Issue No.54

MARSDEN FUND 2018 UPDATE

MARSDEN FUND
TE PŪTEA RANGAHAU A MARSDEN

ROYAL SOCIETY TE APĀRANGI

Mō te Pūtea a Marsden

E whakahaerehia ana te Pūtea Marsden e Te Apārangi mō te taha ki te kāwanatanga.

E tautoko ana te Pūtea a Marsden i te hiranga i roto i ngā rangahau tino mātāmua rawa i Aotearoa. Ka tīpakohia ngā kaupapa i ia tau mā tētahi tukanga pakari e ngā rōpū whiriwhiri tekau e ārahina ana e ngā whakaaro o ngā kairangahau ā-ao, whakaihuwaka ā-ao hoki. Ko te tikanga ka rato ngā pūtea ki te toru tau mō ia takuhe.

E rua ngā momo takuhe: Ngā takuhe Tīmata-Wawe $300 mano (kore GST) te wāriu i roto i te toru tau mā ngā kairangahau pūhou, ā, ka taea te tuku takuhe Aro Whānui atu ki te $960 mano (kore GST) mō te toru tau. Ka utua e ngā takuhe ngā utu ā-tau, ngā tūranga ākonga me te kairangi, me ngā taonga hoki.

He kairapu te Pūtea a Marsden, ā, mō ngā kaupapa ā-kaitūhura, ka mutu kāore e herea ana ki ngā kaupapa matua a te kāwanatanga. E whakahaerehia ana e Te Apārangi, ā, nā te Kāwanatanga o Aotearoa te pūtea.

He mea whakaingoa tēnei Pūtea ki te kaiahupūngao a Tā Ernest Marsden. He mea whakatū e te kāwanatanga i te tau 1994.

E kīia ana ko te Pūtea a Marsden te taumata o te hiranga, e taea ai e ngā kairangahau toa rawa o Aotearoa te hōpara i ō rātau huatau.

Mō Te Apārangi

He whakahaere huamoni-kore motuhake a Te Apārangi e tautoko ana i ngā tāngata o Aotearoa ki te hōpara, tūhura me te tuari mōhiotanga.

Ka tuku pūtea mā ana kaupapa me te tuku whai wāhitanga akoranga ki ngā kairangahau, kaiako, ākonga kura, me rātau e pakiki ana ki te ao.

Hei whakanui i ngā tūhuratanga o ngā kairangahau o Aotearoa, ka whakawhiwhia e Te Apārangi ngā mētara me te tohu Pūkenga, he manukura nō ō rātau wāhanga. Ka āwhina ēnei tohunga i te Apārangi ki te tuku tohutohu motuhake ki ngā tāngata o Aotearoa me te kāwanatanga mō ngā take e arohia ana e te iwi whānui.

He whānui te kōtuinga mema me ngā hoa o Te Apārangi puta noa i Aotearoa me te pōhiri i te hunga e kaingākau ana ki ngā mahi a ngā tāngata o Aotearoa ki te hōpara, tūhura me te tuari mōhiohio kia whakauru mai.

Mō ētahi atu kōrero anō haere ki royalsociety.org.nz

About the Marsden Fund

The Marsden Fund supports excellence in leading-edge research in New Zealand. Projects are selected annually in a rigorous process by ten panels which are guided by the opinions of world-leading, international researchers. Funding is usually spread over three years for each grant.

There are three types of grants: Fast-Start grants worth $300K (excl. GST) over three years for early career researchers; Standard grants that can be worth up to $960K (excl. GST) for three years; and Marsden Fund Council Award grants worth up to $3 million (excl. GST) over three years. Grants pay for salaries, students and postdoctoral positions, and consumables.

The Marsden Fund is contestable, is for investigator-driven research projects, and is not subject to government priorities. It is administered by Royal Society Te Apārangi and funded by the New Zealand Government.

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 ideas.

Ernest Marsden

About Royal Society Te Apārangi

Royal Society Te Apārangi is an independent not-for-profit organisation that supports all New Zealanders to explore, discover and share knowledge.

Its varied programmes provide funding and learning opportunities for researchers, teachers and school students, together with those who are simply curious about the world.

To celebrate the discoveries of New Zealand researchers, the Society awards medals and elects Fellows, who are leaders in their fields. These experts help the Society to provide independent advice to New Zealanders and the government on issues of public concern.

The Society has a broad network of members and friends around New Zealand and invites all those who value the work New Zealanders do in exploring, discovering and sharing knowledge to join with them.

To discover more visit royalsociety.org.nz

2018 Marsden Fund grants support innovative research in Aotearoa from atoms to Antarctica's microbes

The Marsden Fund allocated $85.6 million (excluding GST) to a total of 136 research projects across New Zealand in 2018. These grants support New Zealand's best investigator-initiated research in the areas of science, engineering, maths, social sciences and the humanities.

In total, 83 grants have been awarded to established researchers. Projects span a range of nationally and internationally relevant issues: from a longitudinal study of self-harm and suicidal behaviour in New Zealand youth, to building a better 'immune system' for software, and from exploring the quantum entanglement of individual atoms, to examining the survival of life in the harsh conditions of Antarctica's Dry Valleys.

Grants to early career researchers have risen from 49 last year to 53 in 2018. Support for early career researchers will enable these talented individuals to establish their careers in New Zealand and build momentum in their areas of research. These researchers will study topics that include improving immunotherapy for cancer, how microplastics first enter our food chain and unique Māori navigational knowledge and practices.

Marsden Fund Council Chair Professor David Bilkey says: "The Marsden Fund is designed to enable our top researchers to develop their most ambitious and exciting ideas. This 'blue-sky' funding is vital to ensuring a vibrant research culture in our country, and the resulting work will help us better understand our environment and society. Some of these fundamental discoveries will also lead to new, and sometimes unexpected, solutions to current problems, in areas as diverse as health care, sustainability and social policy."

Professor Bilkey is pleased to see steadily increasing representation of women and Māori amongst the successful researchers. "It is also gratifying that Marsden Fund applicants who identify as female or Māori have been as successful as male and non-Māori applicants over the past five years. We will continue to monitor the Fund's processes to make sure under-represented groups are not disadvantaged."

"I am also delighted to see strong engagement with mātauranga Māori in applications across a diverse range of disciplines. These range from a study of Māori responses to 20th century welfare policies, to the use of a waka-based craft to access and investigate remote volcanoes," says Professor Bilkey. "These projects exemplify the thoughtful integration of Māori knowledge and methods with specific disciplinary approaches, and were evaluated as both rigorous and innovative by world-leading international referees."

The overall success rate for applicants has continued to rise slightly, from 10.7% in 2016 to 12% in 2017 and 12.4% this year. The success rate for Fast-Start grants for early career researchers was 14.8%. The amount of funding awarded this year, and thus the success rate, remains at an all-time high due to ongoing government support.

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

E tautoko ana ngā takuhe a Te Pūtea a Marsden i ngā rangahau auaha i Aotearoa mai i ngā rāpoi ngota tæ atu ki ngā moroiti o Te Kōpaka Runga

He $85.6 miriona (GST kore) kua tohaina e Te Pūtea a Marsden ki ngā kaupapa rangahau 136 puta noa i Aotearoa. E tautoko ana ēnei takuhe i ngā rangahau ā-tūhura rawe rawa i Aotearoa i roto i ngā wāhanga o te pūtaiao, mātauranga pūkaha, pāngarau, mātauranga pāpori me te aronui.

Huihui katoa, e 83 ngā takuhe kua whakawhiwhia ki ngā kairangahau matatau. E kapi ana ngā kaupapa i ngā take hāngai ā-motu, ā-ao hoki: mai i tētahi rangahau whāroa o te whakamamae whaiaro me ngā whanonga whakamomori o te hunga taiohi o Aotearoa, tae atu ki tētahi 'pūnaha ārai wheori' pai ake mō ngā pūmanawa rorohiko, ā, mai i te hōpara i te whīwhiwhitanga tataunga o ngā ngota, tae atu ki te āta tirotiro i te oranga i roto i ngā āhuatanga uaua rawa o Ngā Whārua Maroke o Te Kōpaka Runga.

Kua piki ake ngā takuhe ki ngā kairangahau pūhou mai i te 49 i tērā tau ki te 53 i te tau 2018. Mā te tautoko i ngā kairangahau pūhou ka noho tonu ēnei tāngata pūmanawa ki te whakaū i ā rātau umanga mahi ki Aotearoa me te whakapakari haere i a rātau anō i roto i ō rātau ake wāhanga rangahau. Ka rangahau ēnei kairangahau i ngā kaupapa pērā i te whakapai ake i te haumanu ārai mate mō te mate pukupuku, he pēhea te uru mai o ngā kirihou moroiti ki tā tātau tāhuhu whakapeto me ngā mōhio me ngā tikanga whakaterenga a te Māori.

Hei tā te Heamana o te Kaunihera Pūtea a Marsden a Ahorangi David Bilkey: "I hangaia Te Pūtea a Marsden ki te hāpai i ā tātau kairangahau mātāmua ki te whakawhanake i ō rātau whakaaro tiketike rawa, whakaongaonga hoki. He hira ēnei pūtea taumata tiketike mō te whakaū i tētahi ahurea rangahau hihiri i tō tātau whenua, ā, ka āwhina ngā hua kia pai ake tō tātau mōhio ki tō tātau taiao me tō tātau iwi whānui. Ko ētahi o ēnei tūhuratanga taketake ka ahu atu ki ētahi rongoā hou, ohorere hoki i ētahi wā mō ngā raruraru onāianei, i roto i ngā wāhanga pērā i te manaaki hauora, toitūtanga me te kaupapahere pāpori."

E hari ana a Ahorangi Bilkey ki te kite i te nui haere o ngā kairangahau wāhine, Māori hoki kua waimarie. "E whakamānawa ana ki te kite ake i ngā kaitono Pūtea a Marsden he wāhine, he Māori rānei kua puta ngā ihu pērā anō i ngā kaitono tāne, tauiwi hoki i roto i ngā tau e rima kua taha ake nei. "Ka tirotiro haere tonu mātou i ngā tukanga o te Pūtea kia kore ai e mahue ngā rōpū kāore i te tino kitea.

"E tino koa ana ahau ki te kite i te whai wāhitanga nui o te mātauranga Māori i roto i ngā tono puta noa i ngā peka mātauranga rerekē. Arā, mai i te rangahau i ngā urupare a te Māori ki ngā kaupapahere toko i te ora o te rau tau 20 ki te whakamahinga o ngā waka hei uru atu me te tūhura i ngā puia mamao," te kī a Ahorangi Bilkey. "E whakatauira ana ēnei kaupapa i te āta whakaurunga mai o ngā mōhiotanga me ngā tikanga a te Māori i te taha o ngā kaupapa peka mātauranga tauwhāiti, ā, ko te whakatau mō ēnei he pakari, he auaha e ai ki ngā kaitaunaki matua ā-ao."

Kei te āhua piki haere tonu ngā kaitono e waimarie ana, mai i te 10.7% i te tau 2016 ki te 12% i te 2017 me te 12.4% i tēnei tau. Ko te ōwehenga momoho mō ngā takuhe Tīmata-Wawe mō ngā kairangahau pūhou he 14.8%. Kei te rahinga o te pūtea i whakawhiwhia i tēnei tau, me te ōwehenga momoho hoki, he tino tiketike tonu nā te tautoko haere tonu a te kāwanatanga.

Ka tohaina ngā takuhe i roto i te toru tau ka mutu e whānui ana te whai pūtea, e utu ana i ngā utu ā-tau, ngā tūranga ākonga me te kairangi, ngā whakapaunga ā-whare wānanga me ngā taonga rangahau.

Toitū te maræ a Tāne
Toitū te maræ a Tangaroa
Toitū te whenua

Care for the domain of Tāne
Mahuta and Tangaroa
and the land will sustain you

Project highlights from 2018

Marsden Fund Awards

Are microalgæ

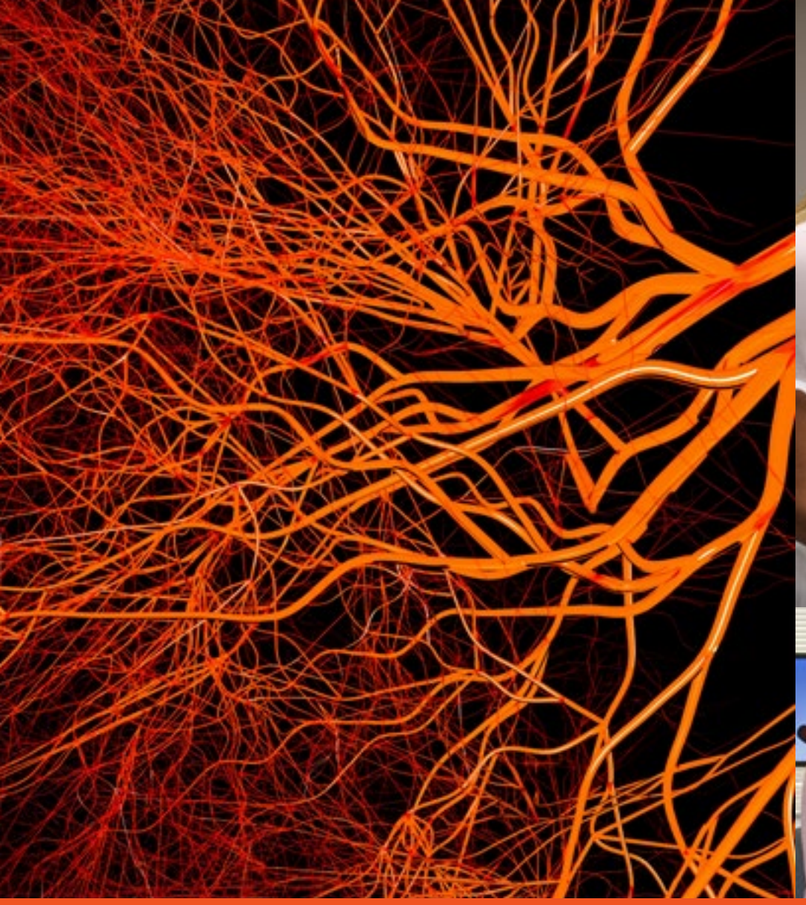
putting plastic in our food?

Dr Julie Hope of the University of Auckland will study if microalgae and their interactions with the ocean sediments are causing microplastics to invade our food chain.

Plastic is everywhere. Nearly 13 million tonnes of plastic waste ends up in the marine environment every year. Most plastics break up into very small particles or microplastics in the ocean. Alarmingly, these microplastic particles are finding their way into our food. A recent study confirmed humans were eating microplastics in Europe, Japan and Russia, and in New Zealand we are likely now consuming these contaminants in our delicious Friday fish and chips as well. The long-term effects on human health are largely unknown. We also don't understand how these microplastics enter our food chain in the first place.

Dr Hope thinks the first and most critical step might be microalgae, a key food source for many fish and other marine animals. She has been awarded a Marsden Fund Fast-Start grant to explore whether plastics enter our food chain via microalgae. She will examine how the complex interactions of coastal microalgae and their sedimentary environment affect the distribution and initial ingestion of microplastics. New Zealand's many kilometres of varied and fertile coastline provide the ideal laboratory to explore this issue.

Her findings will advance our knowledge about the distribution, fate and impact of microplastics in our coastal environments, and will contribute to understanding and mitigating this growing global threat.



Foetal lifeline:

feeding your baby in utero

He āwhina i te kōngahungahu: te whāngai i tō pēpi i rō kōpū

Dr Alys Clark and Dr Joanna James of the University of Auckland will study how blood vessels in the uterus contribute to blood flow to the placenta. This could lead to new tools for diagnosing and treating abnormal pregnancies.

The placenta nurtures a growing foetus by offering oxygen, nutrients and antibodies, and by eliminating waste throughout the pregnancy. It does this by actively modifying the blood vessels in the uterus to increase blood flow to the developing baby. This vital process fails in 10% of pregnancies, leading to foetal growth restriction (FGR) where babies are born abnormally small. This disorder is almost impossible to predict and difficult to diagnose at an early stage of the pregnancy, even with modern medical imaging. We lack understanding of the mechanisms that control the development of a healthy placenta, so the majority of pregnancies affected by FGR are not diagnosed until delivery.

Dr Clark from the Auckland Bioengineering Institute and Dr James from the School of Medicine at the University of Auckland, have been awarded a Marsden Fund grant to investigate the changes in blood flow that affect a mother's ability to nourish her baby. Past research has focused on small blood vessels between the uterus and the placenta. However, Dr Clark's computational models suggest that larger blood vessels also play an important role in regulating blood flow to the placenta. In this project, the team will create a 'virtual uterus' to mimic dynamic changes in blood vessel structure and simulate blood circulation between the uterus and placenta during pregnancy.

This model will help us better understand blood flow to the developing foetus and likely lead to improved early detection and diagnosis of foetal growth restriction. The results may also contribute to the development of novel and effective treatments for abnormal pregnancies.

Ka rangahau a Tākuta Alys Clark rāua ko Tākuta Joanna James o Te Whare Wānanga o Tāmaki Makaurau i te āhua o te tautoko a ngā ioio toto i roto i te kōpū ki te rerenga toto ki te whenua. Ka ahu mai pea i tēnei ko ngā utauta hou mō te whakatau me te whakamaimoa i ngā hapūtanga tino rerekē.

Ka whāngai te whenua i te kōngahungahu e tipu ana mā te tuku hāora, matūkai me ngā pūmuapare, ā, me te whakakore atu i ngā para puta noa i te hapūtanga. Ka oti tēnei mā te āta whakarerekē haere i ngā ia toto i roto i te kōpū kia nui ake te rerenga toto ki te pēpi. Ka hinga tēnei tikanga hira i roto i ngā hapūtanga 10%, ā, ko te mutunga atu ko te whāiti o te tipu o te kōngahungahu (FGR) e tino iti ai te pēpi i te whānautanga. He tino uaua rawa atu te matapae i tēnei mate me te whakatau i te wāhanga tōmua o te hapūtanga, ahakoa ngā atahanga hauora hou. He iti noa iho ō tātau mōhio ki ngā tikanga e whakahaere ana i te whanaketanga o tētahi whenua ora, nō reira kāore e kitea te nuinga o ngā hapūtanga e pāngia ana e te FGR kia whānau rā anō.

Kua whakawhiwhia a Tākuta Clark o te Auckland Bioengineering Institute rāua ko Tākuta James o te School of Medicine i Te Whare Wānanga o Tāmaki Makaurau ki tētahi takuhe Pūtea a Marsden hei tūhura i ngā rerekētanga o te rerenga toto e whakaawe ana i te kaha o te whaea ki te whāngai i tana pēpi. I arotahi ngā rangahau o mua ki ngā ia toto iti i waenga i te kōpū me te whenua. Engari, e ai ki ngā tauira tatau a Tākuta Clark he wāhanga hira tō ngā ia toto nui ake mō te whakahaere i te rerenga toto ki te whenua. I roto i tēnei kaupapa, ka hangaia e te rōpū he 'kōpū mariko' hei tāwhai i ngā rerekētanga akiaki i roto i te hanganga ia toto me te whaihanga i te rere o te toto i waenga i te kōpū me te whenua.

Ka āwhina tēnei tauira i a tātau kia mārama ake ki te rerenga toto ki te kōngahungahu e tipu ana, ā, ko te tikanga ka piki te kitenga tōmua me te whakatau i te whāiti o te tipu o te kōngahungahu. Ka tautoko anō pea ēnei otinga i te waihangatanga o ngā whakamaimoatanga rerekē, whaitake mō ngā hapūtanga tino rerekē.

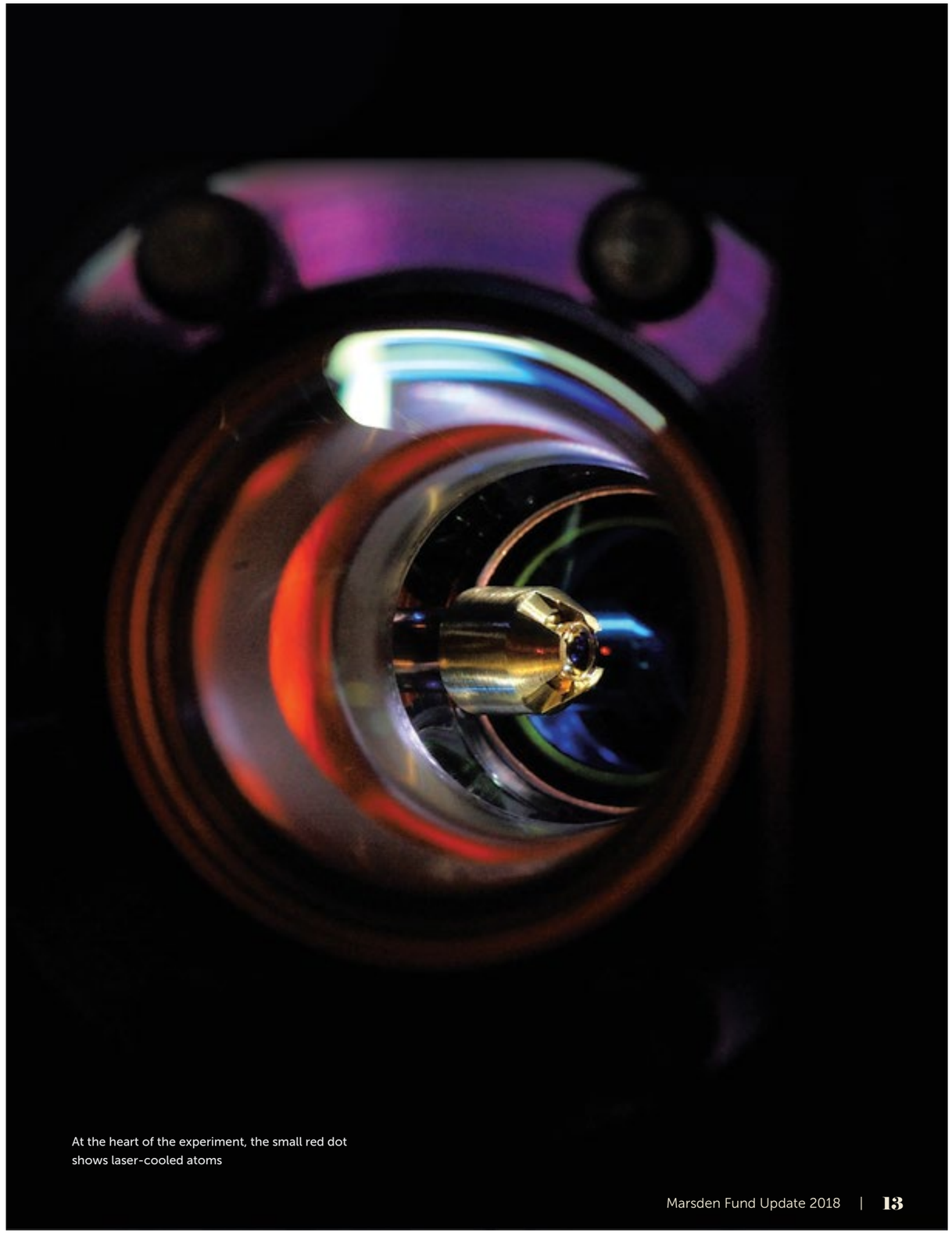
Creating and observing spooky entanglement

Dr Mikkel Andersen from the University of Otago will connect individual atoms through the spooky mechanism of ‘quantum entanglement’, watching as the connection is created and destroyed. This could lead to new technologies for unprecedented accuracy of measurements and speed of computing power.

The defining physical phenomenon that separates the microscopic quantum world from the world of our day-to-day experience is quantum entanglement. If two atoms are entangled, measurement of one atom affects the possible outcomes of measurements on the other atom. This occurs even if the entangled atoms are at opposite ends of the solar system without contact of any sort. This led Einstein to claim that quantum entanglement was too ‘spooky’ to be true. However, quantum entanglement is certainly real. Yet it is often fragile and is easily lost if not kept in an ultra-cold environment. This presently hampers its transition from laboratory experiments to real-life applications.

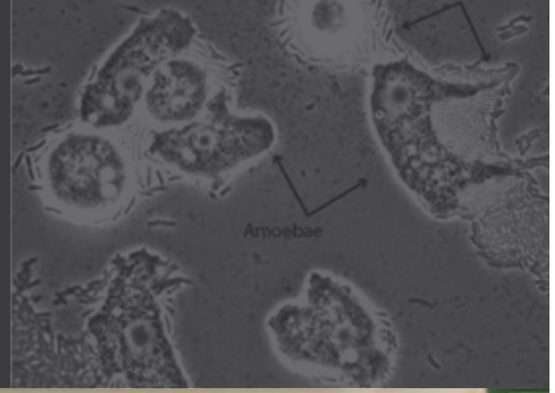
In this new Marsden Fund project, Dr Andersen will show how the random vibrations of a warm environment, the very thing that often destroys entanglement, can be exploited for its generation. Powered by astounding progress in scientists’ ability to control atoms, Dr Andersen will assemble individual atomic pairs held by laser beams, and watch through a sensitive microscope as the atoms entangle when they collide. This project will provide the world’s smallest entanglement-enhanced device capable of detecting magnetic field variations on a nanometre scale.

Armed with this new thermally robust source of entanglement, Dr Andersen will measure delicate magnetic field variations with unprecedented precision. Quantum entanglement is of more than fundamental interest. Observing and understanding this phenomenon will help power future quantum technologies, enabling more secure communications, faster computations, and more precise measurements.



At the heart of the experiment, the small red dot shows laser-cooled atoms

When two became one



Studying the evolutionary partnership that led to complex life

Joanne Turnbull, Richard Yulo, Heather Hendrickson, Courtney Davies, Danielle Kok, Farhad Golzar and (former member) Cody Gilligan

Dr Heather Hendrickson from Massey University will use real-time evolution experiments on bacterial and amoeba populations in the lab to address long-standing questions on the origin of complex life.

In the distant primordial past, a simple bacterial-like cell gave up its independence by taking up residence inside another cell and adapted to reproduce within its new host. This extraordinary occurrence, now known as endosymbiosis, triggered the dawn of complex life on Earth. The resulting complex cells eventually became capable of new and more sophisticated functions. Mitochondria, the tiny energy generators found in nearly all complex cells, including the ones that make up our bodies, represent the earliest-known example of endosymbiosis. There are many other examples of endosymbiosis, such as photosynthesis in plants. However, a major question about this process remains: how are such partnerships able to form and stabilise?

Dr Hendrickson from the Institute of Natural and Mathematical Sciences at Massey University, has been awarded a Marsden Fund grant to study the origins of endosymbiosis in real-time. In doing so, she will address long-standing questions on the origin of complex life. Dr Hendrickson and her team will carry out a series of evolution experiments in the lab, using two separate 'predator-prey' pairs of cells. Over the course of 10,000 generations, predators (amoeba) and prey (bacteria) will be mixed together under different conditions. The team will examine the routes these cells take in adapting towards endosymbiosis and monitor them for collaborative or antagonistic effects on each other, using a cutting-edge combination of novel molecular, genomic and imaging techniques. By establishing this model system, Dr Hendrickson and her team will provide insights into the mechanisms and evolutionary paths for successful endosymbiosis. This research could lay the groundwork for endosymbiosis engineering and provide major insights into the basis of evolutionary transitions.

Brainy bumblebees

But does learning always pay off?

Dr Lisa Evans of Plant and Food Research will head into New Zealand's forests to explore variation in learning ability in colonies of wild bumblebees. This work will further our understanding of how the environment and learning ability affects the ability of bees to successfully reproduce.

Most animals are capable of learning but being a 'good learner' is not always beneficial. Learning requires time and energy that could otherwise be spent gathering food. For example, bumblebees are foragers that learn to use floral traits, such as colour, to predict food quality and quantity. An environment where floral diversity is high and floral traits change over time might favour faster learners. In contrast, being a good learner would be less advantageous for bees in a stable environment with low floral diversity. However, this is yet to be observed in the wild.

With a new Marsden Fund Fast-Start grant, Dr Evans from Plant and Food Research and a team of international researchers will compare the learning capability of wild bumblebees living in these two different kinds of floral environment. They will test the advantage of being a good learner by transplanting colonies of bees from each of the two environments into the other and measuring any changes in their reproductive success.

This research will provide insights into the evolutionary and environmental factors that influence variation in learning abilities between individuals of a single species.

Gamers & gambling

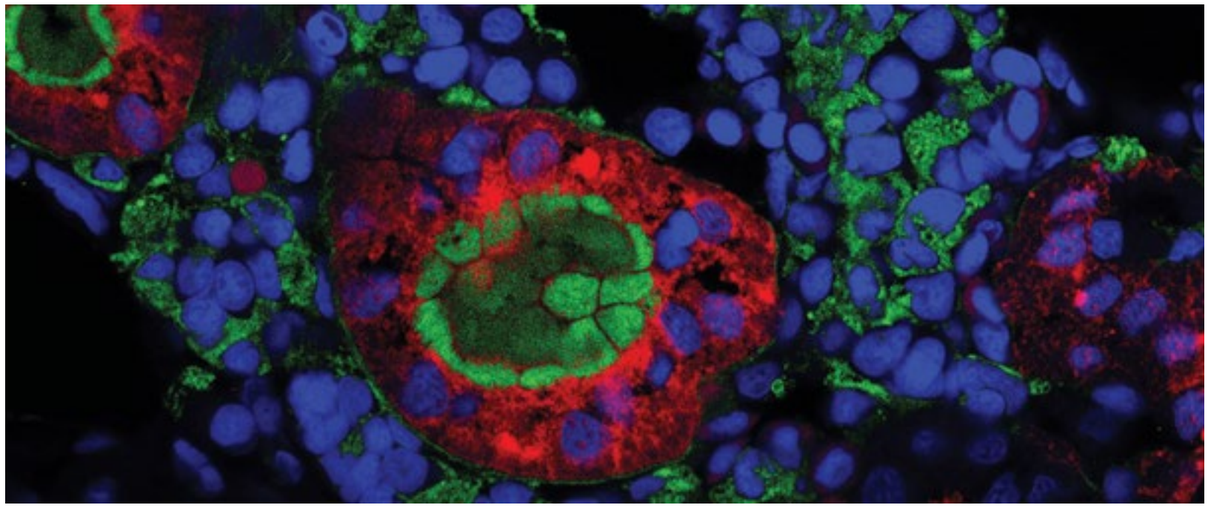
What happens to gamers when video game features approximate gambling?

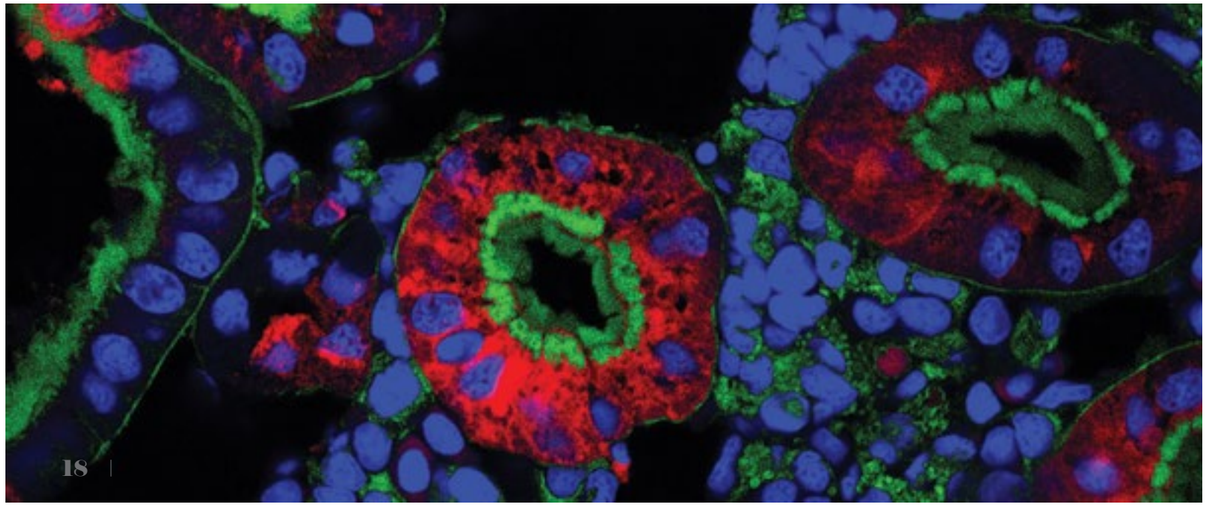
Dr Aaron Drummond from Massey University will lead an international team investigating the potential psychological and financial risks that gambling-related features have on video gamers.

Video games are big business, both within New Zealand and worldwide. In fact, video game development is New Zealand's fastest growing technology export sector. However, politicians, gamers, and parents worldwide have expressed serious concerns about the recent emergence of gambling-related design features in video games, particularly those available to children. Traditionally video gamers were rewarded for their skills in mastering the game, but many video games are starting to feature 'Loot Boxes': randomly dropped rewards containing desirable items that players can use to affect the game. Some 'Loot Boxes' can also be bought and sold with real world money. It is thought this type of reward may lead to the rapid acquisition of new behaviours and produce habits that are seen in conventional gambling. To date, there has been almost no research exploring the potential psychological and financial risks that these gambling-related features pose.

In a new Marsden Fund Fast-Start project, Dr Drummond from Massey University, along with Dr James Sauer (University of Tasmania) and Professor Christopher Ferguson (Stetson University) will examine the psychological impact that in-game gambling-related features have on video game players. The researchers will combine online surveys of gamers with experimental psychology studies to examine how in-game random reward systems affect player behaviour. The results will help identify the extent of excessive gameplay behaviour and the psychological and financial harm associated with these gambling-related mechanisms.

New Zealand has more video game developers per capita than any country in the world. This research is both critical and timely, as the games industry will figure prominently in our economic future and social lives. Dr Drummond's team's findings will contribute to informed policy debate in New Zealand and internationally, and help to develop interventions that limit the negative impact of gambling features in video games.





Kidney kickstarter

New stem cell discovery is the first step towards kidney bioengineering.

Associate Professor Alan Davidson from the University of Auckland has discovered a new source of kidney stem cells in developing embryos. Using zebrafish, he will characterise these cells and determine if they can be exploited to develop new therapies for human kidney disease.

The kidneys play a crucial life-sustaining role in filtering and purifying the blood. New Zealand has a high rate of kidney disease, with Māori and Pacific populations at particularly high risk. There is an urgent need to develop new therapies to treat kidney disease. One possible avenue is using kidney precursor (or stem) cells to regenerate kidneys for affected patients. However, we need a better understanding of how kidneys normally form in an embryo to develop a system to bioengineer new kidneys.

During embryonic development, different stem cells migrate from particular developmental structures to other sites to form the various organs found in an adult. From studies dating back 150 years, we thought we knew where kidney stem cells came from in the developing embryo. However, Associate Professor Davidson has discovered a new source for kidney stem cells in another region of the embryo. Using zebrafish as a model, he has shown that these recently identified cells can form new functional tissue when transplanted into damaged kidneys.

Associate Professor Davidson has been awarded a Marsden Fund grant to characterise these kidney stem cells from zebrafish. He will use molecular techniques to assess their origin in developing embryos and determine how they differ from other stem cell populations. A fundamental understanding of these novel cells is crucial to determine whether they can be exploited to develop new therapies for human kidney disease.

Te ara mai i te tūhuratanga pūtau tātā hou ki te pūkahakoiora tākihi.

Kua kitea e te Ahorangi Tuarua a Alan Davidson o Te Whare Wānanga o Tāmaki Makaurau tētahi pūtake hou o ngā pūtau tātā tākihi i roto i ngā kukune e tipu ana. Mā te whakamahi i te zebrafish, ka tautuhia e ia ēnei pūtau me te whakatau mēnā ka taea te whakamahi hei waihanga ngā haumanutanga hou mō ngā tākihi tangata.

He mahi hira tā ngā tākihi mō te oranga, ā, he tātari me te whakahou i te toto. He tino nui te pānga mai o ngā mate tākihi i Aotearoa, ā, ko te Māori me ngā iwi o Te Moananui-a-Kiwa e tino pāngia ana. E tino hiahiatia ana kia hangaia ngā haumanu hou hei whakamaimoa i te mate tākihi. Ko tētahi ara pea ko te whakamahi i ngā pūtau tātā hei whakahou anō i ngā tākihi mō ngā tūroro. Engari, me mārama ake tātau he pēhea nei te ahu mai o ngā tākihi i roto i tētahi kukune hei waihanga i tētahi pūnaha mō te pūkahakoiora i ngā tākihi hou.

I te whanaketanga kukune, heke ai ngā pūtau tātā rerekē mai i ngā hanganga whanaketanga tauwhāiti ki ētahi atu wāhi hei waihanga i ngā whēkau rerekē e kitea ana i roto i te tangata pakeke. Mai i ngā rangahau e hoki ana ki ngā tau 150 ki mua, ko te pōhēhē i te mōhio tātau i ahu mai ngā pūtau tātā tākihi i roto i te kukune tipu. Engari, kua kitea e te Ahorangi Tuarua a Davidson tētahi pūtake hou mō ngā pūtau tātā tākihi i roto i tētahi atu wāhanga o te kukune. Mā te whakamahi i te zebrafish hei tauira, i whakaaturia e ia ka taea e ēnei pūtau i kitea inātatanei te hanga kikokiko whai take hou ina whakawhitia ki roto i ngā takihi hou.

Kua whakawhiwhia a Ahorangi Tuarua Davidson ki tētahi takuhe Pūtea a Marsden hei tautuhi i ēnei pūtau tātā tākihi mai i te zebrafish. Ka whakamahia e ia ngā tikanga rāpoi ngota ki te tātari i te ahunga mai i roto i ngā kukune tipu me te whakatau i te rerekē ki ētahi atu taupori pūtau tātā. He mea hira kia tino mārama ki ēnei pūtau rerekē mō te whakatau mēnā taea ēnei te whakamahi hei waihanga i ngā haumanutanga hou mō ngā tākihi tangata.

Waka lab to

study volcanoes

in the Pacific Ring of Fire

Ka rangahau te taiwhanga waka i ngā puia i roto i Te Ahi Tipua o Te Moananui-a-Kiwa

Dr Ian Schipper of Victoria University of Wellington and Dr Yves Moussallam of Institut de Recherche pour le Développement, France, will lead an international team on a mission to better understand the effects of volcanic gas emissions. To do this, they will sample some of the world's most inaccessible volcanoes - in a waka.

All active volcanoes give off gases. These emissions play an important role in the timing and nature of volcanic eruptions, and profoundly impact the climate. The volcanoes of Melanesia occupy an intensely active segment of the Pacific Ring of Fire, a volatile area where many earthquakes and eruptions occur. Satellite estimates indicate that one third of all the world's volcanic gases originate from Melanesian volcanoes. However, current sampling is biased towards easily accessible volcanoes in developed countries. This bias limits our understanding of the levels and environmental impacts of volcanic gas emissions.

Dr Schipper and Dr Moussallam have been awarded a Marsden Fund grant to sample gas emissions from the active terrestrial and underwater volcanoes of Papua New Guinea, the Solomon Islands and Vanuatu. In partnership with Māori and Melanesian voyaging societies, they will build a mobile volcano observatory in Melanesia using modern waka. From this 'waka lab', the team will use aerial drones and ocean submersibles to collect samples from submarine volcanoes and provide insight into how volcanoes release gases. This world-first concept will be trialled at White Island using the double-hulled waka *Ngahiraka Mai Tawhiti,* and Māori youth and communities will be invited to participate in recording observations.

By combining modern technology with traditional knowledge, Dr Schipper and Dr Moussallam embrace the notion that, for people all around the Pacific, volcanic hazards and their effects on climate are 'he waka eke noa' or 'the canoe we are all in together'. This work will help to identify potentially hazardous volcanoes in Melanesia, many of which are currently unmonitored. The findings will also increase our understanding of the environmental impacts of volcanic gases and help create better models of our changing global climate.

Ko Tākuta Ian Schipper o Te Whare Wānanga o Te Ūpoko o Te Ika a Māui rāua ko Tākuta Yves Moussallam o te Institut de Recherche pour le Développement, France, ngā kaiārahi i tētahi rōpū ā-ao ki te rapu māramatanga mō ngā pānga o ngā tukunga haurehu puia. Hei whakatutuki i tēnei, ka whakamātauria e rātau ētahi o ngā puia tino arakore nei - mā runga waka.

Puta mai ai i ngā puia hohe katoa ngā haurehu. He tino hira ēnei tukunga ki ngā whakahaere me te āhua o ngā pahūtanga, me te aha he pānga nui ki te āhuarangi. He wāhanga nui tō ngā puia o Merenīhia nō te wāhanga hohe o te Ahi Tipua o Te Moananui-a-Kiwa, he wāhi tipua e pā mai ai ngā rū me ngā pahū maha. E tohu ana ngā amiorangi he hautoru o ngā haurehu puia katoa o te ao kei te ahu mai i ngā puia o Merenīhia. Engari, ko ngā tīpakonga onāianei kei te tītaha kē atu ki ngā puia e taea māmātia ana i ngā whenua taepū. Ka whāiti i tēnei tītahatanga tō tātau mōhio ki ngā taumata me ngā pānga taiao o ngā tukunga haurehu puia.

Kua whakawhiwhia a Tākuta Schipper me Tākuta Moussallam ki tētahi takuhe Pūtea a Marsden hei whakamātau i ngā tukunga haurehu mai i ngā puia whenua me raro i te moana o Pāpua Nūkini, Ngā Moutere Horomona me Whanuatu. I te taha o ngā rōpū whakatere moana Māori me Merenīhia, ka hangaia he waka mātakitaki puia i Merenīhia mā te whakamahi i ngā waka onāianei. Mai i tēnei "taiwhanga waka" ka whakamahia e te rōpū ngā matatopa me ngā waka ruku hei kohikohi tīpakonga mai i ngā puia raro moana me te tuku kitenga mō te āhua o te tuku a ngā puia i ngā haurehu. Ka whakamātauhia tēnei āhuatanga tuatahi o te ao ki Whakaari mā te whakamahi i te waka hourua a *Ngahiraka Mai Tawhiti*, ā, ka pōhiritia ngā taiohi Māori me ngā hapori ki te whakauru mai ki ngā tāhoputanga kitenga.

Mā te whakakotahi mai i ngā hangarau hou me ngā mōhiotanga tuku iho, ka tino ū a Tākuta Schipper rāua Tākuta Moussallm i te whakaaro, mō ngā iwi katoa o Te Moananui-a-Kiwa, ngā mōrearea puia me ngā pānga ki te āhuarangi, 'He waka eke noa'. Ka āwhina ēnei mahi ki te tautuhi i ngā puia mōrearea pea i Merenīhia, ā, ko te maha o ēnei kāore i te tirotirohia. Nā ēnei kitenga ka nui atu tō tātau mōhio ki ngā pānga taiao o ngā haurehu me te āwhina ki te hanga i ngā tauira pai ake o tō tātau āhuarangi hurihuri o te ao.

Ian Schipper (right) and Yves Moussallam at the foot of Cotopaxi Volcano, Ecuador. Image: Trail By Fire

More effective cancer immunotherapy

Dr Sarah Saunderson of the University of Otago aims to modify cancer immunotherapy, a new treatment which uses a person's own immune system to fight cancer, so that it is effective and safer for a wider range of cancer patients.

Cancer continues to be the number one killer of New Zealanders. A promising new strategy for treating cancer, called immunotherapy, harnesses the patient's own immune system to destroy cancer cells. One such groundbreaking therapy genetically engineers the patient's own immune cells (T cells) to express antibodies that target cancer cells. This process generates a cancer therapy using chimeric antigen receptor T cells (CAR T cells). However, there are still two major problems with this exciting new therapy. Firstly, these therapies have been more effective at treating blood cancers than solid tumours. Secondly, this therapy can trigger an excessive immune response leading to serious, potentially life-threatening, side effects for the patient.

Dr Saunderson believes that the key to solving both of these problems is to design the immunotherapy to function specifically within the conditions found inside the solid tumour mass. One key difference between normal tissue and cancer is that solid tumours becomes highly acidic (low pH) due to a build-up of tumour cell waste products. Dr Saunderson has been awarded a Marsden Fund Fast-Start grant to exploit this pH difference to design an antibody 'safety switch'. This antibody switch can be incorporated into CAR T cells so they attack cancerous, but not normal, cells. She will first identify antibodies that are naturally pH dependent, then test them to determine if they are safe and effective novel therapies for solid tumours.

This project utilises the differences between solid tumours and normal tissues to develop more effective cancer immunotherapies. The results will also mean patients experience fewer negative side effects from the treatment.

Saving kauri

with a human drug discovery approach

Te whakaora i te kauri
mā tētahi āhuatanga tūhura rongoā ā-tangata

Professor Michelle Glass from the University of Otago will use a human drug discovery approach to help fight dieback disease in kauri, one of Aotearoa New Zealand's most iconic taonga species.

Kauri *(Agathis australis)* is one of Aotearoa New Zealand's most iconic taonga species. However, populations are currently under threat from kauri dieback, an incurable disease caused by the fungus-like kauri dieback pathogen *Phytophthora agathidicida*. Current efforts to halt the spread of this fatal disease through New Zealand forests are failing. Kauri dieback-causing spores, often introduced by human activity, swim through waterlogged soil towards the roots of host kauri and initiate infection. The molecular mechanisms controlling this movement and infection involve a specific class of receptor proteins on the surface of spores. This class of proteins is present within almost all non-bacterial species, from the kauri dieback pathogen to humans, and mediate virtually every important physiological process in cells. They are also the target of approximately 30% of all current human medicines.

Professor Glass and her multidisciplinary international team have been awarded a Marsden Fund grant to tackle the problem of kauri dieback using an innovative approach modelled on human drug discovery. Professor Glass will study the role of these specific receptor proteins in the migration of, and infection by, kauri dieback-causing spores. She will identify compounds that can interact with these proteins and inhibit their activity. She will then build atomic models to study the interaction between these compounds and receptor proteins.

This project will enable the development of novel treatments that could help in the fight against this devastating dieback disease and protect Aotearoa New Zealand's kauri.

Ka whakamahia e Ahorangi Michelle Glass o Te Whare Wānanga o Otāgo tētahi āhuatanga tūhura rongoā ā-tangata hei āwhina ki te poke i te tahumaero dieback i roto i te kauri, tētahi momo tino hira o Aotearoa.

Ko te kauri tētahi o ngā momo tino hira o Aotearoa. Engari, kei te pokea ēnei rākau e te kauri dieback, he tahumaero rongoā-kore i ahu mai i tētahi tukumate ā-kōpurawhetū te kauri dieback, *Phytophthora agathidicida*. Kāore i te eke ngā whakapau kaha ki te aukati i te hōrapa o tēnei tahumaero whakamate ki Aotearoa. Ka uru ngā pata pūtake o te kauri dieback, i ahu mai i ngā mahi a te tangata, i roto i ngā oneone kī i te wai kia piri ki ngā pakiaka o ngā kauri, ā, ka tīmata te poke. Kei roto i ngā tikanga rāpoi ngota e whakahaere ana i tēnei nekehanga me te tahumaero ko tētahi rōpū ake o ngā pūmua urupare kei te mata o ngā pata. Kei roto ēnei momo pūmua i te nuinga o ngā momo paturopi-kore, mai i te tukumate kauri dieback tae atu ki te tāngata, ā, ka takawaenga i ngā tukanga ōkiko hira katoa i roto i ngā pūtau. Tata ki te 30% te arotahi atu a ngā rongoā ā-tangata katoa onāianei.

Kua whakawhiwhia a Ahorangi Glass me tōna rōpū ā-ao peka mātauranga maha ki tētahi takuhe Pūtea a Marsden hei whakatūtaki i te rarururu o te kauri dieback mā te whakamahi i tētahi āhuatanga auaha e whai ana i te tauira mō te tūhura rongoā a te tangata. Ka rangahau a Ahorangi Glass i te mahi a ēnei pūmua tauwhāiti i roto i te hekenga, me whakapoke mai i ngā pata tuku kauri dieback. Ka tautuhia e ia ngā pūhui e taea ana te whakawhitiwhiti me ēnei pūmua me te tāmi atu. Kātahi ka hangaia e ia ngā tauira hei rangahau i te tauwhitiwhiti i waenga i ēnei pūhui me ngā pūmua.

Mā tēnei kaupapa ka taea ngā whakamaimoatanga rerekē te mahi e taea ai te tukituki atu ki tēnei tahumaero dieback kino rawa me te tiaki i te kauri o Aotearoa.

Māori families
creating whānau ora

Dr Aroha Harris from the University of Auckland and independent historian Dr Melissa Williams will examine how Māori families strived for whānau ora (family wellbeing) across the 20th century. They will show how whānau have negotiated with and pushed back against state interventions to maintain family life.

Māori children have been disproportionately represented among New Zealand children living in state care since the late 1970s. Māori families experienced high levels of state intervention, disempowerment and estrangement, a result of welfare policies critical of whānau structures that differed from the Pākehā nuclear family. National histories identify twentieth-century Māori poverty, abuse, and tribal breakdown as the outcomes of colonisation. Yet the experiences of Māori whānau are often absent in these narratives.

In this Marsden Fund project, Dr Harris and Dr Williams will explore how Māori held onto their aspirations for whānau ora while engaging with – or resisting – the twentieth-century welfare state. They will focus on the stories of the women, children and their families who directly faced Māori welfare policies. The team will combine oral histories of whānau with archival research into the roles of Māori nurses and welfare reformists to challenge accounts of Māori as hapless victims or resistant recipients of state services.

The project engages with ongoing contemporary concerns around poverty, incarceration, health and family wellbeing. It is expected to uncover positive models of Māori community resourcefulness, resilience and innovation under the socio-economic pressures of the modern century.

E tirotiro ana a Tākuta Aroha Harris o Te Whare Wānanga o Tāmaki Makaurau me te pūkenga hītori motuhake a Tākuta Melissa Williams i te āhua o te whai a ngā whānau Māori i te whānau ora puta noa i te rau tau 20. Ka whakaatu rāua i te whakaritenga a ngā whānau me tā rātau pana atu i ngā whakataunga a te kāwanatanga kia ū ai te noho a te whānau.

He tino nui rawa te kitea o ngā tamariki Māori i waenga i ngā tamariki o Aotearoa i noho i raro i te maru o te kāwanatanga mai i rā anō i ngā tau whakamutunga o te 1970. He nui te pā mai o ngā whakataunga kāwanatanga ki ngā whānau Māori, he tango mana me te aupēhi, ā, i ahu mai ēnei āhuatanga i ngā kaupapahere toko i te ora e whakahē ana i te āhua o te whānau Māori e rerekē nei ki te āhua o te whānau Pākehā. Kua kitea e ngā hītori ā-motu o te rau tau rua tekau te pōhara o te Māori, ngā tūkinotanga me te pakarutanga o te mana o te iwi nā ngā kaupapa whakapākehā i te iwi Māori. Heoi, kei te ngaro ngā wheako o ngā whānau Māori mai i ēnei kōrero i te nuinga o te wā.

I roto i tēnei kaupapa Pūtea a Marsden, ka hōpara a Tākuta Harris rāua ko Tākuta Williams i te āhua o te ū a te Māori ki ōna wawata mō te whānau ora me te whakauru atu – te ātete rānei – ki te toko i te ora a te kāwanatanga. Ka arotahi rāua ki ngā kōrero a ngā wāhine, tamariki me ō rātau whānau i pākia e ngā kaupapahere toko i te ora mō te Māori. Ka whakakotahitia e te rōpū ngā kōrero ā-waha a ngā whānau me ngā rangahau kōrero mō ngā nēhi Māori me ngā kaiwhakatikatika toko i te ora hei tukituki i ngā whakapae he pārurenga koretake te Māori, i uaua rānei te whakaae atu ki ngā ratonga kāwanatanga.

Ka whakauru atu te kaupapa ki ngā māharahara o ēnei rā mō te rawa kore, mauheretanga, me te hauora me te oranga o te whānau. Ko te tūmanako ka tūhuratia ngā tauira pai o te kakama o ngā hapori Māori, te pakari me te auaha ahakoa ngā pēhitanga oha-pori o tēnei rau tau.

Images: Neil Pardington/BWB

Te hāpai ā nga whānau Māori i te whānau ora

Rejuvenating Māori navigation knowledge

Te whakarauora i ngā mātauranga whakaterenga o te Māori

Dr Haki Tuaupiki from the University of Waikato will combine ancient Māori navigational knowledge with contemporary voyaging practices to create the first comprehensive, uniquely Māori navigation system.

Ka whakakotahi i a Tākuta Haki Tuaupiki o Te Whare Wānanga o Waikato ngā mātauranga whakaterenga o te Māori me ngā tikanga whakatere moana onāianei hei waihanga i tētahi pūnaha whakaterenga Māori ahurei.

Māori ancestors undertook deliberate voyages to and from Aotearoa New Zealand using complex navigation skills and the cutting-edge technology of the time: the double-hulled waka. For successive generations, the Pacific Ocean was a superhighway of voyaging passages and complex networks of culture and trade. As Māori adapted to the unique environment of Aotearoa, however, knowledge of the technology and skills for long-distance voyaging declined.

Dr Tuaupiki from the University of Waikato's Te Pua Wānanga ki te Ao (School of Māori and Indigenous Studies) has received a Marsden Fund Fast-Start grant to rediscover and regenerate Māori navigational knowledge. The recent revitalisation of Polynesian voyaging has focused mainly on Micronesian and Hawaiian navigational practices. By contrast, Dr Tuaupiki will examine karakia (chants), mōteatea (songs), whakataukī (proverbs) and pūrākau (ancient narratives) and conduct interviews with knowledge holders to recover traditional Māori navigational knowledge. Dr Tuaupiki will also work with contemporary Māori navigators to understand their practices, culminating in a waka voyage from Aotearoa to Hawai'i in 2020. Finally, he will synthesise traditional and contemporary knowledge to produce the first comprehensive Māori navigation system. Available in te reo Māori and English, the resulting manual will incorporate environmental indicators used in unique ways by Māori, such as the sun and stars, winds and clouds, ocean movement, and bird and whale migrations.

The project brings astronomy, maritime studies, and marine biology together with mātauranga Māori to enrich waka voyaging in Aotearoa and make a major contribution to the recent revitalisation of trans-Pacific navigation. The research will help a new generation of Māori voyagers reconnect with their tupuna and with Polynesian navigators across the Pacific.

I whakaterehia e ngā tīpuna Māori te moana ki Aotearoa, ā, hoki atu anō mā te whakamahi i ngā pūkenga whakaterenga matatini me ngā hangarau tino auaha o te wā: te waka hourua. Mai rā anō i tērā wā, ko Te Moananui-a-Kiwa te ara nui i whakaterehia e rātau me ngā kōtuitui matatini o te ahurea me te tauhokohoko. I te taunga haere o te Māori ki te taiao tūturu o Aotearoa, ka ngaro haere te mōhio ki ngā hangarau me ngā pūkenga whakatere moana ki tawhiti.

Kua whakawhiwhia a Tākuta Tuaupiki o Te Pua Wānanga o Te Ao o Te Whare Wānanga o Waikato ki tētahi takuhe Tīmata Wawe mai i Te Pūtea a Marsden hei tūhura anō me te whakaora mai anō i ngā mātauranga whakaterenga o te Māori. E aro ana ngā kaupapa whakaora onānoanei i ngā whakaterenga o Porinīhia ki ngā tikanga whakaterenga kē o Maikoronīhia me Hawaī. Heoi, ka tirotiro anō a Tākuta Tuaupiki i ngā karakia, mōteatea, whakataukī me ngā pūrākau me te uiui i ngā pūkenga kōrero ki te whakahoki mai anō i ngā mātauranga whakaterenga Māori. Ka mahi tahi anō a Tākuta Tuaupiki me ngā kaiwhakatere Māori onāianei kia mōhio ai ki ā rātau tikanga, ā, i te mutunga ka haere mā runga waka moana mai i Aotearoa ki Hawaī ā te tau 2020. Heoi, ka kōtuitui e ia ngā mātauranga tuku iho me ō nāianei hei whakaputa i te pūnaha whakaterenga matawhānui tuatahi. Ka tuhia tēnei ki te reo Māori me te reo Ingarihi, ā, ka whakahiato mai te puka tohutohu i ngā tohu taiao i whakamahia e te Māori, pērā i te rā me ngā whetū, ngā hau me ngā kapua, te neke o te tai, me ngā hekenga manu, tohorā hoki.

Ka whakahiato mai tēnei kaupapa i te tātai arorangi, ngā mātauranga ahumoana, koiora moana me te mātauranga Māori hei whakarākei ake i te whakatere waka i Aotearoa me te tuku i tētahi wāhanga nui ki ngā mahi whakaora i ngā whakaterenga i Te Moananui-a-Kiwa. Ka āwhina ngā rangahau i tētahi reanga kaiwhakatere Māori hou kia tūhono anō ki ō rātau tīpuna me ngā kaiwhakatere Poronīhia puta noa i Te Moananui-a-Kiwa.

Against the odds

How microbes survive in Antarctica's harsh conditions

Dr Adele Williamson from University of Waikato will study how microbes survive under the hostile conditions of Antarctica's Dry Valleys. She will identify the diversity of DNA repair systems present in these microbes that protects their genetic code from the extreme conditions.

The Dry Valleys of Antarctica are some of the harshest places on earth, with little water, high UV radiation, and multiple daily cycles of freezing and thawing. Despite their apparent barren appearance, microbial life prevails within this inhospitable environment. However, these unforgiving conditions are highly damaging to the genetic code of these organisms. DNA is critical to survival as it stores the hereditary information necessary to build and maintain an organism. These microbes must possess extremely efficient DNA repair systems to survive, though we have little understanding of these processes.

Dr Williamson has been awarded a Marsden Fund Fast-Start grant to identify DNA repair enzymes from microbes in Antarctic soils. These microbes cannot be easily grown in the cushy conditions of the laboratory, so Dr Williamson will instead use computer algorithms to discover potential DNA repair enzymes within DNA sequences from the combined genetic material found in Antarctic soil samples. She will then produce these enzymes in a pure form in the laboratory to determine their overall structure, the type of DNA damage they target and the chemical reactions they perform to repair this damaged DNA.

By studying structures and reaction mechanisms of these DNA repair enzymes, Dr Williamson will help explain how life survives in one of the most extreme environments on Earth. The results may also contribute to new biotechnology tools to repair DNA, using enzymes that function in cold conditions.

Cracking under pressure

Do crevasses make glaciers melt faster?

Dr Heather Purdie from University of Canterbury will investigate the impact of seasonally-exposed crevasses on glacial melting in New Zealand's Southern Alps. Her work will help us understand the response of glaciers to climate change.

Whether glaciers advance, retreat, or stay put depends on the amount of accumulating snow and melting ice.

As the world warms, the snow cover on mountain glaciers is thinning, so that crevasses are exposed earlier in the summer season and have a greater potential impact on glacier melting. Crevasses in a glacier's surface change the way the glacier interacts with wind and sun, leading to an increase in the rate of melting.

Dr Purdie has been awarded a Marsden Fund Fast-Start grant to pioneer a study comparing melt rates of crevassed and un-crevassed regions of the same glacier. To do this, Dr Purdie will use a drone equipped with an infrared camera to map the shape of the surface of Haupapa/Tasman Glacier. High-tech weather stations erected on the glacier will provide detailed measurements of heat exchange between the crevasses and snow surface, and the overlying atmosphere. The information will feed into mathematical models to determine the impact that crevasses have on surface roughness of the glacier and the turbulent movement of heat above it, both of which effect melting.

The results will demonstrate the influence of crevasses on glacial melt rates. This will help scientists develop better models to predict the health of high mountain glaciers around the world and more accurate estimates of glacial response to a warming climate.

Images: Julian Thomson/Tim Kerr

Drug trading

on the dark side of the net

Associate Professor Chris Wilkins from Massey University will examine the new and emerging role of the 'darknet' in the supply of illegal drugs in Aotearoa New Zealand.

The darknet is a part of the internet where both publishers and web surfers can be anonymous. These sites can't be indexed by Google or other search engines and are only available to authorised users. They are the ideal web-spots for illicit drug buying and selling. The online drug trade has developed exponentially during the last decade, in parallel with technological improvements such as encryption, rating systems, and digital currencies. Current research suggests that darknet drug markets have proliferated in geographically isolated countries, such as New Zealand. However, no empirical research on the illegal online drugs market has been conducted here.

Associate Professor Wilkins, from the SHORE & Whariki Research Centre, Massey University, has been awarded a Marsden Fund grant to investigate clandestine websites and their impact on New Zealand's illegal drug market. His team will use web-crawlers to estimate the volume of sales and prices in New Zealand for major drug types from the seven largest darknet sites. In addition, the team will perform a comprehensive wastewater analysis to assess the total quantity of each drug type consumed in New Zealand. Monitoring the presence of drugs in wastewater will help capture information on consumption that may not be accessible through surveys.

The findings will provide information about the impact of the darknet on New Zealand's illegal drug market and give new insights into the market structure, pricing and wider operation of darknet drug trade in New Zealand. The findings could help in the development of new strategic and policy responses to the emergence of the darknet and related illicit markets.

Next-generation glasses

that could help you find a needle in a haystack

Dr Tobias Langlotz from the University of Otago will develop the first prototype of computational eyewear that amplifies users' perception of their environment in real time. These glasses have the potential to enhance human vision as well as compensate for visual impairments.

Imagine wearing glasses that could amplify your awareness of changes in your environment in real time. For example, if you were looking for a needle in a haystack, the glasses would work like a subtle Instagram filter to make any bright, shiny object stand out from the hay, allowing you to find that elusive needle. The glasses could alert the wearer to potential dangers as they happen, a feature particularly useful in high-risk environments such as construction sites. They could also highlight mechanical parts in jet engines that require attention, such as a loose screw. The rise of glasses with an integrated semi-transparent display in the user's view, known as 'optical see-through head-mounted displays (OSTHMDs)', offer the potential to move beyond what is possible with purely optical prescription glasses. However, glasses currently on the market are not designed for enhancing our vision but for games and other augmented reality applications.

Dr Langlotz has been awarded a Marsden Fund Fast-Start grant to develop a computational prototype for glasses that will enhance, rather than alter, the visual field of the user. He will design the hardware and software aimed at conventional-style eyewear that senses and amplifies the environment using a semi-transparent display with pixel perfect precision. The resulting glasses will provide subtle cues to the wearer so that they are not distracted from the task at hand, or have the feeling of being controlled by the glasses.

This project will contribute substantially to the growing field of wearable and visual computing. The results may help extend human vision and compensate for visual impairments.

An immune system for software

Professor James Noble of Victoria University of Wellington will build software tools to verify that computer programmes are secured from within. This will allow software to more safely interact with external, unexpected, and even untrusted agents.

Software guards our secrets. As more personal and corporate information moves onto the internet, security breaches can end careers, win elections and cost hundreds of millions of dollars. Much of the attention to date regarding security has been focused on protecting systems from external attacks once they are in use. While important, it is impossible to know in advance what components or entities will seek to interact with a piece of software.

An alternative approach is to secure software from within, allowing components to connect and interact only if they have the right permissions. This can be likened to an immune system for the computer programme. Programmers can define rules that internal software components must obey. Each rule captures a particular security requirement, and so prevents a particular category of bugs or attacks. Until now, however, it has not been possible to know or check if the rules are correctly implemented.

Professor Noble has been awarded a Marsden Fund grant to solve this issue. This project will develop new tools capable of verifying that this type of security system for a programme has been configured correctly. These tools will allow software developers to mathematically prove that the internal components of a programme each have their correct permissions and that all the rules are being correctly obeyed.

This project will make developing secure programmes easier. Armed with these new tools, software engineers will be able to ensure that programmes are robust and secure.

The genetic recipe book for natural medicinal compounds

Professor Emily Parker FRSNZ from Victoria University of Wellington will investigate how subtle genetic differences create diverse and useful chemical compounds in fungi. The results will help us tailor-make compounds with medicinal uses.

Living organisms make a diverse suite of natural chemicals, allowing them to combat predators, fight off pathogens and meet specific environmental challenges. These compounds have been the leading source of medications for millennia. Our ancestors chewed certain herbs to relieve pain or wrapped leaves around wounds to improve healing. Today, these natural products are the richest source of compounds in modern drug discovery and development.

Professor Parker from the Ferrier Research Institute at Victoria University of Wellington has received a Marsden Fund grant to investigate a family of bioactive compounds found in fungi known as indole diterpenes. This family of compounds has important anti-viral, anti-bacterial and anti-cancer properties, as well as acting as a natural insecticide. In previous work, Professor Parker was part of the team that discovered the genes responsible for the creation of indole diterpenes. In this project, she will examine small genetic variations that enable fungi to produce a diverse range of indole diterpene compounds. These variations will provide a recipe book for producing different and potentially useful compounds.

This research will provide a better understanding of how different organisms develop their unique chemical signatures at a molecular level. The results will allow us to tailor-make compounds with enhanced and useful bioactive properties for medicinal use.

Are you more than just

a number?

Improving population studies from science to policy

Population research shapes everything from public health interventions to national conservation priorities and your insurance premiums.

Dr John Matthewson from Massey University will develop a new framework to help ensure research into populations is rigorous and ethical.

From medical trials to ecology and psychology, scientific research is frequently about populations. Population statistics are also used extensively in the public and private sphere, often to justify important decisions regarding individuals. Such data may be used to assess your risk of heart disease, your resilience following traumatic events, or the probability you will commit a crime. In the era of big data, population-level research will increasingly drive crucial decision-making. However, what counts as a 'population' and how such information should be used is not neutral or well defined.

Dr Matthewson from Massey University's School of Humanities has received a Marsden Fund Fast-Start grant to develop a framework that identifies key properties of populations across the natural and social sciences. He will combine philosophical analysis with case studies to examine the theoretical, practical, and ethical dimensions of defining a population. Dr Matthewson is uniquely placed to tackle this significant interdisciplinary issue, having trained and worked as both a medical doctor and a philosopher.

Population research can benefit society, but misuse or misunderstanding of such data can harm groups and individuals. This project will outline how and when population-based evidence can be fairly and accurately applied in scientific and policy analysis and inform real-world decisions. The resulting framework will contribute to more rigorous scientific methodologies for population research.

Associate Professor Joanna Kidman from Victoria University of Wellington and Dr Vincent O'Malley of HistoryWorks will explore how New Zealanders selectively remember and forget difficult and violent events from our colonial past.

Ka hōpara te Ahorangi Tuarua a Joanna Kidman o Te Whare Wānanga o Te Ūpoko o Te Ika a Māui rāua ko Tākuta Vincent O'Malley o HistoryWorks i te āta maumahara me te whakawareware o ngā tāngata o Aotearoa i ngā āhuatanga uaua, whakarekereke hoki o tō tātau ao taipūwhenua o mua.

Lest we remember

In 2015, students from Ōtorohanga College successfully called for a national day of commemoration for the New Zealand Wars. Their petition highlighted that wars fought on distant soils are better known and commemorated than those that occurred within our own nation. Why are some conflicts publicly remembered while others are forgotten? And who decides the stories we tell about our past?

In a new Marsden Fund project, Associate Professor Kidman and Dr O'Malley will explore how the New Zealand Wars have been collectively remembered or forgotten across time by different groups. They will combine archival research, ethnography and hīkoi to examine contested memories of conflict in Māori tribal society and the wider New Zealand nation. Focusing on the wars' impact in Waikato, Tūranga and the Bay of Plenty, the team will ask how memories of conflict have been transmitted between generations and how they shape contemporary group identities.

The Māori saying 'Me huri whakamuri, a ka titiro whakamua' highlights that the future can only be understood in the context of what has gone before. Genuine reconciliation and cross-cultural engagement require an understanding of divergent memories about pivotal events in New Zealand's past and how these memories shape the narratives told by subsequent generations. The project aims to help New Zealanders better remember, commemorate and own our collective past.

Kei maumahara tātau

Ite tau 2015, i arohia mai te karanga a ngā ākonga o te Kāreti o Ōtorohanga kia tū he rā ā-motu hei whakamaumahara ki Ngā Pakanga Whenua o Aotearoa. E ai ki tā rātau petihana he nui ake te mōhiotia me te whakamaharatia o ngā pakanga i tū ki tāwāhi tēnā i ērā i tū ki tō tātau ake whenua. He aha i whakamaumaharatia ai ētahi pakanga engari ka warewarehia ētahi? Kei a wai te mana ki te whakatau ko ēhea ngā kōrero hei whakaputa mō tō tātau hītori?

I roto i tēnei kaupapa hou a Te Pūtea a Marsden, ka hōpara a Ahorangi Tuarua Kidman me Tākuta O'Malley i te āhua o te whakamaumahara, te wareware rānei i Ngā Pakanga Whenua o Aotearoa e ngā rōpū rerekē i roto i te wā. Ka whakakotahitia e rāua ngā rangahau pūranga tawhito, mātauranga ahurea me te hīkoi hei tirotiro i ngā pūmahara taupatupatu o ngā tohetohe i roto i ngā iwi Māori me te iwi whānui o Aotearoa. E aro ana ki ngā pakanga i Waikato, Tūranga me Toi Moana, ko te pātai a te rōpū he pēhea te tuku i ngā kōrero o ngā pakanga i roto i ngā reanga, ā, me te āhua o te whakaawe i ngā tuakiri rōpū o ēnei rā.

E tohu ana te kōrero a te Māori, 'Me huri whakamuri, ā, ka titiro whakamua', arā, mā te mōhio ki ngā āhuatanga o mua ka mārama ki te ao anamata. Mō te whakahoanga tūturu me te whakawhitiwhiti ahurea me mārama ki ngā pūmahara rerekē mō ngā tino wā hira i Aotearoa i ngā rā o mua, ā, he pēhea te whakaawe a ēnei pūmahara i ngā kōrero ka kōrerohia e ngā reanga e heke iho. Ko te whāinga o te kaupapa he āwhina i te iwi o Aotearoa kia pai ake te maumahara, whakamaumahara me te manaaki i tō tātau hītori o mua.

Untangling the link between self-injury & suicide

Te wetewete i te hono mai i te whakamamae whaiaro me te whakamomori

Professor Marc Wilson from Victoria University of Wellington will investigate whether self-harm leads to suicidal thoughts and behaviour, or vice versa, in New Zealand youth. This study will help us better understand suicide, a major cause of death among 15-29 year olds in Aotearoa New Zealand and globally.

Half of young New Zealanders engage in non-suicidal self-injury, such as cutting. Our nation also has one of the highest rates of youth suicide in the developed world, with Māori and Pasifika disproportionally affected. Suicide is the second biggest killer of 15-29 year-olds internationally, surpassed only by road traffic accidents. Research has shown that self-injurious thoughts and behaviour can predict suicidal thoughts and behaviour. However, the causal link between non-suicidal self-injury and suicide is poorly understood.

Professor Wilson from Victoria University of Wellington's School of Psychology has received a Marsden Fund grant to examine why so many young people deliberately hurt themselves, and whether non-suicidal self-injury is a 'gateway' to suicidal thoughts and behaviour or vice versa. With a team of psychologists and researchers, he will undertake a longitudinal study of secondary school students. The team will survey around 2,000 youth each year on measures of self-harm, suicidal thoughts, and possible contributing factors such as self-esteem, social connectedness, and perfectionism. The team will also examine the link between physiological markers of stress (such as pain sensitivity, endocrine function, and heart-rate variability) and self-harm and/or suicidal thoughts and actions.

This will be the first longitudinal study in the world to test whether self-harm leads to suicidal thoughts and behaviour, or whether the reverse is true. The results will help to answer urgent questions about self-injury and suicide – their causes and consequences – among New Zealand youth and enable better interventions for at-risk youth.

Kei te tūhura a Ahorangi Marc Wilson o Te Whare Wānanga o Te Ūpoko o Te Ika a Māui mēnā ko te mutunga atu o te whakamamae whaiaro ko ngā whakaaro me ngā whanonga whakamomori, tētahi kē rānei, mō ngā taiohi o Aotearoa. Ka āwhina tēnei rangahau kia pai ake tō tātau mārama ki te whakamomori, he pūtake nui o te mate o te hunga 15-29 tau i Aotearoa me te ao.

He haurua o ngā taiohi o Aotearoa he whakamamae i a rātau anō, pērā i te haehae, engari ehara i te whakamomori. Ko tō tātau whenua tētahi o ngā whenua e tino kitea nuitia ana te whakamomori o te taiohi i te ao taepū katoa, ka mutu e tino pākia ana ko te Māori me te Pasifika. Ko te whakamomori te pūtake tuarua o te mate mō te hunga 15-29 tau i te ao, ko te aituā waka kei mua. E ai ki ngā rangahau ka tohu ngā whakaaro me ngā whanonga whakamamae whaiaro i ngā whakaaro me ngā whanonga whakamomori. Engari, kāore i te tino mārama ki te hono kōkau i waenga i te whakamamae whakamomori-kore me te whakamomori.

Kua whakawhiwhia a Ahorangi Wilson o Te Kura Mātai Hinengaro o Te Whare Wānanga o Te Ūpoko o Te Ika a Māui ki tētahi takuhe Pūtea a Marsden ki te aromātai he aha e tahuri ai te maha o ngā taiohi ki te whakamamae i a rātau anō, ā, mēnā he 'tomokanga' te whakamamae whakamomori-kore ki ngā whakaaro me ngā whanonga whakamomori, tētahi ki kē rānei. I taha o tōna rōpū tohunga hinengaro me ngā kairangahau, ka whakahaerehia e ia tētahi rangahau whāroa i ngā ākonga kura tuarua. Ka uiuitia e te rōpū ngā taiohi 2,000 i ia tau mō ngā whakaritenga o te whakamamae whaiaro, ngā whakaaro whakamomori me ngā āhuatanga tautoko pea pērā i te kiritau, te kaha o ngā whanaungatanga, me te whai i te painga rawa atu. Ka tirotiro anō te rōpū i te hono i waenga i ngā tohu hinengaro o te ahotea (pērā i te aronui ki te mamae, te mahinga a te repe taiaki, me te taurangitanga kapa manawa) me ngā whakaaro me ngā mahi whakamamae whaiaro, whakamomori hoki/rānei.

Koinei te rangahau whāroa tuatahi i te ao ki te whakamātautau mēnā ka neke atu te whakamamae whaiaro ki te whakamomori, mēnā ko tētahi kē rānei te mea tika. Ka āwhina ngā hua ki te whakautu i ngā pātai nui mō te whakamamae whaiaro me te whakamomori – ngā pūtake me ngā mutunga iho i waenga i ngā taiohi o Aotearoa – me te whakarite i ngā whakataunga pai ake mō ngā taiohi noho mōrearea.

Ancient aquaculture

Dr Phil Ross was awarded a Marsden Fund Fast-Start in 2015 to study the influence of early-Māori and ahumoana tawhito (ancient aquaculture) on the toheroa of today

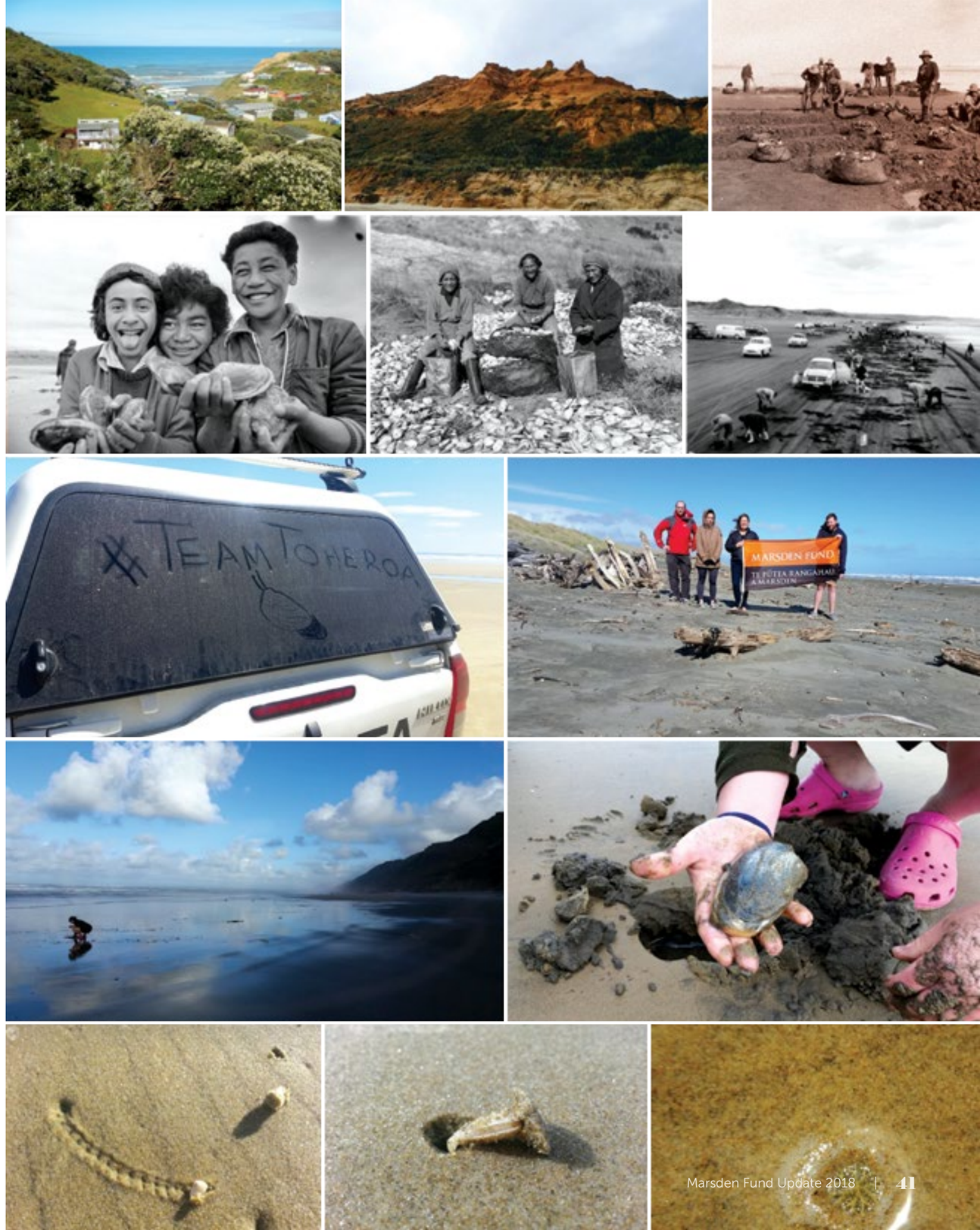
Dr Phil Ross from the University of Waikato is unravelling the history of the mysterious toheroa. Using methods from archaeology, anthropology, and genetics, Dr Ross and his team aim to learn more about how early-Māori managed their seafood resources and determine if the present distribution of this iconic surf clam is a consequence of historical translocations.

It has long been assumed that present-day distributions of marine organisms are a consequence of natural processes (ecological, evolutionary and geophysical) and recent human activity (fishing, habitat modification and biological invasions). However, it is becoming increasingly clear that early-humans across cultures and continents developed sophisticated methods for managing seafood resources and that these practises may have influenced the distribution of marine species as we know them today. Unfortunately, developing an understanding of early aquaculture and resource management has proved difficult in countries with long histories of human occupation because evidence of ancient aquaculture has been obscured by the passage of time. As the last major landmass settled by humans, New Zealand provides an unparalleled opportunity to examine the significance of early human-ecosystem interactions.

Dr Ross is leading a team that was awarded a Marsden Fund Fast-Start grant in 2015 to explore historical Māori management of one of New Zealand's most iconic marine species, the toheroa. Toheroa were once abundant on a handful of west and south coast surf beaches and they were an important food source for Māori. From the late-1890s, recreational and commercial toheroa harvesting became increasingly popular. What followed was decades of unsustainable harvest and the collapse and closure of the toheroa fishery in the 1970s. The failure of toheroa to recover, despite being protected for more than 40 years, is one of the great mysteries of New Zealand marine ecology.

While searching for clues to the continued decline of toheroa, Dr Ross conducted genetic analyses that led him to believe that the present-day distribution of this species may have been modified through human-mediated translocations. Toheroa from northern New Zealand appeared to have been transplanted by Māori to the beaches at the bottom of the South Island. Realising that ecological methods on their own would not solve this mystery, Dr Ross has assembled a team of anthropologists and archaeologists to help explore the human side of the story. The team are working closely with Māori communities to understand the history of their interactions with toheroa and identify ways that mātauranga Māori can assist with toheroa restoration. From the research conducted to date, it is apparent that Māori had a very active resource management ethic. Translocation of kaimoana (including toheroa) was widespread, probably practised over many generations and continues in coastal communities today. While it's not yet known if toheroa translocations to the South Island were to establish new food sources or to enhance exiting populations, ongoing archaeological and genomic research should provide answers.

The new knowledge from this research provides important insights into the early-human component to the ecological theory of species distribution, and an opportunity for fisheries managers to incorporate mātauranga Māori into their attempts to restore this taonga species.



Family memories

can be so much more important than we think

Associate Professor Anna Green from Victoria University of Wellington was awarded a Marsden Fund grant in 2015 to study Pakeha intergenerational family memory.

First published on Stuff Aug 30, 2018. Republished with permission of the author.

OPINION: We know how much Māori cherish family memory, so why do Pākehā tend to neglect this rich and engrossing dimension of their past?

One reason, I think, is the bad rap of memory in popular perception. You know – memory is unreliable, biased, selective. But, in practice, all sources of information about the past require careful analysis for precisely these reasons.

Of course, memory is idiosyncratic and rarely follows the neat parameters of professional or national history. Instead, remembered family stories reveal aspects of the everyday past, including the experiences, emotions, relationships or dispositions of forebears.

Over the past couple of years, four oral historians, including myself, have travelled the length and breadth of the country for a Royal Society Te Apārangi Marsden-funded research project, recording the memories passed down within 60 multigenerational families descended from 19th-century European immigrants (see www.familymemory.nz). Many of our participants have done, or have access to, genealogical research. But they also remembered orally transmitted family stories that enrich and deepen our understanding of earlier generations.

Associate Professor Anna Green: "Of course, memory is idiosyncratic and rarely follows the neat parameters of professional or national history. Instead, remembered family stories reveal aspects of the everyday past."

Margaret, born in the mid-1940s, recounted the following story that had been passed down from her mother. It concerns Margaret's sociable Irish grandmother, who, in the early 1920s, lived in a remote part of Taranaki where her husband ran a sawmill:

"My mother said, 'My mum used to go off and leave us a lot. And Magdalene, the oldest daughter, used to have to do the cooking and everything. And she ran away ... She had to do all the work, when she was only 15, 16 years old. She was taking care of the other seven kids, and cooking with a wood fireplace ... My poor dad had to come in from the sawmill and there was really nothing to eat ... And it was all Magdalene's fault because she ran away, but then she should have run away because she had to work too hard.' So that was one of her stories ... Yes, her mother liked to go off and leave them."

For a brief moment, the texture of everyday family life at this time is illuminated, encapsulating multiple insights into the prescribed roles and desperate responses of a mother and daughter to the heavy domestic labour of caring for large families amid the isolation of the back country.

Women and children outside the house of coal miner Thomas Donaldson, on Denniston Hill, West Coast.
Image: Alexander Turnbull Library, Wellington, New Zealand

Why are these memories important in the present? For the historian, these stories provide irreplaceable insights into the interior world of the family, in all its sensory, emotional and prescriptive dimensions. But equally, if not more important, family stories live on in present-day autobiographical memory, shaping our conscious and unconscious perceptions of both the private and public worlds around us.

How we think about past, present and future is often filtered through the lens of our family stories, and this in turn influences the ways in which we act as citizens, as well as family members, in the present.

Kiwi scientists closing in on killer

infectious disease

Professor Greg Cook, awarded a Marsden Fund grant in 2016 to study unravelling the key role of cytochrome bd oxidase in antimicrobial lethality in tuberculosis.

Republished with permission from the NZ Herald.

Otago University's Professor Greg Cook (pictured) and Dr Kiel Hards have been investigating one of the first new tuberculosis (TB) drugs approved in more than 40 years. Kiwi scientists have discovered a novel property of a new anti-tuberculosis drug which may help develop more drugs to treat the world's biggest-killing infectious disease. Globally, there are about 1.7 million deaths annually that are attributed to TB with rising incidents of drug-resistant TB.

Professor Cook from the University of Otago's Department of Microbiology and Immunology, along with postdoctoral fellow Dr Kiel Hards, has been investigating one of the first new TB drugs approved in more than 40 years, Bedaquiline – which is sold under the brand name Sirturo. Bedaquiline is the first new drug to be developed after four decades of searching for more effective drugs that combat TB and was only approved by the US Food and Drug Administration in 2012. But Cook said one drug wouldn't be enough to reverse a 40-year lull in drug-development. "So our lab is actively searching for new TB drugs to complement Bedaquiline and expand the treatment options available to clinicians worldwide".

To develop even better drugs to combat TB, it was important to understand why Bedaquiline was so good in the first place. "The most promising aspects of the drug are its ability to shorten treatment timeframe to eight weeks and that its target is unconventional for an antimicrobial," Hards said. "Bedaquiline disrupts the ability of M. tuberculosis to generate energy," he said. "What we discovered is that the drug has a second activity or property that may explain how it is able to kill non-replicating cells." This second activity, called 'ionophoric', involved the movement or shutting of ions across the mycobacterial membrane, resulting in the dissipating of critical ion gradients needed for growth and survival.

Potentially, their finding may have ramifications for other antibiotics, as it could be the case that many other antibiotics work by this mechanism. "We believe that we can design more effective TB drugs if we include ionophore-like properties in a similar way to Bedaquiline," Cook said."The 'biological electricity' that these ions normally create is key to energy generation and a whole series of other incredibly important cellular processes."It was already known that disrupting these ion gradients is lethal to M. tuberculosis but before Bedaquiline there were no drugs that could do this and be safe in humans."

Cook said it was very rare to discover new properties about drugs as researchers frequently focus on the primary target of a drug and often the off-target or secondary effects of drugs are ignored. "Subsequent discoveries are usually serendipitous, but in the case of Bedaquiline we realised the previous data didn't explain how it could kill non-replicating cells and so we kept pushing to find the answer," he said. "Many researchers are now turning their attention back to focusing on how antimicrobials actually kill bacteria to uncover new pathways of cell death. "These offer tremendous potential to develop new antimicrobials."

The Otago researchers worked in collaboration with colleagues from The University of Technology in the Netherlands, the University of Illinois in the United States and Vrije University in Amsterdam.

The study was supported with funding from the Marsden Fund, Royal Society and the Maurice Wilkins Centre for Molecular Biodiscovery.

No te hurihuringa

On reflection

Kia ora koutou. It is wonderful to be able to look back through the Marsden Fund Update and to be reminded of the many highlights of the last year. For me it has been a great privilege to be able to have a small part in supporting the wealth of excellent research that is being conducted in New Zealand at the moment. Seeing this research develop, a portion of which you have been reading about in this publication, has to be one of the stand-out experiences of the year. It is also a chance to reflect further back on the enormous impact the Fund has had on promoting excellent investigator-led research in New Zealand. Our understanding of ourselves and our environment is much richer because of it.

In contemplating this success I recognise the foresight of those who had the vision to initiate the Fund in the first place, those who work to manage the mass of applications that flood through the doors every February, and those who ensure that the process is fair and identifies the most excellent work available. This includes the many thousands of overseas referees who have provided independent assessments over the years.

Finally, I acknowledge the investigators themselves who have worked to create the most exciting and innovative research projects that one could imagine, in many cases persevering over several years to fine-tune an idea to excellence.

This a good time to reflect back on the past, but also to look to the future. It is so important for New Zealand that we continue to maintain a strong basic research infrastructure, particularly for investigator-led enquiry. This work has been shown to underpin applied research and technological development, with the resultant economic benefits that flow from that. Critically, however, it also expands our understanding of our world and ensures that we have a broadly-talented and innovative research sector that is ready to take advantage of new opportunities and is resilient against a changing environment. This diversity also allows for the incorporation of the different viewpoints and mātauranga that we have in this country and provides the ability to respond to change by having the intellectual and technical resources available to address the unexpected and to leverage it to advantage. Diversity is, therefore, essential to the future success of the Marsden Fund. By letting the investigator lead, rather than by leading the investigator, we can maintain this diversity and thereby ensure that we achieve the greatest breadth and excellence in our investigative capacity. Doing this will ensure our resilience and provide a capacity to meet the demands of the future, whatever they may be.

Professor David Bilkey
May 2019

2018 Marsden Fund Recipients

Auckland University of Technology

Dr CC Weber - Structure and Reactivity in Nanostructured Ionic Solvents	**$300,000**
Associate Professor SLG Davies - Accessing Assisted Reproduction: Social Infertility and Family Formation	**$816,000**
Dr AL Refiti - Vā Moana: space and relationality in Pacific thought and identity	**$842,000**
Professor RJ Siegert - Untangling inflammation and Depression in a Pacific Youth Cohort	**$827,000**
Dr KA Thom - Responding to citizens in mental distress: Exploring the preventative role of community police	**$794,000**

Bodeker Scientific

Dr JP Conway - How do clouds modify the response of mountain glaciers to climate change?	**$300,000**

GNS Science

Dr EJ Warren-Smith - Semi-conducting fault zones. High-resolution analysis of fault segmentation and rupture	**$300,000**
Dr IS Chambefort - Superhot fluids: The origin and flux of natural greenhouse gases in volcanic areas	**$958,000**

Massey University

Dr OEJL Calder-Dawe - Relentlessly positive? Exploring the imprint of positivity imperatives on the affective lives of young women	**$300,000**
Associate Professor C Wilkins - 'Dark Side of the Net': Exploring and modelling the impact of online illegal drug markets	**$836,000**
Dr HL Hendrickson – 'It's complicated': experimentally tracking the evolution of endosymbiosis in real time	**$884,000**
Distinguished Professor GJ Martin – Modern Analysis and Geometry	**$671,000**
Dr DJW Simpson – Organised chaos: Using geometry to explain robust chaotic dynamics in switched dynamical systems	**$500,000**
Dr PK Duncan – The Natural History of Film Form: Film Aesthetics through Animal, Vegetable and Mineral Matter	**$300,000**
Dr M Rychert – Legal cannabis for sale: home-grown or supermarket?	**$300,000**
Dr SC Lilley – The role of Galleries, Libraries, Archives and Museums (GLAMS) in revitalising te reo Māori	**$300,000**
Dr DJ Winter – Treasure from the junk pile: Do transposable elements drive the evolution of gene expression?	**$300,000**
Dr EA McVitty – Embodying the law: Manhood and authority in the making of English legal culture c.1300-1600	**$300,000**
Professor GB Jameson - Pectin methylesterases: tuning pectin function with complex variations upon a simple theme	**$935,000**
Dr T Morison - Balancing access and agency in Long-Acting Reversible Contraceptive (LARC) programming: Developing a reproductive justice framework for Aotearoa New Zealand	**$300,000**
Dr JA Tate - Getting the balance right: how do allopolyploids successfully integrate interspecific nuclear and cytoplasmic genomes?	**$929,000**
Dr OJW Matthewson - What is a population? A philosophical account of population-oriented research in the sciences	**$300,000**
Dr A Drummond - Understanding the effects of gambling-related mechanisms in game design on problematic video gameplay behaviours	**$300,000**

Malaghan Institute of Medical Research

Professor F Ronchese - Do chemokines have a function other than chemotaxis: a role for CCL17 and CCL22 in T cell activation and differentiation	**$960,000**

NIWA

Dr G Stecca - Managing bed levels and flood risk in braided rivers: does conventional channel confinement theory fail by neglecting key sediment transport processes?	**$300,000**
Dr AM Lorrey - Calibrating environmental tipping point impacts from global climate reorganisations with swamp kauri	**$960,000**
Dr HJ Biggs - The rolling stones: Are rolling dynamics a critical component missing from conventional sediment transport?	**$300,000**

Plant & Food Research

Dr M Wellenreuther - Beyond DNA: testing the role of epigenomics in thermal adaptation	**$929,000**
Dr LJ Evans - The effect of environmental complexity on learning capacity in wild bumblebee populations	**$300,000**

The University of Auckland

Dr YS Koh - An Adaptive Predictive System for Life-long Learning on Data Streams	**$300,000**
Professor RGJ Flay - Reap the Whirlwind and Produce Carbon-Neutral Power From Atmospheric Buoyancy Vortices	**$948,000**
Dr JJ Eldridge - Understanding the stars and galaxies associated with gravitational wave events	**$936,000**
Dr NJ Matzke - How much does extinction matter for phylogenetic biogeography? Using exponential integrator technology to improve realism and speed in model-based biogeographical inference	**$300,000**
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