000
UOA1626	**Symmetry, group structure, algorithms and representations**	Associate Professor J An (The University of Auckland), Distinguished Professor MDE Conder (The University of Auckland), Professor EA O'Brien (The University of Auckland)	$500,000
UOA1627	**Geometric structures critical for analysis and physical theories**	Professor AR Gover (The University of Auckland)	$525,000
UOA1630	**Advanced mathematical and cryptographical tools for software protection**	Associate Professor G Russello (The University of Auckland), Professor SD Galbraith (The University of Auckland)	$590,000

CONTRACT	TITLE	PRINCIPAL INVESTIGATORS	FUNDS
UOA1631	**Understanding the geometry of dynamics: invariant manifolds and their interactions**	Professor HM Osinga (The University of Auckland)	$590,000
UOA1633	**Understanding internal communication within proteins**	Dr G Bashiri (The University of Auckland), Dr JM Johnston (The University of Auckland)	$870,000
UOA1636	**Power Politics: Electricity and Sustainability in Post-Disaster Ōtautahi (Christchurch)**	Associate Professor SD Matthewman (The University of Auckland)	$630,000
UOA1638	**Māori, Pasifika Youth and Justice: International Comparisons**	Dr RD Webb (The University of Auckland), Associate Professor TM Suaalii-Sauni (The University of Auckland)	$695,000
UOC1601	**Quantifying the importance of non-additive competition in diverse natural plant communities**	Associate Professor DB Stouffer (University of Canterbury), Associate Professor MM Mayfield (University of Queensland)	$795,000
UOC1602	**Counting the number and distribution of planets in the Galaxy.**	Associate Professor MD Albrow (University of Canterbury)	$870,000
UOC1603	**An Artificial Algebra for Implicit Learning of Mathematical Structure**	Professor RC Grace (University of Canterbury), Professor S Kemp (University of Canterbury)	$705,000
UOC1605	**New methods for imaging biological macromolecules using x-ray free-electron lasers**	Professor RP Millane (University of Canterbury), Professor HN Chapman (DESY and Hamburg University)	$830,000
UOC1607	**What is the Southland accent?**	Dr L Clark (University of Canterbury)	$530,000
UOC1608	**A new paradigm for organelle targeting**	Professor AJ Fairbanks (University of Canterbury)	$870,000
UOO1601	**Hypothalamic Inflammation: Cause of leptin resistance and obesity?**	Dr A Tups (University of Otago)	$795,000
UOO1602	**Drinking for two: Central resetting of water balance in pregnancy and lactation**	Professor CH Brown (University of Otago)	$825,000
UOO1603	**Unraveling the key role of cytochrome bd oxidase in antimicrobial lethality in tuberculosis**	Professor GM Cook (University of Otago), Professor KL Krause (University of Otago)	$825,000
UOO1604	**Bones under pressure. How does the skeleton sense gravity?**	Professor SP Robertson (University of Otago)	$825,000
UOO1605	**In vivo gene editing with CRISPR to define estrogen feedback in the brain**	Professor AE Herbison (University of Otago)	$825,000
UOO1606	**The genes of life and death: a role for placental-specific genes in cancer?**	Professor MR Eccles (University of Otago)	$825,000
UOO1607	**Becoming master of your destiny: insights into genome activation from nuclear structure**	Associate Professor JA Horsfield (University of Otago), Associate Professor JM O'Sullivan (The University of Auckland)	$810,000
UOO1609	**Silencing unwanted expression in molecular circuits using naturally evolved solutions**	Professor CW Ronson (University of Otago)	$750,000
UOO1610	**Growth factors mediating prolactin-induced neurogenesis in the adult brain**	Professor DR Grattan (University of Otago)	$810,000
UOO1612	**Epigenetics and Evolutionary Theory**	Professor HG Spencer (University of Otago)	$825,000
UOO1613	**Parasitic Puppeteers – How do They Pull the Strings?**	Professor NJ Gemmell (University of Otago)	$830,000
UOO1616	**Digging into the biggest explosive submarine eruption ever "seen" to understand seafloor volcanism**	Professor JDL White (University of Otago)	$855,000
UOO1617	**Quit or persist? The neural mechanisms of forfeit behaviour**	Dr KL Hillman (University of Otago)	$705,000
UOO1622	**The origins and development of pre-European contact musical instruments in Aotearoa (New Zealand), Rekohu and Rangiaotea (Chatham and Pitt Islands).**	Mr MA Solomon (Hokotehi Moriori Trust), Dr JA Cattermole (University of Otago)	$530,000
UOW1601	**Using New Zealand's divaricate plants to test a new hypothesis about the evolution of anti-browsing defences**	Dr CH Lusk (The University of Waikato)	$830,000
UOW1604	**Macromolecular rate theory (MMRT) and the catalytic power of enzymes**	Professor VL Arcus (University of Waikato), Professor AJ Mulholland (University of Bristol)	$870,000

CONTRACT	TITLE	PRINCIPAL INVESTIGATORS	FUNDS
UOW1605	**Counting our Tūpuna: Colonisation and Indigenous Survivorship in Aotearoa NZ**	Professor TH Kukutai (University of Waikato)	$735,000
VUW1601	**From parasitism to mutualism: symbiosis interaction states and the adaptability of reef corals to climate change**	Professor SK Davy (Victoria University of Wellington)	$830,000
VUW1602	**Testing for Fishing-Induced Evolution using DNA from Ancient and Modern Snapper**	Dr PA Ritchie (Victoria University of Wellington), Dr B Star (University of Oslo)	$830,000
VUW1603	**Mapping the Cosmic Web with the Murchison Widefield Array**	Associate Professor M Johnston-Hollitt (Victoria University of Wellington)	$870,000
VUW1608	**Nanostructuring in iron-based wires for ultra-high current density**	Dr SV Chong (Victoria University of Wellington)	$720,000
VUW1609	**Distributed Processing with Information Privacy in Sensor Networks**	Professor WB Kleijn (Victoria University of Wellington)	$790,000
VUW1610	**Constituent Power and the Law**	Dr I Colon-Rios (Victoria University of Wellington)	$420,000
VUW1611	**Woe is me': women and complaint in the English Renaissance**	Dr SCE Ross (Victoria University of Wellington)	$450,000
VUW1612	**The Mysterious Disappearance of Tuuaahu**	Associate Professor JD Sissons (Victoria University of Wellington)	$390,000
VUW1613	**Dimension reduction for mixed type multivariate data**	Associate Professor RA Arnold (Victoria University of Wellington), Dr I Liu (Victoria University of Wellington)	$550,000
VUW1616	**On the theory of distribution-free tests for statistical hypothesis and unitary operators in functional spaces**	Professor EV Khmaladze (Victoria University of Wellington)	$585,000
VUW1617	**The Mathematics of Computation**	Professor RG Downey (Victoria University of Wellington), Dr AG Melnikov (Massey University Auckland)	$565,000
VUW1618	**Probing the optical absorption of molecules adsorbed on metallic nanoparticles**	Professor EC Le Ru (Victoria University of Wellington)	$840,000
VUW1619	**The missing link: A traceless linking strategy for the conjugation of complex carbohydrates to proteins and peptides**	Associate Professor MSM Timmer (Victoria University of Wellington)	$870,000
VUW1620	**The origin of UV photoprotection in the brown skin pigment eumelanin**	Associate Professor JM Hodgkiss (Victoria University of Wellington)	$870,000
VUW1623	**War and peace in the Nursery: How do young children negotiate conflict to establish belonging and well-being in a multi-ethnic NZ early childhood centre?**	Professor MC Dalli (Victoria University of Wellington)	$735,000
VUW1624	**A 'Big Data' Approach to the Problem of Electoral Turnout**	Professor J Vowles (Victoria University of Wellington)	$635,000
VUW1626	**Ngā Takahuringā ō te ao – The effect of Climate Change on Traditional Māori Calendars**	Dr PL Harris (Victoria University of Wellington)	$720,000

For the complete list of awarded Marsden Fund investigators please see:
www.royalsociety.org.nz/what-we-do/funds-and-opportunities/marsden/awarded-grants/marsden-awards-2016/

Marsden Fund

Royal Society Te Apārangi
11 Turnbull St, Thorndon, PO Box 598
Wellington 6140, New Zealand
Phone: +64 4 470 5799
Email: marsden@royalsociety.org.nz

ISSN 1175-0073

MARSDEN FUND
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