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MARSDEN FUND
TE PŪTEA RANGAHAU A MARSDEN

ROYAL SOCIETY TE APĀRANGI

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TE PŪTEA RANGAHAU A MARSDEN

MARSDEN FUND UPDATE

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Te Kāwanatanga o Aotearoa
New Zealand Government

Ministry of Business,
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The cover is a contemporary design of a tukutuku pattern, purapura whetū, representing stars and the great number of people in our nation.

RĀRANGĪ ŪPOKO CONTENTS

Sir Ernest Marsden

MŌ TE PŪTEA RANGAHAU A MARSDEN

E tautoko ana te Pūtea Rangahau 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 toru ngā momo takuhe: Atu ki te $3 miriona (kore GST) te wāriu o ngā takuhe a Te Tohu Kaunihera Pūtea Rangahau a Marsden i roto i te toru tau; Atu ki te $960K (kore GST) te wāriu o ngā takuhe Arowhānui mō te toru tau; ā, atu ki te $360K (kore GST) te wāriu o ngā takuhe Arowhānui mō te toru tau mā ngā kairangahau pūhou. Ka utua e ngā takuhe ngā utu ā-tau, ngā tūranga ākonga me te kairangi, me ngā taonga hoki.

He kairapu te Pūtea Rangahau 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 te Pūtea Rangahau a Marsden ki te kaiahupūngao a **Tā Ernest Marsden**. He mea whakatū e te kāwanatanga i te tau 1994. E kīia ana ko te Pūtea Rangahau 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: Marsden Fund Council Award grants worth up to $3 million (excl. GST) over three years; Standard grants that can be worth up to $960K (excl. GST) for three years; and Fast-Start grants worth $360K (excl. GST) over three years for early career researchers. 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 Marsden 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.

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.

Te Pūtea Rangahau a Marsden is managed by Royal Society Te Apārangi on behalf of the New Zealand Government with funding from the Ministry of Business, Innovation and Employment. Nā te Hīkina Whakatutuki te mana hāpai.

To discover more visit royalsociety.org.nz

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PROJECT HIGHLIGHTS FROM NEW MARSDEN FUND AWARDS

SUPPORTING WORLD-LEADING RESEARCH

In 2022, Te Pūtea Rangahau a Marsden, the Marsden Fund, allocated $77.391 million (excluding GST) to 113 research projects led by researchers in New Zealand. These grants support excellent research in the humanities, engineering, mātauranga, mathematics, science, and the social sciences for three years.

Established researchers and their teams were awarded 72 Marsden Fund Standard grants, for a total of $62,631,000 (excluding GST), with a success rate of 12.4%. These research projects will address a wide range of issues of both local and international importance, including seeing if we can use ionic liquids as an alternative to harmful solvents, investigating the role of fructose in diabetic heart disease, understanding the history and future of the kūmara through Māori oral historical perspectives, and exploring the maths behind imaging technologies.

The Marsden Fund continues to provide strong support for up-and-coming researchers, with 41 Fast-Start grants awarded, for a total of $14,760,000 (excluding GST). Fast-Start grants are designed to encourage the development of independent research and build momentum for exceptional careers in Aotearoa. The 2022 success rate was 13.0% for these awards. Funded projects this year cover a broad range of topics including quantifying the impact of climate change on glaciers, uncovering cultural history of the taniwha, countering resistance to antibiotics, understanding the drivers of solar cell adoption in Aotearoa, and exploring writing in vagahau Niue, the language of Niue.

The successful projects are of world-class standard, having made it through a highly rigorous selection process, including substantial international peer review. Professor David Bilkey sees out the end of his term as Marsden Fund Council Chair this year. Reflecting on this year's funding round, he says, "Te Pūtea Rangahau a Marsden was created to enable our leading and early-career researchers to develop their most inspired and ambitious ideas. Support for curiosity-driven 'blue-sky' ideas is vital sustenance to feed the healthy, resilient, and diverse research culture we have in Aotearoa. The resulting mahi can be expected to challenge accepted ways of thinking, introduce new lines of enquiry, and sometimes lead to unexpected discoveries.

"The depth and breadth of knowledge represented in this year's funded research is something to be proud of, with research excellence and scholarly impact in areas such as adapting to the climate crisis, improving hauora health and wellbeing, and advancing fundamental research that underpins new technologies.

"Māori research and mātauranga Māori has been recognised across a range of disciplines this year", notes Professor Bilkey. "For example, one project will use materials science and mātauranga Māori to try to explain the special physical properties of pounamu, and in another example the aim is to understand and leverage mātauranga Māori-led recovery approaches to improve how we recover from disasters. Some examples of kaupapa Māori approaches funded this year include an exploration of Māori views and expressions of emotions, and another which uses a kaupapa Māori research paradigm to understand how mainstream sport can be decolonised to enable Māori self-determination. There is strong representation of the diversity of Māori world views in this research, which will benefit Aotearoa in many ways – for example, by helping us to better understand who we are, and by applying transformative approaches to some of our most pressing problems."

The overall picture of funded projects this year includes an increased success rate for investigators identifying as Māori, which is 10.1% in 2022, compared to 8.9% last year.

The projects funded in this round will help fulfil one of the Marsden Fund Council's goals for the fund:

Ka pūmau tonu te hapori mātanga i te katoa me te whānuitanga o ngā kaupeka rangahau.

Maintain a New Zealand community of experts in the full and expanding range of research fields.

The overall success rate for applicants is up slightly from last year (12.6% this year, compared to 10.4% last year). The main reason for this is a slight fall in the total number of applicants.

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

Read more from Professor David Bilkey and meet the new Marsden Fund Chair (page 70).

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KA TAUTOKO TE PŪTEA MARSDEN I NGĀ RANGAHAU AUAHA I AOTEAROA

I NGĀ RANGAHAU MĀTĀMUA O TE AO

He $77.391 miriona (kore GST) kua tohaina e Te Pūtea Rangahau a Marsden ki ngā kaupapa rangahau 113 e ārahina ana e ngā kairangahau i Aotearoa. E tautoko ana ēnei tahua i ngā rangahau tiketike i roto i te mātauranga toi tangata, pūkaha, mātauranga, pāngarau, pūtaiao, me ngā mātauranga pāpori mō te toru tau.

I whakawhiwhia ngā kaiārahi tautōhito me ō rātau rōpū ki ngā takuhe Pūtea Marsden Arowhānui 72, he $62,631,000 (kore GST) te nui, me te auau angitu o te 12.4%. Ka whakarite ēnei kaupapa rangahau i ngā tūmomo raru hira whānui i te motu me tāwāhi, me te tiro mēnā ka taea e tātau te whakamahi ngā wē katote hei kōwhiringa kē mō ngā whakarewa kino, te tūhura i te mahi a te huahuka i roto i te mate manawa matehuka, te mārama ki te hitori me te anamata o te kūmara mā ngā tirohanga tuku iho ā-waha a te Māori, me te hōpara i te pāngarau i muri i ngā hangarau atahanga.

E kaha tautoko tonu ana te Tahua Marsden i ngā kairangahau kei te ara ake, ā, 41 ngā takuhe Tīmata-Wawe i whakawhiwhia, ā, he $14,760,000 (kore GST) te nui. He mea waihanga ngā takuhe hei whakahau i te whanaketanga o ngā rangahau motuhake me te whakatipu kaha mō ngā ara mahi whakaharahara i Aotearoa. He 13.0% te auau angitu mō ēnei tohu i te tau 2022. E kapi ana ngā kaupapa whai pūtea i tēnei tau i ngā tūmomo take tae atu ki te pānga o te huringa āhuarangi ki ngā kōpaka, te tūhura i ngā hitori tuku iho o te taniwha, te ārai i te papare ki ngā rongoā paturopi, te mārama ki ngā tino kaupapa o te whakamahi pūtau kōmaru i Aotearoa, me te hōpara i te tuhituhi i te reo Niue.

He taumata tiketike rawa ngā kaupapa i waimarie, i puta i tētahi tukanga tīpakonga tino pakari, tae atu ki te aropā ā-ao nui. I kī te Heamana o te Kaunihera Pūtea a Marsden a Ahorangi David Bilkey, "he mea hanga Te Pūtea Rangahau a Marsden kia taea ai ā tātau kairangahau mātāmua, pūhou hoki ki te whakawhanake i ō rātau whakaaro auaha, hao nui hoki. He mea taketake te tautoko i ngā whakaaro auaha mō te wairua pākiki hei whāngai i te ahurea rangahau, tū pakari, me te rangahau kanorau i konei i Aotearoa. Ko ngā mahi ka puta kāore e kore he werowero i ngā tikanga whakaaro ake, he whakauru mai i ngā uiui hou, ā, ko te mutunga atu i ētahi wā ko ngā tūhuratanga ohorere.

"Ko te hōhonu me te whānui o ngā mōhiotanga kua whakatakotoria i roto i ngā rangahau i utua i tēnei tau he mea whakahīhī, me te tiketike o te rangahau me te pānga mātauranga i ngā wāhi pērā i te urutau ki te raruraru āhuarangi, te whakapai ake i te hauora me te oranga, me te koke whakamua i ngā rangahau taketake e paihere ana i ngā hangarau hou.

"Kua āhukahukatia te rangahau Māori me te mātauranga Māori puta noa i ngā tūmomo peka mātauranga i tēnei tau", te kī a Ahorangi Bilkey. "Hei tauira, ka whakamahia e tētahi kaupapa ngā rauemi, pūtaiao me te mātauranga Māori hei whakamārama i ngā āhuatanga ōkiko o te Pounamu, ā, i tētahi atu tauira ko te whāinga kia mārama me te whakawhānui i ngā aronga whakaora ā-mātauranga Māori hei whakapai ake i te ahau e whakaora ana i a tātau mai i ngā aituā. Ko ētahi tauira o ngā aronga kaupapa Māori i whai pūtea i tēnei tau ko te hōpara i ngā whakaaro Māori me ngā kīanga kare ā-roto, me tētahi atu e whakamahi ana i tētahi āhuatanga rangahau kaupapa Māori kia mārama ai me pēhea te wetewete i te tāmitanga i te hākinakina matua hei whakamana i te tino rangatiratanga o te Māori.

He nui te kitea o te rerekētanga o ngā tirohanga Māori i tēnei rangahau, e whai hua ai a Aotearoa i ngā āhuatanga maha – hei tauira, mā te āwhina i a tātau kia mārama ake ko wai tātau me te whakamahi i ngā aronga takahuritanga ki ētahi o ngā raruraru tino hira."

Ko te tirohanga whānui o ngā kaupapa i whai pūtea i tēnei tau ko te piki o te auau angitu o ngā kaitūhura uri Māori, he 10.1% i te tau 2022, tēnā i te 8.9% i tērā tau.

Ko ngā kaupapa i whai pūtea i tēnei rauna ka āwhina ki te whakatutuki i tētahi o ngā whāinga a te Kaunihera Pūtea a Marsden mō te pūtea:

Ka pūmau tonu te hapori mātanga i te katoa me te whānuitanga o ngā kaupeka rangahau.

Kua āhua piki te rahinga o ngā kaitono i waimarie mai i tērā tau (12.6% i tēnei tau, tēnā i te 10.4% i tērā tau). Ko tētahi hekenga paku nei ki te maha o ngā kaitono te pūtake matua mō tēnei.

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.

Read more from Professor David Bilkey and meet the new Marsden Fund Chair (page 70).

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MARSDEN FUND STANDARD GRANTS

FINDING OUR WAY

WHEN THE SPACE AROUND US PLAYS BY DIFFERENT RULES

Professor Randolph Grace and Professor Simon Kemp from Te Whare Wānanga o Waitaha the University of Canterbury, will use immersive virtual reality (VR) to test the flexibility of our perception of space.

Humans and nonhumans alike can navigate by path integration – updating one's current position relative to a start point. For example, imagine that you are standing in a featureless expanse; you walk, departing from an origin point and stop at a second point. You turn to the right and walk to a third point. Now you wish to return to the origin. Even though there are no features to guide you, by gut feeling you know the correct homing direction and can estimate the distance to your origin point. Although people do make systematic errors in laboratory tests of path integration, we typically perform well in such tests, as do other animals that have been tested. Path integration is remarkable because it appears to require us to mentally calculate in a way that is consistent with the geometry of the space around us.

Professor Randolph Grace

Above: Eight360 Nova VR sphere. Designed and manufactured in New Zealand, the Nova is a 'virtual vehicle' that allows you to experience realistic sensations of movement in fully 3D immersive VR

But how do our cognitive and neural systems accomplish path integration? Professor Randolph Grace and Professor Simon Kemp have proposed that intuitions about algebraic structure are inherent to perception: we create representations of objects and shapes which have a consistent geometry and draw on these representations to perceive the spaces we navigate. In this Marsden Fund project, they will lead a team to test this by using immersive Virtual Reality (VR) at the HIT (Human Interface Technology) lab, including using cutting-edge VR technology that allows for 3D motion sensation. They will explore whether people can learn to operate in non-Euclidean spaces – that is, spaces where, for example, the internal angles of triangles add to more, or less, than the usual 180°, but which still obey a geometry that is algebraically consistent. As a study participant for the project, you might be asked to walk around a VR space which appears distorted, with objects warping in strange ways as you move closer or further away from them, making it hard to tell how distant they are. Could you navigate back to your starting point?

If people can learn to navigate in these non-Euclidean spaces, it would suggest that we can modify our mental representations of space to fit the geometric rules we encounter. This would provide compelling evidence that our perceptual system has the flexibility to perform computations that are distinctly different than those required in the world in which we evolved.

VR treadmill ('Virtuix Omni'). While supported by a harness and wearing special shoes, you can walk freely in any direction in virtual reality

COMING BACK TO LIFE: JUST ADD WATER!

CHLOROPLAST ASSEMBLY IN RESURRECTION PLANTS

Dr Christopher Carrie, from Waipapa Taumata Rau the University of Auckland, will investigate how chloroplasts, the tiny factories responsible for photosynthesis, are assembled in resurrection plants. This could lead to increased photosynthetic efficiency and improved crop yields.

Photosynthesis, where energy from the sun is harvested by plants and some bacteria to convert water and carbon dioxide to biomass and oxygen, is essential to support life on Earth. Chloroplasts are the tiny factories inside green plant cells that are responsible for photosynthesis. They contain specialised structures called thylakoid membranes, which house the essential protein complexes that harvest the sun's energy during the light reactions of photosynthesis. Understanding how chloroplasts and their thylakoid membranes are built is a fundamental biological question, and is essential for future advancements such as increasing photosynthetic efficiency for improved crop yields. However, despite recent advances, the events leading to chloroplast assembly are poorly understood.

Dr Christopher Carrie

Dr Christopher Carrie, from the University of Auckland, along with colleagues from South Africa and Germany, has been awarded a Marsden Fund Standard grant to study how chloroplasts and their specialised photosynthetic machinery are assembled. They will study specifically how this works in resurrection plants, which get their name from their remarkable ability to survive extreme dehydration for months or even years, completely dismantling their chloroplasts and their associated thylakoid membranes. When the dried-out plants are watered, they can rapidly reconstruct their chloroplasts to enable normal photosynthesis to resume. Tolerance to desiccation makes these plants a unique model system to study chloroplast assembly.

Dr Carrie and his team will use a variety of molecular and imaging techniques to map chloroplast and thylakoid assembly. They will be the first team to comprehensively describe the molecular events involved in resurrection after extreme dehydration. The team will gain unprecedented insights into how the photosynthetic machinery is built over time, as well as identifying new genes essential for chloroplast biogenesis. In the future, it could be possible to rewire or redesign chloroplasts to help improve stress tolerance and productivity, particularly in the context of climate change-related impacts and increasing demands on global food production.

GIVING VOICE TO THE HUMBLE KŪMARA

Kāore te kumara e kōrero ana mō tōna ake reka. The kūmara does not talk about its own sweetness. Professor Paul Tapsell of Takarangi Research Ltd is well acquainted with this whakataukī. He together with Professor Merata Kawharu are embarking on a journey to explore our nation's stories about the mighty staple crop that cannot be done through Western, archaeological lenses. We can then uncover narratives about the settlement, histories, and kōrero of Aotearoa and reconsider the value of kūmara culturally and economically for our present and future.

There is significant potential to unlock and rediscover hidden narratives from Māori oral historical perspectives, using kūmara as central vines linking them together. Academic and popular writing on kūmara is replete with Western, science-heavy archaeological research emphasising the value of kūmara to early settlements. While this is critical to understanding the first inhabitants of Aotearoa, where are descendant-maintained histories of kūmara in academic and publicly-accepted discourses? Without mātauranga – Māori framed knowledge systems including cross-generational understandings on the topic – DNA sampling and archaeological explanations for the arrival of kūmara remain incomplete and highly controversial at best, often reminiscent of the popularised twentieth century belief that Polynesians were accidental drift voyaging settlers.

Prof Paul Tapsell

While archaeologists continue to debate origins of pre-European kūmara in the Pacific through journals, orally maintained narratives supported by genealogies, navigational signposts, and varietal dispersal, have been carefully transmitted by kūmara knowledge holders up to recent times. Professor Tapsell, along with Associate Investigator Professor Merata Kawharu, have been awarded a Marsden Fund Standard grant to conduct research directly guided and supported by tohunga expert community-knowledge holders. With mātauranga at the heart of the investigation, the team will reassess current scientific understandings of kūmara through a whakapapa-focused lens. This combination of knowledge will provide a way forward for hāpori communities, especially amongst those who maintain kūmara gardens today. It is they who draw on past learnings while simultaneously responding to major challenges including climate change and water degradation, so that they can strengthen the economic and cultural fabric of marae communities in particular.

We know kūmara are vital to local identity and to first settlement. It is time to rediscover the sweetness of its narratives, take a new look at our nation's history and the cultural and economic innovation potential of the mighty kūmara.

Mātauranga kūmara specialists inspecting crops, Hokianga. Image: Pā to Plate Project

TE TUKU REO KI TE KŪMARA

Kāore te kumara e kōrero ana mō tōna ake reka. E tino mōhio ana a Ahorangi Paora Tapihana o Takarangi Research Ltd ki tēnei whakataukī. Kei te whai rāua tahi ko Ahorangi Merata Kawharu i tētahi ara ki te hōpara i ngā kōrero o te motu mō tēnei tino kai e kore e taea e te tirohanga Pākehā, whaipara. Kātahi ka taea e tātau te tūhura ngā kōrero mō te noho, ngā hitori, me ngā kōrero o Aotearoa me te whai whakaaro anō ki te uara ā-ahurea, ā-ōhanga o te kūmara mō tēnei wā me āpōpō.

He nui ngā āhuatanga ka taea hei whakatuwhera me te tūhura anō i ngā kōrero huna a ngā tirohanga tuku iho ā-waha a te Māori, mā te whakamahi i te kūmara hei aka matua e hono katoa ana i ēnei. E mātotoru ana ngā tuhinga mātauranga, hira hoki mō te kūmara me te arotahi a ngā rangahau whaipara mātauranga Pākehā i te uara o te kūmara ki ngā nōhanga tuatahi. Ahakoa he mea taketake tēnei kia mārama ai ki ngā kainoho tuatahi o Aotearoa, kei hea ngā hitori tuku iho a ngā uri whakaheke mō te kūmara i roto i ngā tuhinga kōrero mātauranga, tūmatanui hoki? Ki te kore te mātauranga, ka noho tarepa tonu, tohetohe hoki ngā tīpakonga pītauira me ngā whakamāramatanga whaipara mō te taenga mai o te kūmara, otirā e ū tonu ana ki te pōhēhē o te nuinga i te rau tau rua tekau i tūpono ohorere noa mai ngā iwi o Poronīhia ki konei, ā, nā te ia o te moana rātau i rātau i tere mai ki konei.

Prof Paul Tapsell

Ahakoa e taupatupatu tonutia ana te ahunga mai o te kūmara i mua o te taenga mai o te Pākehā i Te Moananui-a-Kiwa i roto i ngā tuhitaka, i tautokona e ngā whakapapa, ngā tohu whakatere, me te momo ruinga, kua āta tukua e te hunga mōhio ki ngā kōrero mō te kūmara tae noa ki ēnei wā. Kua whakawhiwhia a Ahorangi Tapsell, me te Kaitūhura Tuarua a Ahorangi Merata Kawharu, ki te takuhe Tahua Arowhānui a Marsden hei whakahaere rangahau e ārahina ana, e tautokona ana e ngā tātau o te hapori e matatau ana ki ngā kōrero. I te mea ko te mātauranga kei te iho o te tūhuratanga, ka āta tirotiro anō te rōpū i ngā mōhio mātauranga onāianei mō te kūmara mā tētahi tirohanga ā-whakapapa o te takohanga mātauranga. Ka kitea he ara whakamua i ngā mōhiotanga mō ngā hapori, otirā rātau e mahi māra kūmara ana i ēnei rā. Ko rātau te hunga ka toro i ngā akoranga o mua me te urupare ki ngā whakapātaritari nui tae atu ki te āhuarangi rangi me te kino haere o te wai, kia taea ai e rātau te whakakaha te taha ōhanga me ngā tikanga o ngā marae.

E mōhio ana mātau he hira te kūmara ki te tuakiri o te hapori me ngā kainoho tuatahi. Koinei te wā hei tūhura anō i te reka o ngā kōrero, te whai i tētahi tirohanga hou ki te hitori o tō tātau whenua me ngā pūmanawa nohopuku auaha ōhanga o te kūmara.

Mātauranga kūmara specialists inspecting crops, Hokianga. Image: Pā to Plate Project

BLOOD FLOW ACROSS THE PLACENTAL SURFACE

HOW DOES THIS AFFECT FETUS SIZE?

Associate Professor Jo James from Waipapa Taumata Rau the University of Auckland will explore how blood flow across the placental surface impacts the birth of dangerously small pēpi babies.

One of the most complex blood spaces in the human body, called the intervillous space, develops in pregnancy. It is an expansive vascular space with a tree-like structure involved in placental exchange – where blood flow carries nutrients and oxygen between the whenua (placenta) and intervillous space – which is critical for growing a healthy fetus. An impaired placental exchange can lead to a condition called fetal growth restriction, when pēpi babies are born dangerously small. This is a significant clinical issue and has no treatment other than preterm delivery. Over 50% of fetal growth restriction cases are not detected prior to delivery, which makes this condition the largest risk factor for stillbirth.

Associate Professor Jo James

A unique cell called the syncytiotrophoblast on the outer surface of the whenua can sense blood flow through the intervillous space. Previous work from the Pregnancy Modelling Group that Associate Professor James co-leads with Associate Professor Alys Clark, has suggested this sensing results in a dynamic relationship between blood flow and whenua development across pregnancy. However, there has been little consideration how the interplay between blood flow and whenua tissue architecture evolve over the course of pregnancy.

Associate Professor James and her team have been awarded a Marsden Fund Standard grant to investigate how blood flow across the placental surface changes in fetal growth restriction. They will look at the responses of shear stress on the syncytiotrophoblast cell of the whenua, and the impacts of this cellular stress on whenua development and function. This project will combine cutting-edge bioengineering tools, such as 3D Micro-Computed Tomography imaging, with stem cell tools. The overall goal is to tease apart the relationships between whenua architecture, intervillous space blood flow, and syncytiotrophoblast cell function that are fundamental for human life to develop. These insights are imperative to shed light on the underlying processes of fetal growth restriction and improve the ability to identify at-risk pēpi.

HE PĒHEA TE PĀNGA O TE RERENGA TOTO KI TE MATA WHENUA KI TE NUI O TE KAHU?

Ka hōpara a Ahorangi Tuarua Jo James o Waipapa Taumata Rau i te pānga o te āhua o te rerenga toto ki te mata whenua ki te whānautanga mai o tētahi pēpi iti rawa.

Ko tētahi o ngā wāhi toto ino uaua i roto i te tinana tangata, e kīia ana ko te 'intervillous space', ka whanake i te hapūtanga. He wāhi manawa tino whānui me tētahi hanganga ā-rākau kei roto i te whakawhitinga whenua - e rere ai te toto me te kawe i ngā matūkai me te hāora i waenga i te whenua me te wāhi intervillous - he tino hira mō te whakatipu i tētahi kahu hauora. Ko te mutunga atu pea o tētahi whakawhitinga waimaero ko tētahi mate e kīia ana ko te tipu whāiti o te kahu, ka whakaraerae te whānau mai o te pēpi tino paku. He raru haumanu nui tēnei, ā, kāore he maimoatanga i tua atu o te whānau pī. Neke atu i te 50% o ngā āhuatanga tipu whāiti o te kahu kāore e kitea i mua o te whānautanga mai, ā, ko tēnei mate te āhuatanga mōrea nui rawa mō te whānau kahu.

Ka rongo tētahi pūtau tino rerekē e kīia ana ko te syncytiotrophoblast kei te mata o waho o te whenua i te rerenga toto mā te wāhi intervillous. E kī ana ngā mahi o mua a te Rōpū Whakatauira Hapūtanga e ārahina ana e ta Ahorangi Tuarua James rāua Ahorangi Tuarua Alys Clark ka puta i tēnei rongo ko tētahi hononga akiaki i waenga i te rerenga toto me te whanaketanga o te whenua puta noa i te hapūtanga. Engari, he tino iti noa te whai whakaaro ki te tipu o te whanaungatanga i waenga i te rerenga toto me te hoahoa pūtautau whenua i te roanga o te hapūtanga.

Kua whakawhiwhia te Ahorangi Tuarua James me tōna rōpū i tētahi takuhe Tahua Marsden Arowhānui hei tūhura i te āhua o te huri o te rerenga toto i te mata whenua i roto i te tipu whāiti o te kahu. Ka tiro rātau ki ngā urupare o te kaha ahotea o te pūtau syncytiotrophoblast o te whenua, ngā pānga o tēnei ahotea pūtau ki te whanaketanga me te mahi a te whenua. Ka whakakotahi tēnei kaupapa i ngā utauta pūkahakoiora tino hou rawa, pērā i te atahanga Whakaata Tinana Rorohiko-Mōkito, mā ngā utauta pūtau tātā. Ko te whāinga whānui he wetewete i ngā hononga i waenga i te hoahoa whenua, te rerena toto wāhi intervillous, me ngā mahi pūtau syncytiotrophoblast e hira ai mō te tipu o te ira tangata. He mea nui ēnei tirohanga kai mōhiotia ai ngā tukanga taketake o te tipu whāiti o te kahu me te whakapai ake i te kaha ki te tāutu i te pēpi e noho mōrea ana.

WHY IS POUNAMU SO TOUGH?

Dr Nick Mortimer and Dr Simon Cox from Te Pū Ao GNS Science and pounamu artisans will use materials science and mātauranga Māori to explain the special physical properties and uses of pounamu – Aotearoa New Zealand's nephrite jade.

Worldwide, nephrite jade is renowned for its extreme toughness compared to other rocks and materials. This makes it very suitable for artisanal work such as carving, shaping, and holding a sharp edge; these special properties, along with symbolic and spiritual associations, have made it highly sought after.

In Aotearoa, pounamu is a tāonga and the subject of much mātauranga. Varieties of pounamu, found only in certain places on the South Island, are distinguished by Māori according to colour, translucency and inclusions (other minerals trapped inside). These include kahurangi (translucent apple green), kawakawa (dark green to black with dark inclusions), īnanga (pearly white), and tangiwai (olive to yellowish brown, or blueish green). Mineralogically, most pounamu is nephrite but some is serpentinite.

Despite its mana and prestige, the mineralogical explanation of pounamu's physical toughness remains elusive. All minerals have a natural hardness that is measured on the Mohs scale, which rates from 1-10, where a rating of 1 would be a soft mineral like talc, and a 10 would be diamond hard. Nephrite jade is only meant to be moderately hard (6 – 7), which is not consistent with how tough and resistant to fracture it is known to be. Theories for this discrepancy abound – from twisted and interwoven mineral fibres, to ultra-fine grain size, to stored strain.

This collaborative Marsden Fund Standard grant project will weave Western science with mātauranga Māori to address these theories, using state-of-the-art materials science and iwi cultural knowledge to form a larger picture of pounamu use over time. Knowledge transfer will be two-way: bringing together scientists who are unfamiliar with the carving properties or history of various samples and pounamu artisans who have yet to include physical science data in their work.

Outcomes from this project will further our understanding of the metal-like toughness of pounamu, inform the selection and cutting process of high-quality pounamu for carving, and illuminate future development of super-tough synthetic materials. With its cultural, geological, archaeological and materials science significance, this project can rewrite the jade textbooks of the world and lead to better management of this precious resource.

Image: GNS Science

HE AHA E TINO MĀRŌ AI TE POUNAMU?

Ka whakamahia e Tākuta Nick Mortimer rāua ko Tākuta Simon Cox o Te Pū Ao, he tohunga pounamu hoki, ā, ka whakamahia ngā pūtaiao rawa me te mātauranga Māori hei whakamārama i ngā āhuatanga ōkiko motuhake me ngā whakamahinga o te pounamu.

E mōhiotia ana te pounamu i te ao katoa mō tōna tino mārō tēnā i ētahi atu toka, rauemi hoki. Nā tēnei ka tino pai rawa tēnei mō ngā mahi ā-rehe pērā i te whakairo, te ahuahu, me te pupuri taha koi; nā te taha wairua, whai tohu hoki ō ēnei āhuatanga motuhake, e tino hiahiatia ana ēnei.

I Aotearoa, he taonga te pounamu, ā, he nui te mātauranga e pā ana ki tēnei. Ka wehewehea ngā momo pounamu, e kitea ana i ētahi wāhi anake i Te Waipounamu, e te Māori e ai ki te tae, whakatīaho me ngā mea o roto (ētahi atu ōpapa kei roto). Kei roto i ēnei ko te kahurangi, te kawakawa, te īnanga, me te tangiwai. Ko te āhuatanga ōpapa o te nuinga o ngā pounamu he nephrite engari he serpentinite ētahi.

Ahakoa tōna mana, kāore tonu i te mōhiotia te whakamāramatanga ā-ōpapa o te mārō o te pounamu. He āhuatanga tūturu tonu te mārō o ngā ōpapa katoa ka inea ki te tauine Mohs, ka whakatauria mai i te 1-10, ā, ko te whakatauranga o te 1 he ōpapa ngohengohe tērā pērā i te tāke, ā, ko te 10 he rite ki te taimana tōna mārō. Ko te pounamu nephrite he āhua mārō (6 - 7), ā, kāore i te hāngai ki te mārō me te uaua ki te wāhi ki tērā e mōhiotia ana. He maha ngā ariā mō tēnei hapanga - mai i ngā weu ōpapa e whīwhiwhi ana, e whiriwhiri ana i roto, ki ngā rahi pata iti rawa hei pupuri i te riaka.

Ka whiriwhiria tahitia tēnei kaupapa takuhe Pūtea Marsden Arowhānui mahi tahi i te mātauranga Pākehā ki te mātauranga Māori hei whakarite i ēnei ariā, mā te whakamahi i te mātauranga matū tino hou rawa me ngā mōhiotanga tuku iho o ngā iwi kia tino mārama ai ki te whakamahinga o te pounamu i roto i te wā. He ahunga rua te rere o ngā mōhio: e whakakao mai ana i ngā tohunga pūtaiao kāore i te mātau ki ngā āhuatanga whakairo, hītori rānei o ngā tūmomo tīpako me ngā momo whakamahi i te pounamu kāore anō kia whakaurua mai ngā raraunga pūtaiao ōkiko ki ā rātau mahi.

Ko ngā putanga mai i tēnei kaupapa ka whakawhānui haere anō i tō tātau mārama ki te āhuatanga mārō o te pounamu, e mōhio ai ki te tukanga tīpako me te tapahi o te pounamu tino kounga mō te whakairo, me te whakaari i te whanaketanga anamata o ngā rawa tino mārō rawa. Nā tōna hiranga pūtaiao ahurea, arowhenua, whaipara me te mātauranga rawa, ka taea e tēnei kaupapa te tuhi anō ngā puka akoranga o te ao mō te pounamu, ā, ko te mutunga atu ka pai ake te whakahaere i tēnei rawa kahurangi.

DO YOU HAVE A SWEET HEART?

UNDERSTANDING THE POSSIBLE ROLE OF FRUCTOSE IN DIABETIC HEART DISEASE

Dr Kim Mellor from Waipapa Taumata Rau the University of Auckland will investigate the detrimental role of fructose in the diabetic heart.

High dietary sugar is known to induce metabolic disease such as diabetes, and research is now pointing to a greater role of sugar in heart disease. Levels of fructose in our blood are generally low compared to glucose levels, so fructose was not previously thought to play much of a role in diabetes at the organ level. However, Dr Mellor and her team have recently discovered that fructose levels in the heart can be dramatically elevated in diabetic patients. A promising finding from this work so far is that inhibiting the breakdown of cardiac fructose can reverse or 'rescue' heart disease onset in diabetic animals. Beyond this exciting discovery, little is known about how fructose is metabolised (converted into energy at the cellular level) by the heart.

Dr Mellor has been awarded a Marsden Fund Standard grant to take a closer look at what contributes to elevated fructose in the diabetic heart, including finding out if the fructose from our diets plays a role, or if cellular production is the culprit. The team will utilise biochemical, physiological and state-of-the-art imaging methods to track how fructose is metabolised in the diabetic heart.

The findings from these studies will further our understanding of the role of our metabolism in disease, potentially leading to novel treatments for diabetic heart disease. Given the current high prevalence of metabolic and cardiac disease, the long-term benefit of this advance in knowledge has far-reaching health and economic impact, both in Aotearoa and globally.

Dr Kim Mellor

KEI TE MANAWA REKA TŌU?

TE MĀRAMA KI TE WĀHANGA PEA O TE HUAHUKA I ROTO I TE MATE MANAWA MATEHUKA

Ka tūhura a Tākuta Kim Mellor o Waipapa Taumata Rau i wāhanga kino o te huahuka i roto i te manawa matehuka.

E mōhiotia ana ko te nui o te huka i rō kai tētahi pūtake o te mate matūriaka pērā i te mate manawa, ā, e tohu ana te rangahauināianei ki tētahi wāhanga nui ake o te huka i roto i te mate manawa. Ko te tikanga he iti iho te huahuka kei ō tātau toto ki ngā taumata huahuka, nō reira i mua ko te whakaaro he iti noa te wāhanga o te huahuka ki te matehuka mō te āhuatanga ki te whēkau. Engari, nō tata nei a kite a Tākuta Mellor me tōna rōpū ka taea te tino piki ngā taumata huahuka i roto i te manawa i roto i ngā tūroro matehuka. Ko tētahi tino kitenga mai i ēnei mahi i tēnei wā ko te auati i te wāwāhitanga o te huahuka i rō manawa ka taea te takahuri, te 'whakaora' rānei te pānga mai o te mate manawa i roto i ngā kararehe matehuka. I tua atu i tēnei tūhuratanga whakaongaonga, kāore i te tino mōhiotia he pēhea te whakarau pūngao o te huahuka (te whakawhiti hei pūngao i te taumata pūtau) e te manawa.

Kua whakawhiwhia a Tākuta Mellor ki tētahi takuhe Tahua Marsden Arowhānui kia āta tirotirohia i ngā mea ka e hāpai ana i te nui haere o te huahuka i roto i te manawa matehuka, me te rapu mēnā he wāhanga tō te huahuka mai i ā tātau kai, mēnā rānei ko te whakaputa ā-pūtau te raruraru. Ka whakamahia e te rōpū ngā tikanga matūkoiora, hinengaro me atahanga tino hou rawa hei whaiwhai he pēhea te whakarau pūngao i te huahuka i roto i te manawa matehuka.

Ko ngā kitenga o ēnei rangahau ka whakawhānui haere atu i te māramatanga ki te mahi a tō tātau whakarau pūngao i roto i te mate, ā, e puta ai ngā maimoatanga rerekē mō te mate manawa matehuka. Nā te nui o te mate whakarau pūngao me te manawa i ēnei rā, ko te painga wā roa o te anga whakamua o ngā mōhiotanga he tino whānui tōna pānga hauora me te ōhanga, i Aotearoa me te ao.

STUCK AT HOME

WHY IS A NOVEL HEAT-LOVING BACTERIUM ONLY FOUND HERE?

Associate Professor Matthew Stott from Te Whare Wānanga o Waitaha the University of Canterbury asks why a type of bacteria that appears to tolerate a range of hot spring conditions is abundant in Aotearoa but isn't found anywhere else.

Matthew Stott on Mt Erebus researching the microbiology of geothermal soils

Matthew Stott collecting a sample at Orakei Korako for the 1000 Springs Project. Image: Jean Power

Geographic isolation enables the evolution of new organisms. Some species develop traits that allow them to migrate and populate widespread regions of the globe, while others are limited (endemic) to localised areas. Endemism might be expected to be relatively common amongst extremophiles – bacteria and archaea that live in extreme habitats such as hot springs and volcanic vents – but microbial endemism is rare. Traits such as large population densities, rapid growth rates, and the ability to become temporarily dormant allow bacteria to distribute over time and space with relative ease. Even the world's most isolated volcanic system, Mt Erebus in Antarctica, hosts globally common microbes thought to have been transported there through large volcanic eruptions.

Imagine the surprise then, when Associate Professor Stott and colleagues recently identified a bacterial genus, Venenivibrio, and found that while it is the most abundant microorganism across Aotearoa hot springs, it isn't known anywhere else. Given the range of temperatures, chemistry, and acidity of New Zealand hot springs, the bacterium can obviously tolerate a range of environmental conditions and migrate relatively easily across short distances. In contrast, its sister genus Sulfurihydrogenibium, which has the same broad physiological characteristics, is readily identified in international hot springs. What limits Venenivibrio to our islands?

Through this Marsden Fund Standard grant, Associate Professor Stott and team aim to understand what makes Venenivibrio the 'kiwi' of microorganisms. They will investigate questions such as: how does Venenivibrio distribute domestically? Does it lack the traits to survive long distance migration? Is there something unique about Aotearoa hot springs that Venenivibrio, but not Sulfurihydrogenibium, is dependent on? In collaboration with Ngāti Tahu-Ngāti Whaoa (mana whenua of the type strain), they hope to learn what makes this species a taonga, and how it can be cared for through data sovereignty, management, and conservation.

TE NOHO KI TE NOHOANGA

HE AHA TE TAKA KA KITEA ANAKE TĒTAHI HUAKITA RATA KI TE WERA I KONEI?

Ko te ui a Ahorangi Tuarua Matthew Stott o Te Whare Wānanga o Waitaha he aha e matomato ai tētahi momo huakita he tepe ki ētahi momo āhuatanga kōanga wera i Aotearoa engari kaore e kitea ana i wāhi kē.

Mā te taratahi ā-whenua ka taea te kunenga mai o ētahi momo rauropi hou. Ka tipu ngā āhuatanga ki ētahi momo e taea ai te heke me te tipu kia hua ki ngā wāhi whānui o te ao, ā, ko ētahi he noho anake (taketake) ki ngā wāhi tauwhāiti. Ko te whakaaro pea ka kitea noatia te taketaketanga i waenga i extremophile - he huakita me te moroiti e noho ana i ngā nohoanga mutunga mai pērā i ngā waiariki, me ngā kōwhāwhā o ngā puia - engari tino rerekē te taketaketanga moroiti. Ko ngā āhuatanga pērā i ngā kiato taupori, ngā auau tipu tere, ā, nā te kaha ki te noho taharangi mō te wā poto ka māmā noa te tuari haere a te huakita i roto i te wā me te takiwā. Kei roto hoki i te pūnaha puia taratahi rawa o te ao, a Maunga Erebus i te Kōpaka Runga, kei roto i te rauropi papa ko ngā moroiti e kitea noatia ana i te ao i kawea mai e ngā pahūtanga puia nui.

Nō reira ka ohorere, i te kitenga a Ahorangi Tuarua Stott rātau ko ana hoa mahi i tētahi puninga , te Veneivibrio, i nā tata nei ehara konei te momo moroiti matomato rawa puta noa i ngā waiariki i Aotearoa, kāore e kitea i wāhi kē. Nā ngā momo pāmahana, āhuatanga matū, me te waikawatanga o ngā waiariki o Aotearoa, ka tū pakari te huakita i roto i ngā tūmomo āhuatanga taiao, ā, māmā noa te heke i ngā tawhiti poto noa. Ko te mea rerekē, ko tōna puninga tuahine, te Sulfurihydrogenibium, he rite ōna āhuatanga ā-tinana whānui, kei te kitea noatia i ngā waiariki o te ao. He aha ngā mea whakatepe i te Venenivibrio ki ō tātau motu?

Mā tēnei Tahua Arowhānui a Marsden, ko te whai a Ahorangi Tuarua Stott me tōna rōpū kia mārama he aha i taketake ai te momo rauropi moroiti Venenivibrio ki Aotearoa. Ka tūhuratia e rātau ngā pātai pērā i tēnei: he pēhea te tuari paetata te Venenivibrio? Kāore i te whai i ngā āhuatanga kia ora ai i ngā hekenga tawhiti? He ahurei ngā waiariki o Aotearoa e whirinaki ai te Venenivibrio, engari kaua te Sulfurihydrogenibium? I te taha o Ngāti Tahu-Ngāti Whaoa (te mana whenua o te momo aho), ko tā rātau e whai ana he ako he aha e hira ai tēnei momo taonga, ā, me pēhea te tiaki mā te mana raraunga, te whakahaere me te kaitiakitanga.

Artist's Palette, Wai-O-Tapu

KA RITE!

KAPA HAKA FOR SCREENS

Dr Jani Wilson (Ngāti Awa, Ngā Puhi, and Mātaatua) of Te Kunenga Ki Pūrehuroa Massey University will explore the various adaptations to kapa haka as a response to technological development and assess where the art presently sits.

Dr Jani Wilson

Kapa haka image: supplied

Kapa haka is an integral part of te ao Māori, used as part of significant cultural rituals to entertain, unify, and transfer knowledge. It brings forward a Māori worldview on issues across time, and allows space to have challenging, historical, political, and emotional discussions. Contemporary kapa haka fosters, develops, validates, and celebrates te ao Māori, te reo Rangatira honouring the chiefly language, and kaupapa Māori collaborative or shared approaches to issues.

Over the last century, kapa haka has evolved exponentially, largely in response to the advancement of screen technologies. Yet there is little research exploring Māori and screen production. This Marsden Fund project, led by Dr Jani Wilson, is unique. It will be the first to invite kaihaka performers and kaitito composers to transition their profound knowledge of kapa haka into academic research, marrying theory and practice. Dr Wilson will analyse significant changes throughout history to film technologies and kapa haka, creating a historical overview of screened kapa haka performances. This will range from early performances captured primarily to display 'what the natives do' in this part of the empire, through to the audience-inclusive screening of contemporary kapa haka. They will also perform a multigenerational audience study using a refined iteration of Rōpū Whānau – a focus group methodology established by Wilson – where closely linked whanaunga relatives respond to kapa haka screenings.

The filming and screening of kapa haka has an impact on the art's ebbs and flows, the conflicts between maintaining traditions and exploring innovation. This project will welcome experienced kaihaka and kaitito with their plethora of performance and research skills to academic study. This project will also facilitate spaces for Māori to consider the future potential of kapa haka in te ao hurihuri the changing world.

KA RITE!

TE KAPA HAKA MŌ TE POUAKA WHAKAATA

Ka tūhura a Tākuta Jani Wilson (Ngāti Awa, Ngā Puhi me Mātaatua) o Te Kunenga Ki Pūrehuroa i ngā tūmomo urutaunga ki te kapa maha hei urupare ki te whanaketanga hangarau me te tātari kei hea tēnei āhuatanga ināianei.

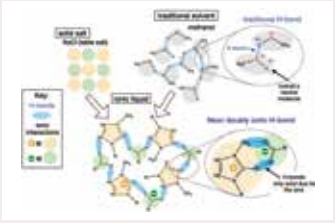
He wāhanga hira te kapa haka o te ao Māori, e whakamahia ana i roto i ngā tikanga hei whakangahau, whakakotahi me te whakawhiti mōhiotanga. Ka ara ake i tēnei ko tētahi tirohanga Māori mō ngā take puta noa i tō tātau wā, me te whai wāhi ki ngā kōrerorero werowero, hitori, tōrangapū, ā-whatumanawa hoki. E whāngai, e whakawhanake, me te whakamana te kapa haka onāianei me te whakanui i te ao Māori, te reo rangatira me ngā aronga ngātahi ki te mahi tahi i raro i te kaupapa Māori.

I te rau tau kua hipa, i tino tere te rerekē haere o te kapa haka, otirā nā te kauneke o ngā hangarau mata. Engari he iti noa ngā rangahau e hōpara ana i te Māori me te whakaputa whakaaturanga. He ahurei te kaupapa Tahua Marsden, e arahina ana e Tākuta Jani Wilson. Koinei te mea tuatahi ki te pōhiri i ngā kaihaka me ngā kaitito ki te kawe i ō rātau mōhio hōhonu ki te ao kapa haka ki te rangahau mātauranga, e tūhono ana i te ariā ki te mahi. Ka tātari a Tākuta Wilson i ngā huringa nui puta noa i te hitori hangarau hopu whitiāhua, e puta ai tētahi tirohanga whānui tuku iho o ngā whakaaturanga kapa haka kua whakaahuatia i runga pikitia. Arā, mai i ngā whakaaturanga o mua rā anō me kī i hopukia hei whakaatu 'i ngā mahi a te Māori' i roto i tēnei wāhanga o te emepaea, tae noa ki ngā whakaaturanga kapa haka onāianei mā te hunga mātakitaki. Ka whakahaerehia anō e rātau tētahi rangahau reanga-mahakaimātakitaki mā tētahi āhuatanga hou ake o Rōpū Whānau – he tikanga rangahau rōpū arotahi i whakatūria e Wilson – e urupare ana ngā whanaunga tino tata ki ngā whakaaturanga kapa haka.

He pānga o te whakaahua me te whakaatu kapa haka ki ngā piki me ngā heke o tēnei momo toi, ngā tukituki i waenga i te pupuri i te tikanga me te tirotiro i ngā auahatanga. Ka tuwhera tēnei kaupapa ki ngā kaihaka me ngā kaitito me ō rātau whakatūtū me ngā pūkenga rangahau huhua ki te akoranga mātauranga. Ka takawaenga tēnei kaupapa i ngā wāhi mō te Māori ki te āta whiriwhiri i te anamata ka taea mō te kapa haka i roto i tēnei ao hurihuri.

SOLVING HARMFUL SOLVENTS WITH IONIC LIQUIDS

Professor Patricia Hunt from Te Herenga Waka—Victoria University of Wellington aims to understand the structure of ionic liquids towards developing environmentally friendly alternatives to industrial solvents.



Professor Patricia Hunt (left)
Cameron Weber (right)

While, for many of us, hearing the word 'solvent' will make us think of paint thinner or building worksite cleaning products, solvents are any liquids used to dissolve other substances. Water is an example of a common solvent, dissolving and carrying molecules and ions within your body and within the environment. Solvents are ubiquitous and critical to making pharmaceuticals, recycling waste and various industrial chemical processes. Many solvents do invoke a high environmental cost, for instance when they are volatile, flammable, toxic, or when large quantities are required. Ionic liquids are novel materials, composed solely of charged particles, which represent an alternative to traditional solvents and their associated sustainability issues. Ionic liquids can be chemically designed for low environmental impact, stability, and improved solubility. However, to design ionic liquids for industrial applications, we need a deeper understanding of how their underlying chemical structure influences their properties.

Professor Patricia Hunt has received a Marsden Fund grant to unravel the structure within the complex bonding network of ionic liquids. She will lead a team of computational and experimental scientists to create new models that describe the links between the chemical structure of ionic liquids and their physical properties. They also aim to use quantum chemistry to generate new knowledge of the electronic structure and interactions of ionic liquids at the atomic level. Based on the insights obtained, they then plan to chemically design and make new ionic liquid materials.

Ionic liquids have potential to be employed in, and create new, sustainable industries in Aotearoa. One example is the production of fibres such as viscose and rayon from cellulose, which currently requires toxic and corrosive chemicals to break up the wood pulp starting material. The novel ionic liquids developed in this project hold promise for replacing harmful industrial solvents used in Aotearoa and worldwide.

PROGRAMMING IN AN 'EYE FOR DETAIL'

NEW COMPUTER IMAGING TOOLS TO GIVE A NEW PERSPECTIVE ON ANCIENT AND MODERN SECRETS

Associate Professor Steven Mills from Te Whare Wānanga o Ōtākou the University of Otago will develop new computer imaging tools and use them to enhance our view of ancient Māori archaeological artefacts.

Computer-based image processing is hugely important to modern life, including use in medical diagnoses, security, conservation, and archaeology. Although we rely on computers to automate image processing, they're not good at it naturally. For example, when humans look at images, we use statements, movement, or drawings to describe and interrelate shapes within images. Computers don't have these luxuries, instead using shape analysis to describe and interrelate objects within images. Improving shape analysis is difficult, requiring a mixture of geometric equations, computer code improvements, and machine learning.

In this Marsden Fund grant Associate Professor Steven Mills and team will propose a new method to tackle shape analysis – Geometric Declarative Networks. Geometric Declarative Networks will combine the latest in geometry equations and deep learning tools to unlock the next generation of computer imaging tools. Working with archaeologists, Māori heritage experts, and a traditional stone tool maker, they will verify the capabilities of Geometric Declarative Networks by examining ancient (pre-European contact) Māori archaeological artefacts such as the flakes of stone left behind in tool making. Understanding the finer geometric details of these waste flakes will provide unique insights into how Māori fabricated and perfected stone tools, uncovering stories within these precious taonga.

Geometric Declarative Networks could also have important applications in other image processing technologies, including those used in medical diagnoses, unlocking a whole suite of improvements to modern life.

Above L-R: Dr Gerard O'Regan (Curator Māori, Otago Museum), Associate Professor Steven Mills and Professor Richard Walter (Archaeology, University of Otago)

Below: Measuring flakes

Brewster Glacier, New Zealand, during the 2019 End of Summer Snowline flight

03 /
MARSDEN FUND FAST-START AWARDS

WHAT HAVE WE DONE?

HOW MUCH OF OUR GLACIERS ARE MELTING DUE TO CLIMATE CHANGE?

Dr Lauren Vargo from Te Herenga Waka—Victoria University of Wellington will calculate how much glacier melt can specifically be attributed to human-induced climate change, to empower decision-making for the billions of people who are, and will be, impacted by their retreat.

Lauren Vargo measuring glacier mass change on Brewster Glacier, New Zealand, 2018

Image: Brian Anderson

Glaciers are Earth's water towers, but approximately one third of glacier ice has melted since the year 2000 as global temperatures have risen by 0.5°C. This affects billions of people who rely on glacier melt for drinking water, power generation, and agriculture. For example, temperatures in Pakistan were up to 7°C warmer than normal in May 2022, leading to the rapid melting of Shispar Glacier. This triggered a glacier lake outburst flood that destroyed a bridge and damaged homes, buildings, and power plants.

Global models of climate change are continually improving through advances in technology and understanding. For example, we can now calculate how much glacier melt, especially extreme melting events, is due to human-caused climate change compared to natural climate cycles. This can inform local governments on the necessary mitigation strategies for glacier melt in their specific region, which is increasingly important as those impacts are anticipated to intensify.

Through this Marsden Fast-Start project, Dr Vargo and an international team of researchers will use computer models to simulate glacier mass change 'without climate change' (where greenhouse gases are one third of what they are now) and 'with climate change' (greenhouse gases at modern levels). They will quantify how much man-made climate change has altered the likelihood and severity of ice-melting in 230 individual glaciers. They will also look to project future changes in extreme glacier melt as temperatures continue to rise. This research will provide a template for future studies that aim to quantify the impacts of anthropogenic climate on other disaster-causing systems, including landslides and earthquakes.

While this research has clear global implications, the team also wants their research to benefit glacier systems in Aotearoa. Working with local iwi and the guides at Franz Josef and Fox Glacier, they will update the display panels and brochures at these sites to inform people of the danger that climate change poses to glaciers. They will also develop educational outreach days for four local schools, to support the next generation of glacier guardians.

Lauren Vargo before the 2020 End of Summer Snowline flight. Image: Rebekah Parksons-King

A TAONGA FOR ALL NEW ZEALANDERS?

HOW WELL ARE MĀORI DOING AMIDST THE TE REO BOOM?

Fifty years on from the delivery of the Māori Language Petition, Pākehā engagement with te reo Māori has exploded. While positive for revitalisation of the language, perceived unequal resource allocation favouring Pākehā, and continuing barriers for Māori to access te reo seem to be emerging. Dr Kiri Dell of Waipapa Taumata Rau the University of Auckland will investigate the many facets and implications for Aotearoa becoming a te reo speaking nation.

Normalising te reo Māori is a strategy viewed by many language revitalisation experts as essential for its survival. As a consequence of efforts towards normalisation, the uptake of te reo by non-Māori speakers has increased significantly. However, adverse psychological implications for Māori wellbeing are surfacing and becoming increasingly apparent as well-known non-Māori receive accolades for embracing and using te reo. Examples include fluent te reo speaker New Zealander of the Year 2020 Jennifer Te Atamira Ward-Lealand, media icon and champion of te reo usage Jack Tame, and global pop star Lorde's te reo Māori translated EP.

Vitally, Māori and Pākehā (non-Māori) relationships with te reo differ. Via birthright, Māori relate to te reo for access to land, authority to act on whānau/hapū/iwi issues, and rights regarding marae politics. However, fewer than 20% of Māori can speak the language confidently, and some Māori feel marginalised by current revitalisation efforts, perceiving them as focused on Pākehā accessing, speaking, and using te reo Māori. Dr Kiri Dell has been awarded a Marsden Fast-Start grant to analyse Māori wellbeing in relation to the efforts of normalising te reo, drawing on media engagement as a window to understanding evolving Pākehā-Māori relationships.

Using a unique methodology termed Kaupapa Māori Discourse Analysis (KMD), Dr Dell will analyse large amounts of media, including social media. She will look at both affirming and opposing content, written by many contributors, all reacting to public reporting of high-profile Pākehā and non-Māori consumption of te reo. This analysis will help Dr Dell and her team understand how Māori identities are constructed and maintained in relation to te reo and the ways their thoughts, feelings, experiences, and general wellbeing are affected. Interviews will also inform understandings of the many facets of te reo identities, which will enable researchers to further centre Māori voices. In a society dominated by Pākehā culture, hearing and prioritising the wellbeing of those whose language is being celebrated, is an important step in the journey to becoming a truly bicultural, bilingual Aotearoa.

Dr Kiri Dell teaching the importance of community self-determination at Waipapa Taumata Rau the University of Auckland

HE TAONGA MŌ NGĀ TĀNGATA KATOA O AOTEAROA?

KEI TE PĒHEA TE HAERE A TE MĀORI I ROTO I TE PUĀWAITANGA O TE REO?

Kua rima tau tekau tau mai i te whakatakotoranga o te Petihana Reo Māori, kua tino nui rawa atu te whai a te Pākehā i te reo Māori. Ahakoa he pai mō te whakarauoranga o te reo, te whakaaro kāore i te ōrite te tohanga rauemi e tītaha ana ki te Pākehā, me te ara ake o ngā tauārai e ārai ana i te toro a te Māori i te reo. Ka tūhura a Tākuta Kiri Dell o Waipapa Taumata Rau i ngā āhuatanga me ngā pānga maha mō te eke a Aotearoa hei whenua kōrero Māori.

He maha ngā mātanga reo Māori kua kī he mea waiwai te rautaki o te whakatūturu i te reo Māori mō te ora o te reo. Nā te whakapau kaha ki te whakatūturutanga, kua tino nui rawa atu te whai a te hunga tauiwi i te reo. Engari, kei te puta ake ngā pānga ā-hinengaro kino mō te oranga o te Māori, ā, kei te kitea haerehia ēnei i te whiwhi hōnore a ngā tauiwi mō te whai me te me te whakamahi i te reo. Ko ngā tauira ko te kaikōrero matatau i te reo, te Tino Tangata o Aotearoa mō te Tau 2020 a Jennifer Te Atamira Ward-Lealand, te pūkōrero o te ao pāpāho me te kaitaunaki i te reo a Jack Tame, me te waiata a te kaiwaiata rongonui o te ao a Lorde i whakamāoritia.

Ko te mea hira, he rerekē ngā hononga o te Māori me te Pākehā (tauiwi) ki te reo. Hei taonga tuku iho, ko te pānga o te reo o te Māori ko te hono ki te whenua, he mana ki te kōrero mō ngā take whānau/hapū/iwi, me ngā tika e pā ana ki ngā tōrangapū o te marae. Engari, he iti iho te 20% o te Māori ka tino taea te kōrero Māori, ā, ki ētahi Māori kei te mahue rātau ki muri i ngā mahi whakarauora onāianei, hei tā rātau kei te aro kē atu ngā kaha ki te toro, te kōrero me te whakamahi a te Pākehā i te reo Māori. Kua whakawhiwhia a Tākuta Kiri Dell ki te takuhe Tīmata Wawe a Marsden hei tātari i te oranga o te Māori e pā ana ki ngā mahi mō te whakatūturu i te reo, te titiro ki te whakamahi a te ao pāpāho e mārama ai ki te rerekē haeretanga o ngā hononga Pākehā-Māori.

Mā te whakamahi i tētahi tikanga ahurei e kīia ana ko te Kaupapa Māori Discourse Analysis (KMD), ka tātari a Tākuta Dell i ngā pāpāho tino nui, tae atu ki te pāpāho pāpori. Ka tirotiro ia ki ngā kōrero tautoko me te whakahē, i tuhia e ngā kaituhi maha, e urupare katoa ana rātau ki ngā pūrongo tūmatanui o te whakamahi a ngā Pākehā me ngā tauiwi rongonui i te reo. Ka āwhina tēnei tātari i a Tākuta Dell me tōna rōpū kia mōhio ai he pēhea te hanga me te pupuri i ngā tuakiri Māori e pā ana ki te reo me te whai pānga ki ō rātau whakaaro ā-hinengaro, ā-ngākau hoki, ngā whenako, me te oranga whānui. Ka whakamōhio anō ngā uiui i te mārama o te maha o ngā tuakiri reo, e taea ai e ngā kairangahau te paihere anō i ngā reo Māori. I roto i te iwi whānui ko te ahurea Pākehā te mana nui, ko te rongo me te hāpai i te oranga o te hunga nō rātau te reo e whakanuitia ana, tētahi mahi hira i roto i te whai kia tūturu ai te noho a Aotearoa hei whenua ahurea-rua, reorua hoki.

OSCILLATING PROSTATE SIZE

HOW THE BRUSHTAIL POSSUM CAN HELP US UNDERSTAND PROSTATE CANCER

Dr Melanie Laird of Te Whare Wānanga o Ōtākou the University of Otago will determine the genetic mechanisms controlling prostate enlargement and regression in animals that breed seasonally.

The prostate in mammals which breed seasonally undergoes a dramatic enlargement and then regression during the mating season. Rapid shifts between cell growth and death are otherwise rare in adult tissues, to prevent uncontrolled growth and cancer. The fact that the cellular changes which allow the prostates of seasonal breeders to oscillate in size is both controlled and reversible means that these species offer a unique opportunity to study the mechanisms of controlled prostate growth.

Dr Melanie Laird has been awarded a Marsden Fund Fast-Start grant to undertake an ambitious study of this phenomenon, identifying the specific genetic patterns that switch on and off mammalian prostate changes. This study will compare the gene expression in two seasonal breeders (brushtail possums and red deer), to two animals that breed year-round (opossums and black rats). The genes they discover will then be studied, determining their specific functionality.

This will be the first study to identify the functional roles of prostate genes involved in seasonality. It will shed light on the fundamental processes controlling cell growth and death, as well as how diverse mammalian species overcome the challenges of seasonal reproduction. Findings from this research have the potential to lead to future therapies for prostate cancers in humans.

Left: Melanie Laird collecting possum tissue

Image: Tim Hore

COULD REWILDING BE THE KEY TO RESTORING AOTEAROA'S RIVERS?

Dr Simon Stewart, from the Cawthron Institute, will investigate the link between levels of īnanga whitebait in our rivers and numbers of tuna (longfin eel), a freshwater apex predator in decline.

Globally, we are facing a freshwater biodiversity crisis. Approaching this problem by 'putting it back to the way it was' – aka habitat restoration – has been our main tool to reverse species decline. It's now clear that environmental restoration is only one piece of the freshwater revitalisation puzzle. Rewilding – which restores interactions between species across food webs – has emerged as another key to freshwater revitalisation.

Dr Simon Stewart
Tuna (eel) otolith
Image: Dr Simon Stewart

In Aotearoa, tuna (longfin eels) are important in rivers because they are at the top of the food chain. Despite decades of habitat restoration their numbers continue to decline, with a major challenge being the uniquely slow growth rates of tuna populations. Dr Simon Stewart recently found that in a stream well supplied by upstream migrating īnanga whitebait, tuna growth rates were inferred to be 10–20 times faster than other populations in Aotearoa's rivers. This begs the question, could historical declines in īnanga explain declining populations and unusually low growth rates of our wild tuna?

Dr Stewart has been awarded a Marsden Fast-Start grant to address this question. In partnership with local rūnaka/rūnanga, he and his team will combine field experiments across freshwater habitats, modelling total īnanga consumption, and developing new growth monitoring tools. He will use a novel method for measuring the nitrogen isotope values in the growth rings found in otoliths (ear bones) of tuna. By comparing isotope values from contemporary and archived tuna otoliths, changes in tuna growth and diet can be tracked. Dr Stewart will test the theory that the unusually slow growth of tuna is driven by declines in annual upstream migration of īnanga, meaning that tuna growth rates will improve as annual īnanga runs increase.

Finally, Dr Stewart hopes this project will catalyse incorporation of mātauranga Māori-aligned concepts of holistic ecosystem management into national freshwater restoration and conservation, and ultimately restore tuna to their former glory, firmly atop the freshwater food chain.

KO TE ORANGA O TE WHAKAORA I Ō TĀTAU AWA KO TE WHAKAHOKI KI TŌNA ĀHUATANGA TŪTURU?

Ka tūhura a Tākuta Simon Stewart, o te Cawthron Institute, i te hono i waenga i ngā nui o ngā īnanga i roto i ō tātau awa me te maha o ngā tuna e itiiti haere nei.

Puta noa i te ao, e mōrearea ana te rerenga rauropi o te wai māori. Ko tā mātau tino tikanga hei whakarite i tēnei raruraru ko te 'whakahoki ki tōna āhua ake' - arā, te whakaoranga nohoanga - hei takahuri i te itiiti haere o te momo. Kua mārama ināianei he wāhanga kotahi noa iho te whakaoranga taiao i roto i te mahi whakarauora i te wai māori. Kua ara ake ko te kaupapa o te whakaora i ngā taunekeneke i waenga i ngā momo puta noa i ngā raupapa kai hei āhuatanga tino hira mō te whakarauora i te wai māori.

I Aotearoa, he hira te tuna i roto i ngā awa i te mea kei runga rawa te tuna o te mekameka kai. Ahakoa ngā mahi whakarauora nohoanga i roto i ngā tau maha kei te heke haere tonu te nui o te tuna, ā, ko tētahi whakapātaritari nui ko te iti o ngā auau tipu o ngā taupori tuna. I kitea e Tākuta Simon Stewart i nā tata nei tētahi kōawa e nui ana te heke a te īnanga, i tere ake te tipu o te tuna mā te 10-20 whakarea ake tēnā i ētahi atu taupori i ngā awa o Aotearoa. Kātahi ka toko ake te pātai, kei roto i te itiiti haere o ngā īnanga o mua ki te iti haere o ngā taupori tuna me te iti o te auau tipu o ngā tuna?

Kua whakawhiwhia a Tākuta Stewart ki tētahi takuhe Tīmata Wawe a Marsden hei whakautu i tēnei pātai. I te taha o ngā rūnaka / rūnanga, ka whakakotahitia e rātau ko tōna rōpū ngā whakamātautau i ngā nohoanga wai māori, te whakatauira i te whakapetonga īnanga tapeke, me te waihanga utauta tirotiro tipuranga hou.

Ka whakamahia e ia tētahi tikanga tino rerekē mō te inu i ngā uara kanoirite hauota i roto i ngā rīngi tipu e kitea ana i ngā kōiwi taringa o te tuna. Mā te whakataurite i te kanoirite hauota mai i ngā taringa tuna onāianei me mua, te whai haere i te huringa o te tipu me te kai a te tuna. Ka whakamātautau a Tākuta Stewart i te ariā e kōkirihia ana te tipuranga pōturi tino rerekē o te tuna e te iti haere o te piki o te īnanga, arā, ka pai ake te auau tipu o te tuna i ngā nui haere o ngā hekenga ā-tau o te tuna.

Heoi anō, ko te tūmanako o Tākuta Stewart mō tēnei kaupapa ka tere ake te whakauru mai i ngā āhuatanga mātauranga Māori o te whakahaere whānui i te pūnaha rauropi o te whakarauora i te wai māori me te kaitiakitanga, otirā ko te whakaora i te tuna ki tōna tiketiketanga o mua, ki runga o te mekameka kai wai māori.

THE TAILS OF TANIWHA TOLD

A CULTURAL HISTORY

A team led by Dr Kirsty Dunn (Te Aupōuri, Te Rarawa, Ngāpuhi) and Dr Madi Williams (Ngāti Kuia, Ngāti Koata) from Te Whare Wānanga o Waitaha University of Canterbury will create biographies of taniwha, presenting them – and the various rich kōrero which describe and illuminate them – in a way that both centres and celebrates Māori knowledges, experiences, perspectives, and relationships.

Many New Zealanders equate taniwha with the dragons, trolls, and ogres of fairy tales and fables. Indeed, in the most well-known stories, taniwha are often depicted as mythical, scary, supernatural beasts. But taniwha are far removed from the troll lurking under the bridge across the river. Rather, they are the river: they are whanaunga kin, whose narratives and lingering presence provide vital ways to explain both the complexities and potentiality of whakapapa (genealogy, layer-making), as well as our responsibilities to the world around us.

Stories about taniwha feature in the work of early ethnographers and there is some discussion of them in more contemporary texts. However, there are few in-depth explorations in the current research literature, comprehensive analyses of artistic depictions of taniwha, or discussions regarding their representation in news media.

Dr Kirsty Dunn (left)
Dr Madi Williams (right)

Image: Melissa Banks

Dr Kirsty Dunn and Dr Madi Williams will explore, document, and share taniwha pūrākau (ancestral narratives, stories) in this Marsden Fast-Start project, drawing connections with Indigenous whanaunga. They will conduct a series of interviews with kaumātua elders about local taniwha throughout Aotearoa, drawing upon pūrākau. They will analyse representations of taniwha in various forms of narrative including waiata, whakataukī, whakairo, poetry, and film, amongst others, and consider references to taniwha in news media. Their aim is to create biographies of a selection of taniwha and their continuing significance, in the form of a general audience pukapuka book.

This will be the first work to engage with taniwha in a biographical sense: The project asks "who" rather than "what" are taniwha? To whom are they related and how? Are there connections between taniwha narratives? What kinds of knowledge are embedded in these narratives? And how might taniwha narratives help us to understand and navigate current conflicts and challenges that are present both here in Aotearoa and beyond? This project will contemporise the stories of taniwha in order to relate to local and global contexts and discover how these whanaunga exist in both the shadows and in our everyday worlds.

TE KŌRERO MŌ NGĀ HIKU TANIWHA

HE KŌRERO TUKU IHO

Ka hangaia e tētahi rōpū e arahina ana e Tākuta Kirsty Dunn (Te Aupōuri, Te Rarawa, Ngāpuhi) rāua ko Tākuta Madi Williams (Ngāti Kuia, Ngāti Koata) mai i Te Whare Wānanga o Waitaha ngā kōrero mō ngā taniwha, e whakaatu ana i a rātau – me ngā momo kōrero hōhonu e whakaahua me te whakaari i a rātau – mā tētahi āhuatanga e whakaara ana, e whakanui ana i ngā mōhiotanga o te Māori, ngā wheako, ngā tirohanga, me ngā hononga.

Ka whakataurite te maha o ngā tāngata o Aotearoa i te taniwha ki ngā taniwha, ngā nauhea me ngā kākarepō mai i ngā pakiwaitara me ngā pūrākau. Otirā, i te maha o ngā kōrero rongonui, ko te whakaatu i ngā taniwha he mea pohewa, he whakamataku, whakaharahara hoki. Engari he tino rerekē ngā taniwha mai i te nauhea e huna ana i raro i te piriti o te awa. Engari, he awa kē te taniwha: he whanaunga, kei ōna kōrero me te tōna whai wāhi mai ko ngā āhuatanga hira mō te whakamārama i ngā uauatanga me ngā āhuatanga ka taea o te whakapapa, tae atu ki ō tātau herenga ki tō tātau ao.

Kei roto i ngā kōrero mō te āwhina ko ngā mahi a tohunga ahurea o mua, ā, kei reira ētahi kōrero mō rātau i ngā tuhinga o nā noa nei. Engari, he iti noa ngā hōparatanga hōhonu i roto i ngā tuhinga rangahau onāianei, ngā tātaritanga matawhānui o ngā whakaaturanga toi o ngā taniwha, ngā kōrerorero rānei e pā ana ki te whakaaturanga a te hunga pāpāho.

Ka hōpara, ka tuhi, ka tuari hoki a Tākuta Kirsty Dunn rāua ko Tākuta Madi Williams i ngā pūrākau taniwha i roto i tēnei kaupapa Tīmata Wawe a Marsden, e hono ana ki ngā whanaunga iwi taketake. Ka whakahaerehia e rātau ngā uiui me ngā kaumātua mō ngā taniwha o ngā rohe puta noa i Aotearoa, mai i ngā pūrākau. Ka tātarihia e rātau ngā whakaaturanga o ngā taniwha i roto i ngā tūmomo kōrero tuku iho pērā i ngā waiata, ngā whakataukī, whakairo, ruri, me ngā whitiāhua, me ētahi atu, me te whai whakaaro ki ngā kōrero mō ngā taniwha i roto i te ao pāpāho. Ko tā rātau e whai ana ko te hanga haurongo mō ētahi taniwha me ō rātau hira, hei pukapuka mā te iwi whānui.

Koinei te mahi tuatahi mō ngā taniwha hei tuhinga haurongo: Ko te pātai a te kaupapa "ko wai" te taniwha kaua "he aha"? E hono ana ki a wai, ā, he pēhea? He hononga anō i waenga i ngā kōrero taniwha? He aha ngā momo mōhio kua whakaūngia ki ēnei kōrero? Ā, ka pēhea pea te āwhina a ngā kōrero taniwha i a tātau kia mōhio, kia wherawhera hoki i ngā tukituki me ngā whakapātaritari onāianei kei konei i Aotearoa me tāwāhi? Kei roto i tēnei kaupapa ko ngā kōrero mō ngā taniwha kia hāngai ana ai ki ngā horopaki ā-motu, ā-ao hoki me te rapu he pēhea te noho a ēnei whanaungai roto i te pōuritanga me ō tātau ao o ia rā.

DRUGS TARGETING BIOFILMS

UNSTICKING THE BIOFILMS THAT LEAD TO ANTIBIOTIC-RESISTANT BACTERIAL INFECTIONS

Dr Matthias Fellner of Te Whare Wānanga o Ōtākou the University of Otago will develop new drugs targeting biofilms which play an important role in chronic antibiotic-resistant bacterial infections.

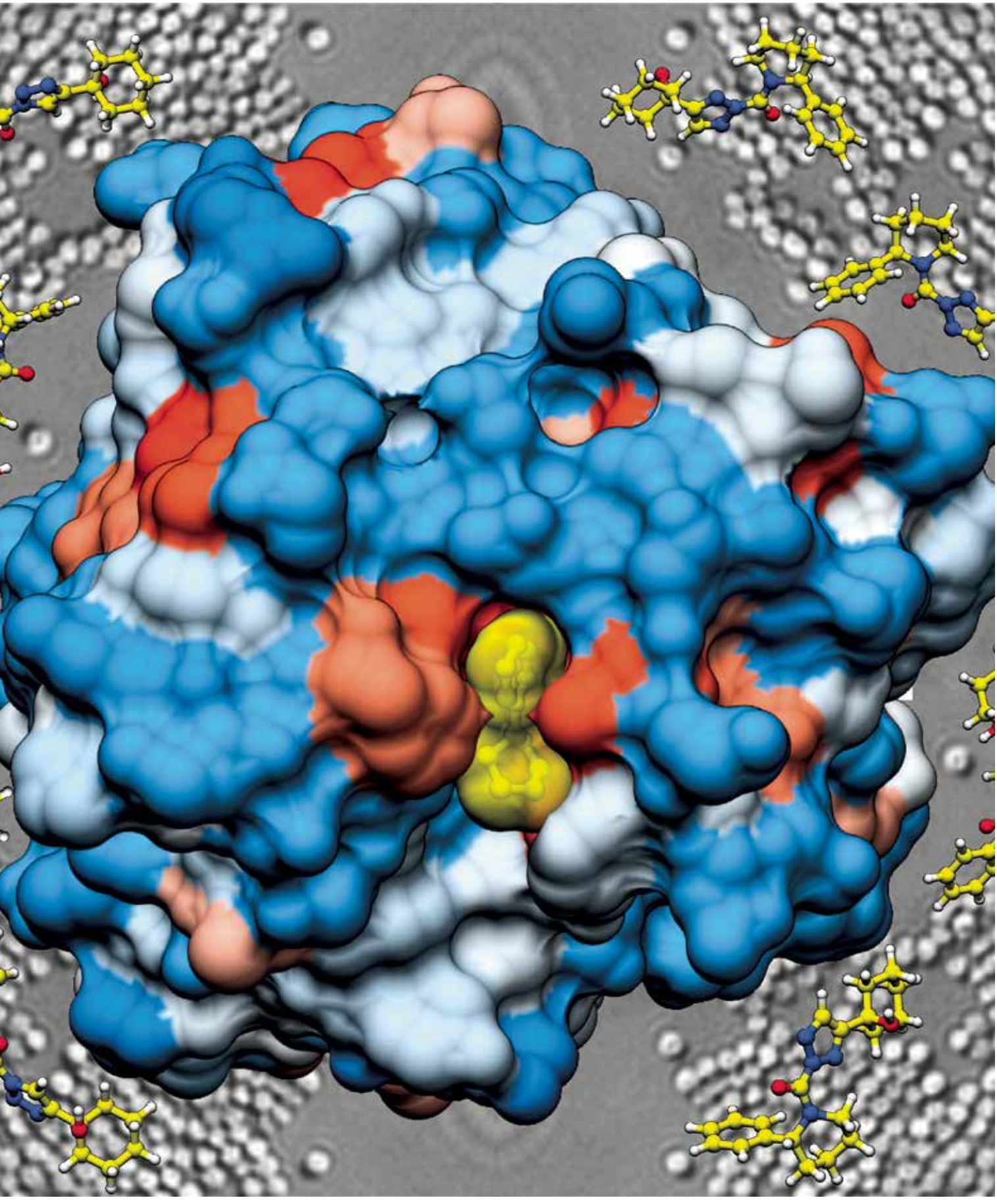
Antibiotic resistance presents a major challenge to public health worldwide. In Aotearoa the number of antibiotic-resistant Staphylococcus aureus related infections are among the highest in the developed world. S. aureus is a bacterium that causes a variety of diseases ranging from local skin or soft tissue infections to invasive chronic infections such as pneumonia. Such infections are a major cause of death, and they also disproportionately affect Māori and Pacific peoples. Invasive chronic infections are often linked with the ability of S. aureus to form biofilms: complex mixtures of biomolecules made by microorganisms, which allow them to stick to surfaces (including human tissue), colonise them, and resist antibiotic treatment. The underlying mechanisms that make S. aureus cling on so tenaciously are, so far, not well understood.

In this Marsden Fund Fast-Start grant, Dr Matthias Fellner and his international team will investigate how S. aureus modifies biomolecules within a biofilm to create infections in humans. Previous research by Dr Fellner found several enzymes which can break down lipid (fat) molecules within the biofilm. This project will provide a fuller picture of how these enzymes work, determining their role in how biofilms adhere and grow, as well as how the biofilms counter the immune system and some antibiotics. Dr Fellner will then design and optimise compounds to stop the biofilm enzymes from working. These compounds will be tested on different S. aureus strains, including strains isolated from patients in Aotearoa.

This project offers a novel approach to solving the problem of antibiotic resistance, which could provide more effective treatment options for people with chronic bacterial infections.

Left: Dr Matthias Fellner

Right illustration: hydrophobic protein surface of the biofilm-associated Staphylococcus aureus fluorophosphonate-binding hydrolase F in complex with an inhibitor. The structures of the inhibitor KT129/KT130 are shown in front of S. aureus bacteria. Image: Dr Matthias Fellner



HOMES HARNESSING SUNSHINE

WHAT DRIVES THE VALUE OF SOLAR CELLS IN AOTEAROA?

Dr Yvonne Matthews, of the National Institute of Water and Atmospheric Research (NIWA) has been awarded a Marsden Fund Fast-Start grant to understand what drives people and communities to adopt solar cell technologies.

The use of solar cells, which convert sunlight to electricity, has increased dramatically worldwide in the last 4-5 years. Solar energy is key to reducing Aotearoa's emissions, as flagged by the Climate Change Commission's roadmap of 2021. Despite this, the adoption of solar technologies remains slow in Aotearoa relative to other countries – only 0.47 % of our total power is solar-derived. The future of energy will likely include solar technologies, so it is important to understand what their uptake will look like so we can ensure that we get the best out of them. To get there, we need to understand what motivates people when it comes to increased solar adoption. This prompts all sorts of key questions: What drives individuals and communities to go solar? Do current energy policies enhance or dim solar adoption? How will adoption be equitable? One thing is clear: if we want to achieve our climate goals, more research into solar adoption is essential.

Dr Yvonne Matthews

This Marsden Fund Fast-Start project, headed by Dr Yvonne Matthews, will dive into the motivations and constraints of solar adoption by analysing data from solar users and applying leading-edge behavioural economics models to understand how people and communities make the decision to adopt, and what drives people's energy-related behaviours once they make the leap to solar. The behaviours found will be analysed in a pragmatic way – realising decisions are often made through combinations of a person's prior experiences and economic realities.

The team will engage with participants from the community, such as recipients of the Māori Housing Renewable Energy Fund, giving a specific Māori-based perspective on solar energy implementation. An interactive tool will be developed, which will allow individuals to explore costs, energy management strategies, complementary technologies, and potential solar policies. The results of this mahi can contribute to important fields of energy economics, behavioural economics, and energy policy, making the future seem bright indeed.

NGĀ KĀINGA WHAKAMAHI I NGĀ HANA O TE RĀ

HE AHA NGĀ MEA E KŌKIRI ANA I TE WHAKAMAHI I TE PŪTAU I AOTEAROA

Kua whakawhiwhia a Tākuta Yvonne Matthews, o Taihoro Nukurangi (NIWA) ki te takuhe Tahua Tīmata-Wawe a Marsden kia mārama ai ki ngā mea e whakahau ana i ngā tāngata me ngā hapori ki te whai i ngā hangarau pūtau kōmaru.

Kua tino nui ake te whakamahi i ngā pūtau kōmaru puta noa i te ao, e whakawhiti ana i ngā hana o te rā ki te hiko, i roto i te 4.5 tau kua hipa. He mea nui te pūngao kōmaru hei whakaiti i ngā tukunga waro o Aotearoa, e ai ki tērā i tohua i te roto i te mahere 2021 a He Pou a Rangi. Ahakoa tēnei, e pōturi tonu ana te whai i ngā hangarau kōmaru i Aotearoa i te taha o ētahi atu whenua - 0.47 % anake o ā tātau hiko katoa nō te kōmaru. Kāore e kore kei te anamata o te pūngao ko ngā hangarau kōmaru, nō reira he mea nui kia mārama he aha te āhua o te whakamahi hei whakarite ka tino whai kiko tā tātau whakamahi. Kia tutuki ai tēnei, me mārama ai tātau ki ngā mea rikarika ai te tangata kia nui ake te whakamahi i te kōmaru. Ka ara ake i tēnei ngā momo pātai hira katoa: He aha ngā mea e whakahau ai i ngā tāngata me ngā hapori ki whakamahi kōmaru? Ka whakarei ake, ka whakararu rānei ngā kaupapahere onāianei i te whakamahinga kōmaru? Ka pēhea te ōrite o te whakamahi? Kotahi te mea kei te mārama: mēnā kei te hiahia tātau ki te whakatutuki i ō tātau whāinga āhuarangi, he mea waiwai te whai rangahau atu anō mō te whakamahi kōmaru.

Ka ruku ki tēnei kaupapa Tahua Timata-Wawe a Marsden, e ārahina ana e Tākuta Yvonne Matthews, ki te tirotiro he aha ngā mea whakahau me te whakatiki i te whakamahinga o te kōmaru mā te tātari i ngā raraunga mai i ngā kaiwhakamahi raraunga me te whakamahi i ngā tauira ōhanga whanonga tino hou rawa kia mārama ai ki te āhua o ngā whakatau a ngā tāngata me ngā hapori ki te whakamahi, ā, he aha ngā āhuatanga e whakahau ana i ngā whanonga ā-pūngao o te tangata ina whakaae rātau ki te whakamahi kōmaru. Ka whai kiko te tātari i ngā whanonga ka kitea - e mōhio ana ka oti ngā whakatau mā ngā wheako me ngā āhuatanga pūtea tūturu a te tangata.

Ka kōrero te rōpū ki ngā tāngata o te hapori, pērā i ngā kaiwhiwhi i te Māori Housing Renewable Energy Fund, e tuku ai i tētahi tirohanga Māori mō te whakamahi i te pūngao kōmaru. Ka hangaia he utauta pāhekoheko, e taea ai te tangata te tirotiro ngā utu, ngā rautaki whakahaere pūngao, ngā hangarau tautoko, me ngā kaupapahere kōmaru ka taea. Ko ngā otinga ka puta i tēnei mahi ka taea te tautoko ngā wāhanga ōhanga pūngao hira, ngā ōhanga whaonga, me te kaupapahere pūngao, ā, kia pai hoki ngā rā e heke iho.

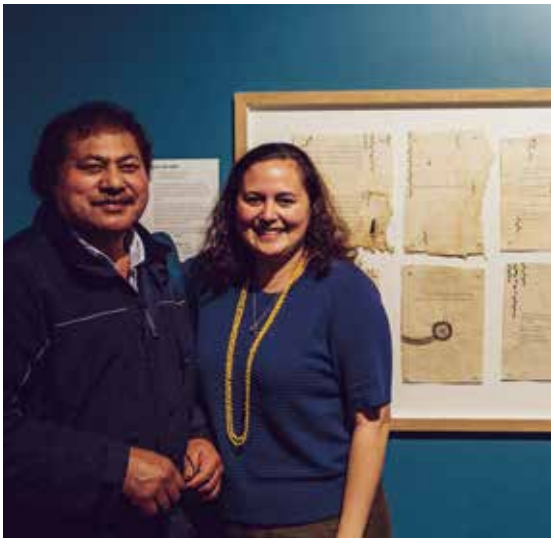
MAPPING NIUE WRITING

IN AND BEYOND AOTEAROA

Dr Jessica Pasisi, Niue (Mutalau, Hikutavake), Pālagi, Ngāti Pikiao, Tahiti from Te Whare Wānanga o Ōtākou the University of Otago ultimately seeks to explore the pleasure that tau tagata Niue, Niue people, gain from engaging with Niue writing.

Tau tagata Niue find joy as avid readers, writers and translators. But the importance of writing in vagahau Niue, the language of Niue, has yet to be fully explored and celebrated through research. The bookshelf of Niue literature is significant, yet there is currently no published work that engages with a number of these key texts. Locating and giving context to these Indigenous tāogo, treasures in Niue, draws attention to the Indigenous knowledge and foresight that created them. This is an opportunity to explore the joy and pleasure tau tagata Niue gain from writing and reading Niue texts, how knowledge and experience is shared, and how vagahau Niue is used and maintained.

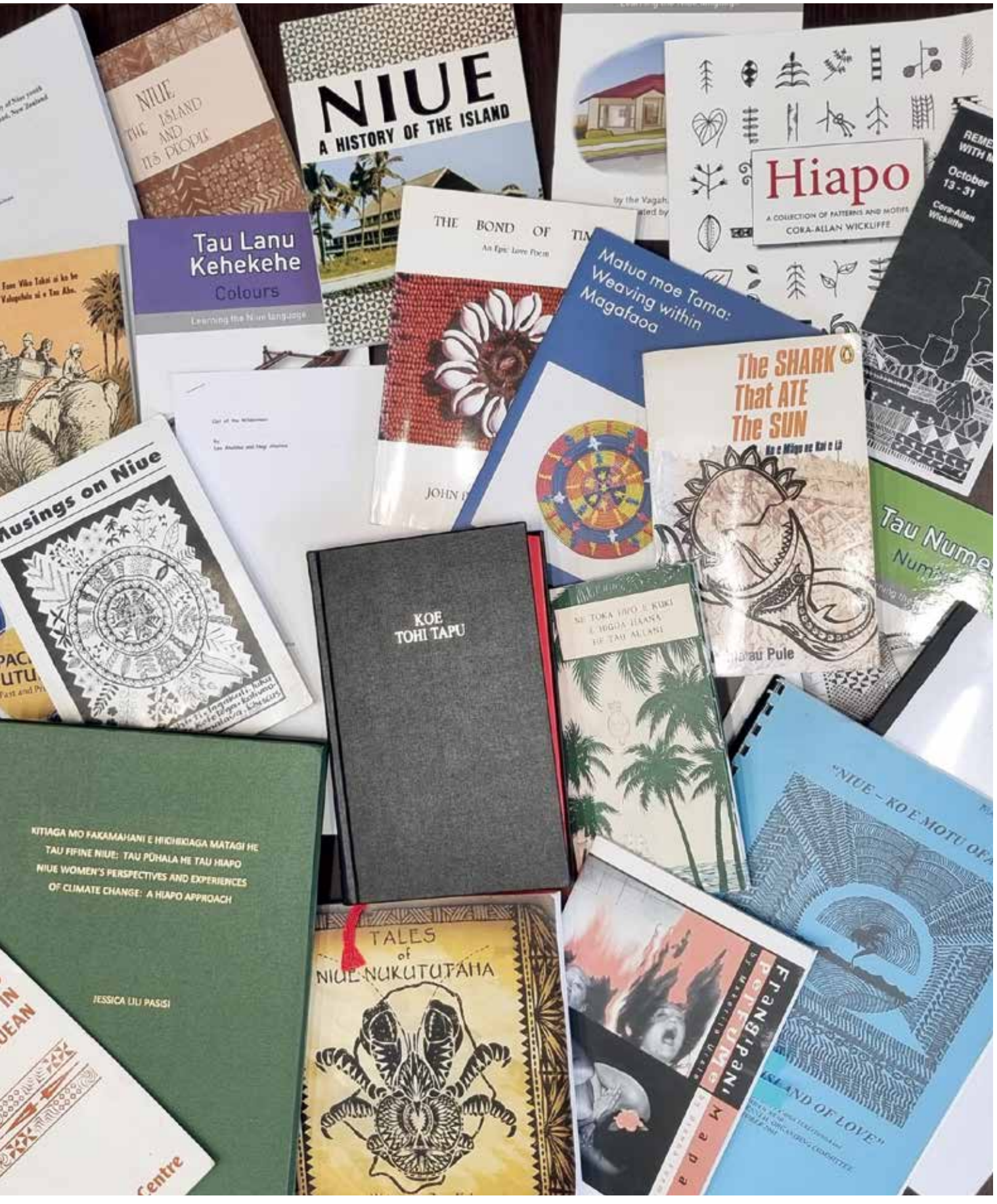
Over the course of this Marsden Fund Fast-Start project, Dr Pasisi will catalogue and critically analyse Niue texts from throughout recorded history and examine how tau tagata Niue engage with Niue texts in contemporary repositories. This research will expand our understanding of Indigenous literary connections between Niue and Māori, New Zealand Realm nations (Aotearoa, Niue, Tokelau and the Cook Islands), and broader global Indigenous communities. Understanding how Niue literary communities link with other Indigenous literary communities can give insight into shared struggles and successes.



Dr Jessica Pasisi with her father Ben Pasisi

Dr Pasisi will examine major contemporary repositories of Niue published written texts in Aotearoa and Niue, analysing the context of where these texts are located, including tracing why and how particular texts came to be published. To explore Niue texts as a wider part of cultural self-expression, a series of workshops will be held to engage with a broader audience. Dr Pasisi will co-lead these publicly accessible workshops with tau tagata Niue artists and writers.

This study will enhance our understanding of Niue Indigenous texts and contemporary engagement with them. Writing, thinking, and scholarly contributions from Niue are integral contributions to the fields of New Zealand history, Pacific Studies and Pacific literature in Aotearoa. As the direction of the New Zealand school curriculum moves to be more deliberate and intentional about the inclusion of Pacific histories, knowledge and languages, there is an urgent need for this critical engagement with the wealth and abundance of Indigenous texts and thinking that is located in repositories across the country.


NIUE
A HISTORY OF THE ISLAND
NIUE
THE ISLAND AND ITS PEOPLE
Hiapo
A COLLECTION OF PATTERNS AND MOTIFS
CORA-ALLAN WICKLIFFE
Tau Lanu Kehekehe
Colours
Learning the Niue language
THE BOND OF
Matua moe Tama:
Weaving within
Magafaoa
The SHARK That ATE The SUN
Musings on Niue
KOE TOHI TAPU
KITIAGA MO FAKAMAHANI E HIKIHIKIAGA MATAGI HE TAU FIFINE NIUE: TAU PŪHALA HE TAU HIAPO
NIUE WOMEN'S PERSPECTIVES AND EXPERIENCES OF CLIMATE CHANGE: A HIAPO APPROACH
JESSICA LIU PASISI
TALES of NIUE NUKUTUTAHA
FANGIPANI
"NIUE – KOE MOTU OF
ISLAND OF LOVE"


RAKAIA
WELCOMES YOU

BIG THINGS ON THE ROADSIDE

MONUMENTS WITH MEANING OR KITSCH KIWIANA?

Statues tell stories. Anecdotes of rich history and its colourful figures, culture and traditions. But statues can also silence stories. So which stories are told by the seemingly random oversized colourful sculptures dotted across Aotearoa landscapes – and which stories are obscured by their big shadows? Dr Maja Zonjić from Te Herenga Waka—Victoria University of Wellington wants to find out.

The big carrot at Ohakune; the giant kiwifruit at Te Puke; the L&P bottle at Paeroa. During the 1980s economic recession, struggling small towns across Aotearoa started building large roadside sculptures – or Big Things – to sell unique provincial identities and attract passing motorists. Today, there are more than two dozen such sculptures in Aotearoa, frequently visited by travellers on a quick stop-over on their road trips.

Despite their roadside hyper-visibility – and possibly due to their status as ordinary objects – Big Things are mostly invisible in critical scholarly research. However, just like statues of Queen Victoria or James Cook, they could be considered ideological expressions or 'silent teachers' that quietly illustrate and reinforce things about the society we live in.

Adopting an approach that focuses on power and historical inequities and injustices, Dr Zonjić will look at how Big Things, which are seemingly innocuous symbols of place, may in fact, provide a means for people to forget settler-colonial histories. Over the course of Dr Zonjić's Marsden Fund Fast-Start project, she will bring a critical gaze to these structures by provoking a new way of thinking about these dominant constructions of colonial objects and the way they obscure land dispossession.

While most scholarly and media attention is given to extremist forms of nationalism, everyday 'hidden' representations of modern nationalism can create powerful systems of beliefs precisely because they are often overlooked. The project seeks to re-centre alternative stories currently hidden in the shadows of the Big Things, culminating in a book and six short films. Internationally, this research provides a timely Aotearoa contribution to contemporary research examining the complex negotiations of decolonising public spaces, and the role that statues, however innocuous they may seem, occupy within them.

Corrugated iron sheep – Tirau

Above: Dr Maja Zonjić

COPYING SPONGEBOB

REPRODUCING THE WAY MARINE SPONGES MAKE MEDICINES

Dr Tristan de Rond of Waipapa Taumata Rau the University of Auckland will explore how a marine sponge makes potentially bioactive molecules by identifying the biosynthetic pathways.

Marine sponges are the richest source of bioactive small molecules from the ocean. These molecules not only serve important ecological roles for the sponge, they have been developed into lifesaving medicines, including the anti-cancer drugs cytarabine and eribulin, enabled by the study of a sponge species from Aotearoa. Developing medicines from the bioactive natural molecules of sponges has traditionally relied on harvesting large quantities of the organism – a process that can be environmentally devastating to the fragile marine ecosystem. A better way to do this would be to learn how the sponges make these natural molecules, so that we can reproduce these processes in a less harmful way, using biotechnology to produce bioactive natural products in the lab. The first step towards this goal is to understand the processes of biosynthesis in these sponges. Biosynthesis is the process that all living organisms use to form complex products from simpler components through reactions at the cellular level. A well-known example of this is photosynthesis, where sugar is biosynthesised from carbon dioxide using the sun's energy.

Dr Tristan de Rond

Dr Tristan de Rond has been awarded a Marsden Fund Fast-Start grant to explore the biosynthesis of molecules made by a marine sponge called Hamigera tarangaensis found living off the coast of Te Tai Tokerau Northland. The biosynthesised products that Dr de Rond will study are called hamigerans and they have medicinal potential including anticancer and antiviral activities. Dr de Rond's goal is to gain insight into how H. tarangaensis produces hamigerans, by identifying the enzymes that carry out hamigeran biosynthesis. This could lead to being able to reproduce hamigerans sustainably through fermentation using engineered microorganisms. To achieve his aims, he will use a combination of DNA sequencing, computational analysis, and chemistry techniques.

This project will contribute to the fundamental understanding of the chemistry that occurs inside this taonga species living off the coast of Aotearoa. In the long-term, knowledge about how they make hamigerans could contribute to making lifesaving medicines.

IS THAT BURIED TREASURE OR A FISH?

IMPROVING THE MATHS THAT UNDERLIE HIGH RESOLUTION IMAGING

Dr Marie Graff of Waipapa Taumata Rau the University of Auckland has been awarded a Marsden Fund Fast-Start grant to develop new solutions to mathematical problems which affect the accuracy of imaging.

High-resolution imaging is used in many of the technologies that are used to 'see through' things, to discover what is within or below a material. They're used in medical imaging to see inside us, and in seismic exploration to discover possible deposits of gas, oil and water. These technologies depend on the accurate measurement of signals as they move through the medium that is being looked through. However, current imaging methods suffer from inaccurate information due to random disturbances to signals as they travel – known as noise. These disturbances vary with the type of interactions between object and signal. The result is missing and corrupted data, which leads to poor image resolution.

Adaptive Eigenspace Inversion (AEI) is a new method which improves the accuracy of the mathematical modelling involved in interpreting data into images, mitigating the effects of poor data and substantially decreasing the computational cost and memory requirements. As one of the primary developers of AEI, Dr Marie Graff will collaborate with Dr Bamdad Hosseini from the University of Washington to further explore AEI. Early tests in underwater modelling simulations suggest that this new method outperforms current methods. However, theoretical understanding of this new method is limited, restricting wider applications. Dr Graff will use this Marsden Fund Fast-Start grant to perform a systematic and thorough theoretical analysis of this new method to understand why it is superior to existing methods and to create frameworks to further improve upon its potential usefulness in imaging.

Forming a better theoretical understanding of AEI could help to extend its use and confirm that we can trust the resulting images it creates. This research will establish AEI as the preferred method for various applications in medicine and seismic prospecting, and will cause a huge shift in the imaging community.

Dr Marie Graff
Dr Bamdad Hosseini

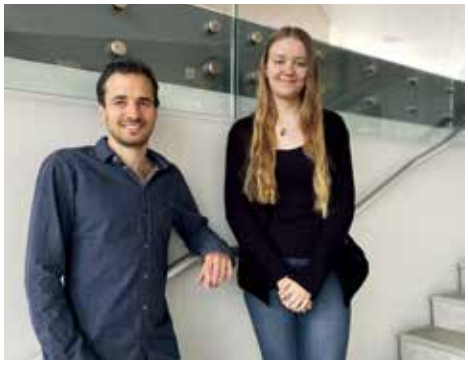
CAN WE MIMIC MICROALGAL PREDATORS?

USING THE NATURAL DEFENCE SYSTEM OF MICROALGAE FOR THEIR SUSTAINABLE HARVESTING IN FOOD AND INDUSTRIAL APPLICATIONS

Dr Maxence Plouviez from Te Kunenga Ki Pūrehuroa Massey University will explore how we can artificially stimulate microalgae to clump together as a cost-effective and sustainable harvesting biotechnology for microalgae-based food production and wastewater treatments.

Microalgae play vital roles in wastewater treatment and the production of food and high value bioactives. Their many uses in the food industry include making gelling agents, supplements (like spirulina), and fermented products including cheese. Likewise, countless communities worldwide rely on microalgae to cleanse wastewater. However, these applications are currently hampered by our inability to harvest microalgae economically and sustainably after they have done their job. For small communities and farms with limited capital, this inability to easily filter microalgae from wastewater ponds means nitrogen and phosphorus removed by microalgae still make it into local waterways. However, while microalgae are difficult to harvest in human-made environments, they readily aggregate into clumps in their natural environments, such as when sensing predators.

Dr Maxence Plouviez has been awarded a Marsden Fund Fast-Start grant to investigate which signals trigger self-aggregation in microalgae and whether these signals can be reproduced on demand. He will focus on compounds known as infochemicals that carry communicative information between two organisms. For example, pheromones are a type of infochemical used to communicate between individuals of the same species. Using RNA-sequencing and molecular and chemical analyses, Dr Plouviez aims to identify how microalgae transmit and receive the infochemicals produced when a predator is sensed, triggering the microalgae to clump together for safety. This fundamental research will establish the foundation for more cost-effective and sustainable harvesting biotechnologies to support the growing demand for microalgae-based industry.



Dr Maxence Plouviez (left) and PhD student Emma Muir

04 /

RESEARCH UPDATES AND MARSDEN FUND IN THE MEDIA

SHARING MEMORIES WITH TODDLERS HELPS THEIR WELL-BEING INTO ADULTHOOD

How mothers share memories with their children during toddlerhood impacts mental health and well-being in early adulthood, a Te Whare Wānanga o Ōtākou University of Otago study has shown.

Researchers found 21-year-olds told more coherent stories about turning points in their lives if their mothers were taught new conversational techniques two decades earlier. These adults also reported fewer symptoms of depression and greater self-esteem compared to adults in the study whose mothers interacted with them as usual.

The study, published in *Journal of Research in Personality*, is a long-term follow-up of a reminiscing intervention in which 115 mothers of toddlers were assigned to either a control group or taught to use elaborative reminiscing for a year.

Elaborative reminiscing involves open, enriched, and responsive conversations with children about shared experiences of everyday events. This is the first study to show long-term benefits of mother-child reminiscing for emerging adult development.

Lead author **Sean Marshall**, a PhD candidate in the Department of Psychology, says understanding ways to improve the mental health of 18 to 25-year-olds is important because of their unique stage of life.

"Emerging adults face a volley of challenges as they leave home and enter university or the workforce. We wanted to understand how well tamariki cope with new challenges as they enter adulthood and find ways to ease the psychological stress that typically accompanies these transitions," he says.

Project lead **Professor Elaine Reese**, of the Department of Psychology, says the 'soft-touch intervention' in early childhood proved to have enduring benefits for psychological well-being and mental health.

"This study is the first of its kind and is informing new interventions at home and in schools with parents and teachers of young children," she says.

The researchers intend to continue the study, which was initially funded by the Marsden Fund, later in adulthood to investigate the potential mechanisms driving the observed mental health and well-being benefits.

PUBLICATION DETAILS:

Growing Memories: Benefits of an early childhood maternal reminiscing intervention for emerging adults' turning point narratives and well-being. Sean Marshall and Elaine Reese.

Journal of Research in Personality

REACH FOR THE STARS

Associate Professor Jan Eldridge at Waipapa Taumata Rau the University of Auckland was awarded a Marsden Fund grant in 2018 to understand the stars and galaxies associated with gravitational wave events.

With her team of PhD students she has developed a school outreach programme as part of her grant. Considering concepts of mātauranga such as Māori cosmogony and taonga, **Professor Eldridge's** team are now actively engaging rangatahi youth in exciting, research-driven learning and skill development in science and innovation in Tāmaki Makaurau.

"Where do we come from?" is a question that can be answered in many different ways. In astrophysics, this question prompts another: where do the elements that are needed for life to exist come from? The short answer to this question is that they come from the stars.

Using many different processes, stars make all the elements around us (except for hydrogen and helium, which were formed in the first few minutes of the Universe after the big bang). But not all stars make all the elements. Instead, different types of stars use different processes to produce specific elements. Carbon and nitrogen, for example, are made in stars like our Sun when they become bloated red giants at the end of their lives. Elements like iron, oxygen and gold are produced by explosions from white dwarfs, massive stars, and merging neutron stars.

Asking where each element comes from allows people to form a deep connection to the Universe and the stars within it. In all cultures there are different objects and materials with significance, for example gold, pāhau whale bone, and pounamu jade. People from all cultures can link these objects and materials back to the stellar factories where they were made. The team realised they could use these connections to help people to learn about the complexities of the Universe and stars.

When **Jude Hancock** from Kōwhai Intermediate School contacted Associate Professor Eldridge about a possible project to run with her students it was an ideal way to try out this idea. The team of PhD students – **Max Briel**, **Petra Tang**, **Wouter van Zeist**, **Sohan Ghodla** and **Sean Richards** – volunteered to work with the students. Over three sessions and a visit to the University, they planned to teach the students about their place in the Universe, the origin of the elements, and how we observe them.

In the first session at the school, students brought along taonga an item that is precious for them. Using the periodic table and help sheets, they identified the elements of their taonga. Then they were introduced to the astrophysical origin of the elements, creating a deeper understanding of their taonga and connection to the stars.

They next explored how we know what elements are out there in the Universe, by observing the elements themselves. Using element lamps, the students got to have a close look at the spectra of hydrogen and helium and were able to figure out what elements they were. This session involved one-on-one interaction with the eager students, including in-depth discussion about why elements emit specific colours instead of a rainbow.

After learning about the elements and observing them, the last session was planned to focus on observing stars, planets, and constellations, and how they move across the sky. Using compasses and self-made star charts, the students would be able to go home and observe the sky at night. However due to COVID-19 lockdowns in 2021, this session did not take place, so the team re-ran the full series of three sessions for 2022.

Despite the disruption, the team discovered that by using small groups and exploration through physical learning, they had created an exciting experience for the school students to better understand where elements come from and define their place in the Universe. Sharing knowledge within the community in this way means that the benefits can directly impact rangatahi and encourage them to reach for the stars in a world where global issues are increasingly informed by scientific research.

To discover more visit bit.ly/MF58-57

Above: Max Briel talking to the class at Kowhai Intermediate School about how elements are made in the stars

Right: Kowhai Intermediate student looking at the spectroscope

Above right: A rainbow that is emitted when white light is shone through a prism. All images: Jude Hancock

WORLD-FIRST NZ TECHNOLOGY

ENABLING RESEARCHERS TO DISCOVER THE SECRETS OF HOW MELANIN PROTECTS SKIN FROM UV RADIATION

In a newly-published paper, a team of researchers at Te Herenga Waka—Victoria University of Wellington has used world-first technology, newly commercialised in New Zealand, to show for the first time precisely how melanin protects our skin from sunlight.

Researchers have long known the melanin in our skin protects against the damaging effects of UV radiation by dissipating high-energy radiation into heat. But exactly how melanin dissipated the energy and afforded this protection has not been well understood. A paper published in the *Proceedings of the National Academy of Sciences* shows that when sunlight hits our skin, a type of melanin called eumelanin protects us against free radical damage through a two-step reaction that dissipates the damaging high-energy radiation.

Te Herenga Waka—Victoria University of Wellington **Professor Justin Hodgkiss**, who led the team, says the research is very relevant to New Zealand, a country with high UV exposure and skin cancer rates, and the findings have potential applications for new sunscreens and filters for paints and plastics.

Dr Justin Hodgkiss' Ultrafast Optical Spectroscopy lab Image: MacDiamid Institute

"We have high rates of skin cancer here in New Zealand. Plus as we know, materials left outside deteriorate when exposed to UV light – any plastics, the paint on our houses for example – these all degrade under UV. So there is potential for these findings to lead not only to new sunscreens but also to new technologies that can filter UV and protect materials like paint."

The research, which was supported by the Marsden Fund, involved studying a particular type of melanin called eumelanin. The natural brown eumelanin, is a complex pigment material and one of several types of melanin found in human skin. Eumelanin acts as a vital barrier to UV light. UV photons can ravage proteins, DNA, and most other organic materials, by rapidly rearranging chemical bonds and generating reactive radical species. Eumelanin works by intercepting UV photons and safely dissipating the energy before damage can occur. The research showed the first step is a rapid sharing of energy between neighbouring chromophores (a molecule that absorbs light), and the second is a partial proton transfer to bound water molecules.

Professor Hodgkiss, whose research also focuses on new types of solar photovoltaics, says the light protection function of eumelanin is exactly the opposite of what a solar photovoltaic needs to do.

"With solar photovoltaics you're wanting the sun's energy to be absorbed in the material and cause the flow of electrical current involving free radicals and separation of charge. You're not wanting heat. In melanin, the process is the opposite – the body is wanting to quickly dissipate the damaging UV energy as heat before radicals can be formed."

One reason the mechanism hadn't been well understood until now is because the reactions within the eumelanin take place on an ultrafast timescale – as short as femtoseconds, or millionths of a billionth of a second, which is the natural timescale that electrons and atoms move around.

The researchers were able to see the key processes on this timescale by using a world-first set of ultrafast optical spectroscopy methods, which probes fast energy absorbtion dynamics using femtosecond laser pulses. The team used a unique combination of three ultrafast spectroscopy methods to capture different types of dynamics – revealing the mechanistic origin of photoprotection in this remarkable biological filter and one of its key building blocks, DHICA.

Professor Hodgkiss, who is also Co-Director of the MacDiarmid Institute, says the University's ultrafast optical spectroscopy lab had a specific advantage in carrying out this research.

"As far as we know, no one else in the world has this powerful mix of three different ultrafast spectroscopy methods required to build a picture of eumelanin: ultrafast fluorescence, ultrafast transient absorption and ultrafast Raman spectroscopy."

The findings relied on new ultrafast fluorescence capability developed by Professor Hodgkiss and others.

"The new ultrafast fluorescence capability we developed and used for this research has now been commercialised with the help of Wellington UniVentures, and the new technology spun out into a startup company Advemto this year."

Professor Hodgkiss said the research team included several early career researchers and prepared them well to solve tough problems in the workplace.

"The work involved the PhD research of **Dr Karen Thorn** and **Dr Sasha Ilina**, building and testing complex optical set ups in the lab, planning and carrying out experiments on tricky materials, then developing computational models to simulate and analyse the data. A second part involved theoretical modelling by postdoctoral fellow **Dr Paul Hume** using quantum chemical computational techniques to predict the signature of different excited states.

"The early career researchers were able to get their teeth into these really difficult problems."

He said that the findings show an aspect of nature that had until now been very well concealed.

"Eumelanin has an extremely complex and disordered structure that makes it really hard to study. By looking at natural and synthetic eumelanin and its molecular building blocks under different conditions, we were able to develop a model that explains the data and disprove some other ideas that had been proposed before. The cool thing is that we now understand that eumelanin's complex structure is actually important to its function."

Story on the MacDiarmid Institute website

Newshub TV3 story from 16 October 2022

FIERCE HOPE

YOUTH ACTIVISM IN AOTEAROA

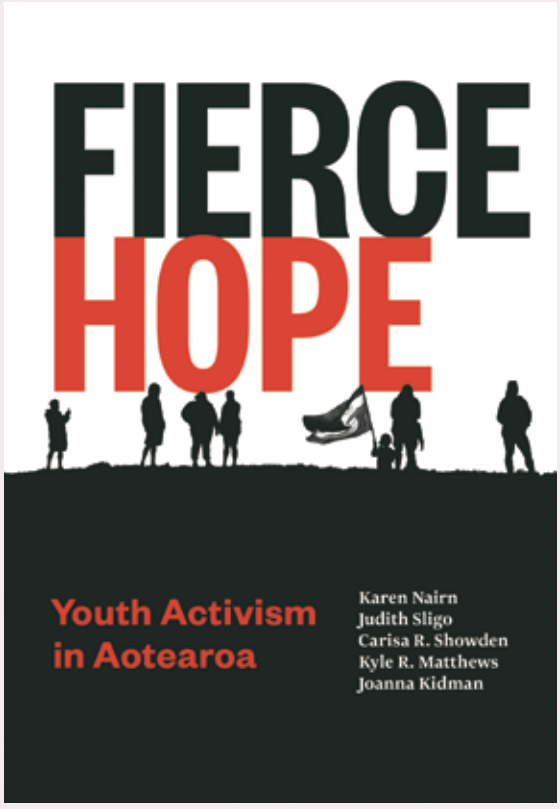
Social movements can create the conditions for fostering collective hope because they allow people to share and acknowledge the emotional labour of activism. Paying attention to activists' emotional work helps us to understand what sustains them.

Fierce Hope is a book which explores social movements in Aotearoa. The book is based on Marsden-funded research about youth activism, led by **Professor Karen Nairn** (Te Kura Ākau Taitoka/ College of Education, Te Whare Wānanga o Ōtākou University of Otago). It opens the doors on six influential activist groups: ActionStation, Generation Zero (Auckland), InsideOUT Kōaro, JustSpeak, Protect Ihumātao, and Thursdays in Black (University of Auckland). These movements address an array of urgent issues, from Indigenous rights to the justice system and imprisonment; from climate change to gender and sexual inequalities.

Over the last few years (2018-2021) Professor Nairn has worked on this project together with **Professor Joanna Kidman** (Te Herenga Waka—Victoria University of Wellington), **Dr Carisa Showden** (Waipapa Taumata Rau the University of Auckland), **Dr Judith Sligo** and **Kyle Matthews** (both from Te Whare Wānanga o Ōtākou University of Otago). They spent time with each group, attending hui and campaigns; following their social media and websites; and exploring the diverse ways they communicated their vision and actions. They interviewed 90 people aged 18 to early 30s who explained vividly what future they want for our country and how we can get there. The research and resulting book shine a light on young people's activism in Aotearoa in these unsettling political times. Their voices convey hope, anger, despair and anxiety – emotions which informed and galvanised their activism.

Explicit acknowledgement of hopelessness, frustration, despair and sadness helps activists identify the obstacles to change, and can help equip them to tackle these obstacles. Being hopeful in a critical way can be useful in avoiding burnout, by acknowledging and then counterbalancing the overwhelming challenges of achieving change. The team concluded that hoping critically is a useful way of understanding what practices sustain groups in the difficult work of social change.

Counteracting burnout is important to these groups because activist turnover has a big impact on collectives and group dynamics. The groups in the study were mainly composed of people in their teens and twenties; Protect Ihumātao was the only multi-generational group. Over the research period they all experienced turnover in membership, including the loss of the valuable contributions of experienced activists. A constant churn of people arriving and disappearing also makes it difficult to establish a sense of community and to share the work.



Despite these challenges the team feels positive about the role of the collective in activism. All of the groups in the study continued to be active as the research team reflected on their findings while writing *Fierce Hope*. The resolution of the whenua at Ihumātao was in the hands of mana whenua, the Kīngitanga and government. The Zero Carbon Act would now be tested in terms of its implementation, and Generation Zero Auckland saw a continued role for its input. ActionStation continued hosting petitions and creating responses to social justice issues under a new director. JustSpeak had appointed new staff and continued its work to change the public narrative on punishment. InsideOUT Kōaro employed several new staff, and further developed ways of improving the world for rainbow young people, including producing resources for primary, intermediate and Christian schools.

Over the time that they shared their stories with the project team, all six groups were working against what many would have viewed as insurmountable odds. Nevertheless, they persisted. Although each group faced unique challenges and opportunities, they were united by a fierce hope for a better world and the belief it can be achieved by working together in community.

These groups were part of creating progressive social change in Aotearoa at a particular time in our history. This project provides important insights into the immense demands of activism, and will help inform how we imagine radical new ways of living in Aotearoa.

Fierce Hope: Youth Activism in Aotearoa published November 2022.

Bridget Williams Books

ADA LOVELACE DAY PROFILES 2022

On Tuesday 11 October, we featured the work of three recent Marsden Fund researchers in honour of Ada Lovelace Day 2022. These wāhine researchers are following in Ada's mathematical footsteps. Ka rawe!

Dr Jodie Hunter

DR JODIE HUNTER

Associate Professor Jodie Hunter is affiliated with the Institute of Education at Te Kunenga Ki Pūrehuroa Massey University, Albany. In 2019, Associate Professor Hunter received Fast-Start funding to explore culturally embedded ways of knowing and successful mathematical experiences of Pāsifika learners outside of school, in their everyday settings in the home and community.

Equity in schooling requires educators to develop understandings of the identities of diverse learners and their 'funds of knowledge.' Aotearoa has one the largest groups of Pāsifika people in the Western world. Our Pāsifika communities are woven from many threads of diverse ethnicities, nationalities, languages, and cultures. However, this cultural knowledge is currently excluded from the classroom. Associate Professor Hunter is working with Pāsifika students aged from 7–15 and their families to document their school experiences with mathematics, aiming to raise awareness of the strengths of Pāsifika learners and address the current equity issues in education.

DR CHARLOTTE JONES-TODD

Dr Charlotte Jones-Todd is a lecturer in statistics at Waipapa Taumata Rau University of Auckland. In 2021, Dr Jones-Todd was awarded a Marsden Fund Fast-Start to better understand how events cluster in time and space. This work will help explain the underlying mechanisms behind real-world phenomena such as tweets going viral, neighbourhood crime waves, and earthquake aftershocks.

The complex mechanism behind any real-world chain of events is not easily measured or perceived. In this research, Dr Jones-Todd will develop new statistical frameworks for modelling events. The models created will incorporate self-exciting behaviours, which are when the presence of one event makes another event more likely. The combination of both event interrelationships and self-exciting behaviour will make the models practical and adaptable. The mathematical frameworks created over the course of this project could see use in a range of different fields from ecology to epidemiology and everywhere in between.

Dr Charlotte Jones-Todd

PROFESSOR BING XUE

Professor Bing Xue, of the School of Engineering and Computer Science at Te Herenga Waka Victoria University of Wellington received a Marsden Fund Standard grant in 2019 to use deep learning algorithms to address current challenges in identifying patterns in images for many real-world applications.

Deep machine learning techniques, particularly deep convolutional neural networks (DCNNs), are very successful in image classification. However, almost all state-of-the-art DCNNs are manually designed, requiring the ongoing support of rich experience and expensive expertise in DCNNs applied to a specific problem. These DCNNs are too complex to interpret, limiting their practical utility. Automated design of optimal DCNNs would address these issues, but this is very challenging because optimal architecture is highly complex and problem dependent. Professor Xue's project is developing an evolutionary computation-based approach to automated design of DCNN architectures. These new models will improve the classification accuracy, speed, simplicity, and interpretability of the learned DCNNs. These novel DCNNs will have numerous applications in security, self-driving vehicles, medicine and beyond.

Professor Bing Xue

SHINING A LIGHT ON MOUNT EREBUS' DEEP MAGMATIC SYSTEM

Antarctica's round-the-clock summer sunlight enables blue-skies research both above and below the Earth's surface.

Antarctica has long drawn explorers and scientists to investigate the icy continent, from the heroic feats of the first expeditions by James Ross, Roald Amundsen, Robert Falcon Scott and Ernest Shackleton to the far more comfortable efforts by scientists of today. Mount Erebus, which holds a unique place culturally in New Zealand, and the companion volcano Mount Terror (dormant) were named after the exploring ships of Sir James Ross, who discovered them and the Transantarctic Mountains in 1841. Erebus was first ascended by Sir Ernest Shackleton and party in 1908, and today is regarded as a key piece in the puzzle for understanding global volcanism and the ascent of magma from the deep mantle.

Mount Erebus is an example of a CO_2-rich rift volcano and, as such, is one of the world's few volcanos to have a lasting lava lake at its summit crater. Continental rifting happens as Earth's crust and mantle are pulled apart either by distant plate boundary forces or by upwelling plumes from great depth. Rift volcanoes stand in stark contrast to the more common arc volcanoes, which occur at subduction margins where one tectonic plate descends beneath another, like those around the Pacific Ring of Fire. Arc volcanoes are typically water-rich due to contributions from the subducting oceanic crust and overlying sediments, and this water prevents their magmas from reaching the surface. As arc magmas ascend and the overlying pressure is reduced, the water becomes supersaturated and flashes out, sometimes explosively as occurred at Mount St Helens in 1980. The remaining 'dehydrated' magma stalls in place, typically around 5 km below the Earth's surface.

To better understand the relatively peaceful ascent of rift magmas all the way to the surface, in this Marsden-funded project **Dr Graham Hill** (Te Whare Wānanga o Waitaha University of Canterbury, Czech Academy of Science), **Professor Phil Wannamaker** (University of Utah) and colleagues used a method called magnetotelluric (MT) sounding to image the Earth's structure approximately 100 km beneath Mount Erebus. MT sounding uses natural electromagnetic waves generated by the sun and lightning. Most such waves travel through the air, but a portion penetrate the Earth, scatter off rock structures and return to the surface where they can be measured by sophisticated volt meters. As the electromagnetic waves pass through Earth's interior, they travel faster or slower depending on the extent to which rock and other material conducts or resists electricity. Magma is conductive, so it can be detected by this technique.

Over three Antarctic summer field campaigns (2014-2017), 129 MT sites were measured around Erebus' Ross Island. Each site required a ground footprint of ~150 × 150 m and necessitated a multi-faceted, international field team of scientists and mountaineers led by guide **Danny Uhlmann**. Electromagnetic observations from all the stations were modelled to generate an image of the magmatic pathway beneath the island and its volcanoes.

Recently published results in *Nature* show a steep magma conduit that originates in the upper mantle and extends continuously through shallow crustal depths right up to the crater lake. The conduit undergoes a pronounced turn in the deep crust (at ~10 km depth), which is interpreted as a structural fault 'valve' that controls the episodic ascent of magma and CO_2 to higher levels.

These results not only image the magmatic pathway for this type of volcano but helps us better understand the scale, volume and controls on CO_2-rich gas transport from the mantle. This work adds another piece to the puzzle of global volcanism and betters our understanding of the links between the deep earth and our atmosphere.

Learn more about this fieldwork from the project's 2017 update or read the article in *Nature*

Above: With Mount Erebus in the background, Dr John Stodt, Phil Wannamaker, and Graham Hill set up a magnetotelluric sounding site in the Windless Bight area of Ross Island. Image: Danny Uhlmann

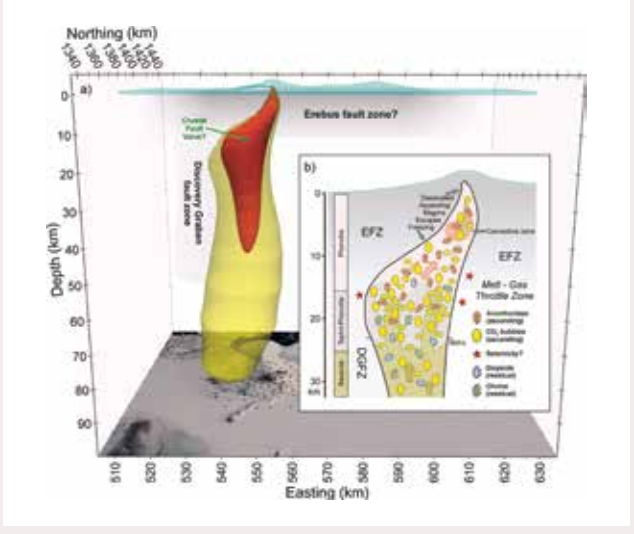


Illustration (R): A 3D visualization from the magnetotelluric scan of Erebus' interior showing the magmatic conduit and its inferred crustal fault valve at the prominent lateral turn (red is the most conductive and magma rich). B: Depiction of magmatic processes conjectured to be occurring in the upper magmatic core zone with rising bubbles of CO_2 and characteristic mineralogy at each depth. Illustration from the paper

KORIHI TE MANU

STORIES OF WHĀNAU AND ADOPTION

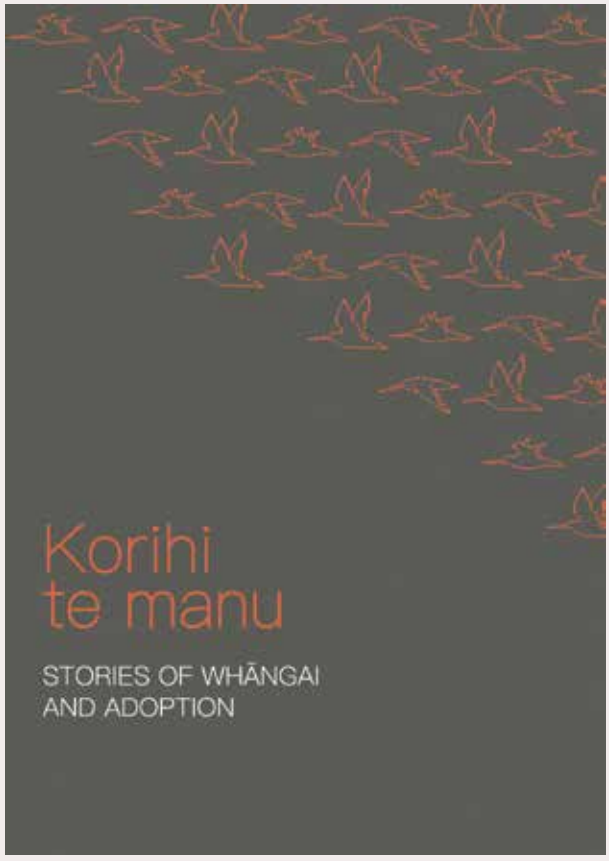
"We have a saying back home, kāore te tōtara e tū mokemoke ai – the tōtara never stands alone. Like all pepeha, it isn't a statement about a tree, it's that people should never be alone." – Moana Jackson.

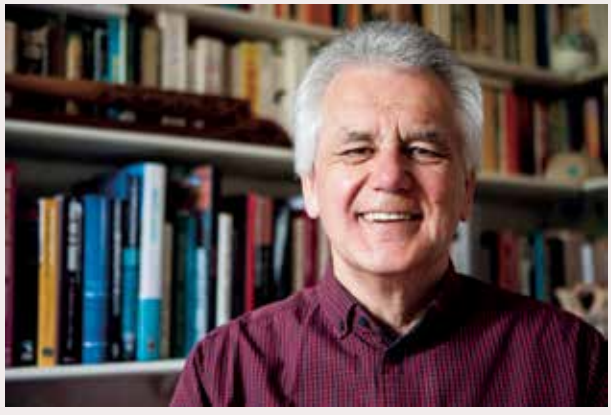
Whāngai is a tikanga developed over hundreds of years to grow strong, connected and safe whānau. Adoption is a much newer practice invented to solve two problems – caring for children whose parents can't raise them, and finding children for adults who want to be parents. Many thousands of Māori children have grown up whāngai or adopted but their experiences are mostly untold.

The stories in this collection are deeply personal and span almost a century. Contributors are whāngai and adopted people, their parents, grandparents, children, grandchildren, siblings, and wider whānau. They tell of the importance of connections, love, acceptance, of knowing your story and the story of your whānau.

Dr Helen Potter, Dr Marine Haenga-Collins, Ani Mikaere, Dr Annabelle Ahuriri-Driscoll, Dr Denise Blake, Dr Jessica Hutchings, Dr Kim McBreen, Jenni Tupo, Dr Moana Jackson.

Published by Te Wānanga o Raukawa





Dr Moana Jackson
Image: Aaron Smale

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NEWS FROM THE MARSDEN FUND

AUCKLAND WRITERS FESTIVAL

The Auckland Writers Festival is one of this country's premiere cultural events and its largest and most successful literary event. It hosts world leading commentators and writers, attracting upwards of 83,000 attendees every year. In 2022, the Festival ran from 23-28 August, featured Marsden-funded authors and three of its events were jointly sponsored by Marsden Fund and Royal Society Te Apārangi.

In recent years the worldwide subversion of facts for political purposes has become a critical challenge – across elections, a pandemic and now a major European war. What is the difference between information, disinformation and misinformation? What do we know about who is doing what, how and why, and how might we counter the rising tide? At the event *Truth and Lies*, defence strategist and author **David Kilcullen**, researcher and author of *A Matter of Fact* **Jess Berentson-Shaw**, and investigative journalist and author of *Truthteller* **Stephen Davis**, came together in conversation with **Kate Hannah** to interrogate manipulation, unrest and the seemingly doomed quest for harnessing the truth.

Cyclones, heatwaves, snow and drought… as a long, narrow group of islands, Aotearoa New Zealand is always at the mercy of wild weather, and that's before accounting for the mounting impacts of climate change. Meteorologist **Lisa Murray**, MetService New Zealand's Head of Weather Communication, co-authored the book *New Zealand's Wild Weather*, and gave a presentation delving into some of this country's most dramatic weather.

In 2010, the National Government signed the UN Declaration on the Rights of Indigenous Peoples, joining more than 140 other countries; in 2019 the Labour Government set up a working group tasked with creating a plan to realise that commitment.

The result is *He Puapua*, a discussion document whose title refers to the break between waves and evokes the concept of a disruption to political and legislative norms. Within days, it would become a political football, with some demanding a 'national conversation'. Working group members, writers and lawyers **Claire Charters** (Ngāti Whakaue, Tūwharetoa, Ngāpuhi, Tainui) and **Jacinta Ruru** (Raukawa, Ngāti Ranginui, Ngāti Maniapoto) spent a fascinating hour discussing sovereignty, mātauranga Māori and igniting the imagination with **Moana Maniapoto** (Ngāti Tūwharetoa, Te Arawa).

Marsden funded research *He Taonga te Wareware? Remembering and Forgetting Difficult Histories in Aotearoa New Zealand* was behind a powerful discussion by sociologist **Joanna Kidman** (Ngāti Maniapoto, Ngāti Raukawa) and historian **Vincent O'Malley** as they spoke with **Stacey Morrison** about their writing, passion and collaborations.

Ranging across medicine, robotics and geology, physicist and science communicator **Laurie Winkless** gave an entertaining and engaging talk on her publication *Sticky: The Secret Science of Surfaces*. The event was much enjoyed by classes from Aorere and Tangaroa Colleges, whose visits were supported by the Marsden Fund via introductions from the Participatory Science Platform.

The Festival celebrates curiosity and a sense of intellectual adventure and the programme is driven by the desire to spark ideas, to get people talking and to give them a time and place to engage with the world, much like the Marden Fund itself.

Image: Ieuan Jenkins

Image: Ieuan Jenkins

NEW CHAIR FOR MARSDEN FUND COUNCIL

Professor Gillian (Gill) Dobbie FRSNZ of Waipapa Taumata Rau the University of Auckland has been appointed Chair of the Marsden Fund Council by the Minister for Research, Science and Innovation. The Council comprises eminent researchers who assess funding applications for the Marsden Fund Te Pūtea Rangahau a Marsden.

Professor Dobbie said, "It is an honour to lead the Marsden Fund Council, which has a long history of funding excellent investigator-led research in Aotearoa. I am especially excited to be involved at this time when the Research Science and Innovation System is being reformed." She has convened the Council's Mathematical and Information Sciences panel since 2015, and succeeds Professor David Bilkey, who has chaired the Council since 2018.

Professor Dobbie is one of the first women to complete a PhD in Computer Science at the University of Melbourne in 1995. Although she has a broad understanding of computer science, her passion is in getting the most out of data, which includes how data can be processed efficiently, and the insights we can gain from data. Her current research focuses on machine learning, in particular data stream mining and adversarial attacks.

NO TE HURIHURINGA ON REFLECTION

PROFESSOR DAVID BILKEY

OUTGOING CHAIR, MARSDEN FUND COUNCIL

KIA ORA KOUTOU,

Despite its comparatively small size, the Marsden Fund has become synonymous for its support of 'blue sky thinking' among the very best emerging, established and eminent researchers. Perhaps, this is because competition for funding is intense, and every year many brilliant ideas must be turned away for lack of funding, even though they are of truly top international standard. I also believe it is because our focus continues to be on the key objectives of excellence, connectivity, diversity and scholarly impact, and our significant role in supporting and retaining the best early-career research talent in New Zealand through our Fast-Start grants.

One of the first highlights of my term as Chair was being onboard for the initiation of a new grant category, the Marsden Fund Council Award, which was instituted in 2018, with the first grants awarded for this category in 2019. The research funded by these grants have met the very highest standard for interdisciplinary research in Aotearoa New Zealand.

The Marsden Fund also celebrated its 25th birthday in 2019, and the big celebratory event in Rotorua was fantastic. Many wonderful speakers also gave talks about their Marsden research across the motu. It was truly humbling to shine a light on some of the incredible research that has been supported by the fund since its inception. It also allowed us an opportunity to thank the many people who have contributed to the fund's success over the years, especially those who have served on assessment panels.

That year we also had our first major sponsorship event for the Fund, with Professor Rangi Mātāmua's Matariki lecture tour, which travelled all over Aotearoa and Australia. It was a stratospheric success in terms of outreach, bringing Matariki to new audiences and communities.

Of course, the onset of the COVID-19 pandemic disrupted the outreach and research efforts of many Marsden Fund recipients, and required some careful manoeuvring to ensure that the funding rounds in both 2020 and 2021 went ahead with minimal impact on applicants. I'm extremely proud to have led the Marsden Fund Council through this challenging time and wish to thank the Council and Executive team for their mahi and support across the whole period of my tenure. The Marsden Council has been steadfast in its desire to support and develop the diverse research environment we have in this country and I'm very pleased that this has been manifested in many ways, including through increasing the value of Marsden PhD and Masters scholarships during this period, a change stemming from the Council's desire to support the development of the next generation of emerging researchers.

Looking ahead, I heartily congratulate Gill Dobbie on her appointment as Chair, and wish the fund every success on its continued support of excellence in the Aotearoa New Zealand research sector.

Professor David Bilkey

A MESSAGE FROM THE MARSDEN FUND COUNCIL

The Marsden Fund Council sincerely thanks Professor David Bilkey, who ends his term as Chair this year. He has been involved with the Marsden Fund since 2009, when he was elected as a Panellist on the Economics and Human Behavioural Sciences panel. He was appointed Convenor of that panel in 2015, and then Chair of the Marsden Fund Council in 2018. David's empathetic and grounded leadership have been valuable contributions to the fund during both the highlights and the more challenging times of his tenure.

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MARSDEN FUND RECIPIENTS

Project ID	Panel	Institution	Project	Principal Investigator	Funding (ex GST)
22-AUT-002	BMS	Auckland University of Technology	Developing Vitamin B12 Conjugates for the Targeted Uptake of Antibiotics in Resistant Gram-negative Pathogens	Professor NE Brasch	$960,000
22-AUT-015	HUM	Auckland University of Technology	A rehabilitation model for professional discipline	Professor K Diesfeld	$647,000
		University of Otago		Professor LJ Surgenor	
22-CAW-003	EEB	Cawthron Institute	Rewilding our rivers: Quantifying the cryptic role of whitebait marine subsidies in structuring New Zealand riverine food webs	Dr SD Stewart	$360,000
22-GNS-005	ESA	GNS Science	Explosion or lava? Understanding controls on the eruption style of rhyolite magma	Dr SM Rooyakkers	$360,000
22-GNS-008	EIS	GNS Science	Harnessing the power of thermal spikes: A new pathway to fabricate size-controlled transition metal carbide nanoparticles for energy conversion and storage	Dr PG Sridhar Gupta	$360,000
22-GNS-011	EIS	GNS Science	Can wonder crystal Perovskites transform solar power generation? Discovering the links between strain and material properties	Dr JV Kennedy	$940,000
22-GNS-012	ESA	GNS Science	Why is pounamu tough? Using materials science and mātauranga Māori to explain the special physical properties and uses of nephrite jade	Dr N Mortimer	$927,000
		GNS Science		Dr SC Cox	
22-IAL-001	SOC	Māori and Indigenous Analysis Ltd (MAIA)	Ngā Kare-a-roto: The Ripples Within - Māori Understandings and Expressions of Emotions	Professor LE Pihama	$870,000
22-MAU-006	EHB	Massey University	How much do they recall? Measuring the effect of safety training on human memory	Dr R Lovreglio	$360,000
22-MAU-018	MIS	Massey University	Minimal mathematical models for dynamical systems with abrupt events	Dr DJW Simpson	$602,000
22-MAU-020	SOC	Massey University	The intimate technology shaping millions of lives: Exploring the possibilities of menstruation and perimenopause tracking apps for people with diverse embodied experiences	Professor SCE Riley	$870,000
22-MAU-033	SOC	Massey University	It takes a village: Picturing family support for transgender young people in Aotearoa	Dr J de Bres	$870,000
22-MAU-045	EEB	Massey University	Gene flow to the rescue? An analytical framework for estimating impacts of genetic augmentation on wildlife population dynamics	Dr EH Parlato	$360,000
22-MAU-052	SOC	Massey University	Kia whakatōmuri te haere whakamua: Translating Mātauranga Māori, usefully applied in the past, to enhance recovery trajectories in the future	Professor CM Kenney	$870,000
		Te Whare Wānanga o Awanuiārangi		Professor TKR Kingi	
		Massey University		Dr SR Phibbs	
22-MAU-053	EHB	University of Waikato	Manahau: In search of the original Māori firm and its philosophy of management	Associate Professor JP Mika	$360,000
22-MAU-057	EIS	Massey University	Understanding the mechanisms of microalgal self-aggregation for economic and sustainable harvesting	Dr M Plouviez	$360,000
22-MAU-071	SOC	Massey University	Sensationalising Sleep: Discourses and practices of sleep in Aotearoa	Dr RH Gibson	$360,000
22-MAU-096	HUM	Massey University	Rangatiratanga and online media: understanding how Māori, create, shape, experience and share our worlds	Dr AM Moewaka Barnes	$647,000

Project ID	Panel	Institution	Project	Principal Investigator	Funding (ex GST)
22-MAU-097	SOC	Massey University	Resisting resource grabs: Understanding emotions in environmental conflict in the Mekong River Basin	Dr AB Beban	$360,000
22-MAU-104	CMP	Massey University	Use it or lose it: what determines the regulation mode of a given gene?	Associate Professor XX Zhang	$934,000
22-MAU-119	CMP	Massey University	Structural basis of viral wars: Innate immune system attack on viral genomes and the counterattack by viruses	Dr E Harjes	$934,000
		Massey University		Emeritus Professor GB Jameson	
22-MAU-126	HUM	Massey University	Kia rite! Kapahaka for Screens	Dr JKT Wilson	$647,000
22-MNZ-001	EEB	Museum of New Zealand Te Papa Tongarewa	Fish, squid and krill: deep-time evolution of marine tetrapod feeding ecology	Dr FG Marx	$958,000
22-NIW-002	EEB	National Institute of Water and Atmospheric Research Ltd	Clear as mud: Revealing subsurface burrows to quantify globally important seafloor sediment biogeochemistry in a changing world	Dr RL Hale	$360,000
22-NIW-005	EHB	National Institute of Water and Atmospheric Research Ltd	Solar prosumers in Aotearoa: a behavioural economic analysis	Dr YS Matthews	$360,000
22-TAK-001	SOC	Takarangi Research Ltd	Kūmara: uncovering new narratives about settlement, histories and kōrero of Aotearoa	Professor PJT Tapsell	$870,000
22-UOA-001	PCB	University of Geneva	A Molecular Machine-Based Approach to Artificial Photosynthesis	Dr CB Larsen	$360,000
22-UOA-009	EEB	The University of Auckland	Hearing and sound communication in crustaceans	Associate Professor CA Radford	$960,000
22-UOA-011	MIS	The University of Auckland	Improved control for synthesis of the Fourier transform under symmetry or dynamical constraints	Dr ME Tacy	$634,000
22-UOA-018	SOC	The University of Auckland	The Residential Red Zone (RRZ) as Futures Lab: Placemaking in the Anthropocene	Professor SD Matthewman	$870,000
		The University of Auckland		Associate Professor L Goode	
22-UOA-035	PCB	The University of Auckland	A Green Awakening for Radical Chemistry	Professor J Sperry	$903,000
22-UOA-038	BMS	The University of Auckland	Stimulating the immune cells to combat cancer by silencing the arylformamidase enzyme	Dr P Tomek	$360,000
22-UOA-048	MIS	The University of Auckland	Spatial tipping points, early warning signals and lung physiology: when can we predict catastrophic change?	Associate Professor GM Donovan	$707,000
22-UOA-052	MIS	The University of Auckland	Genealogies of samples of individuals selected at random from stochastic populations: probabilistic structure and applications	Associate Professor SC Harris	$713,000
22-UOA-072	PCB	The University of Auckland	Elucidating the biosynthesis of bioactive, chemically-unique terpenoid natural products in a New Zealand marine sponge	Dr T de Rond	$360,000
22-UOA-079	EEB	The University of Auckland	The evolution of simplicity: Investigating the Black Queen Hypothesis with biofilm forming cyanobacterial Microcoleus species	Dr KM Handley	$960,000
		Cawthron Institute		Dr LT Kelly	
22-UOA-087	SOC	The University of Auckland	Feeling abnormal about normalising Te Reo: Maori wellbeing and intensifying Pākeha consumption of the Maori language	Dr KM Dell	$360,000
22-UOA-095	EHB	The University of Auckland	Completing the loop with BabyX: Harnessing a novel interactive experimental tool to uncover how infants' communicative signals shape caregivers' interactive responsiveness	Associate Professor AME Henderson	$870,000

Project ID	Panel	Institution	Project	Principal Investigator	Funding (ex GST)
22-UOA-101	MIS	The University of Auckland	Adaptive Eigenspace Inversion: Analysis, improved efficiency, and extensions	Dr M Graff	$360,000
22-UOA-113	EIS	The University of Auckland	Integrated fiber ring resonators for high-performance optical frequency combs	Associate Professor SG Murdoch	$940,000
22-UOA-116	ESA	The University of Auckland	Probing the depths of Auckland's Volcanic Field: An integrated geophysical investigation into the intraplate volcanism of Tāmaki Makaurau	Associate Professor K Van Wijk	$929,000
22-UOA-120	EHB	The University of Auckland	Revealing Dynamic ADHD Brain Behaviour using Hyperband MRI	Associate Professor JW Fernandez	$870,000
22-UOA-148	BMS	The University of Auckland	The overlooked X and Y factor in osteoarthritis development	Dr RC Poulsen	$941,000
22-UOA-151	EIS	The University of Auckland	A blood vessel like no other: How does blood flow across the placental surface impact function?	Associate Professor JL James	$936,000
22-UOA-160	BMS	The University of Auckland	Fructose flux in the heart: discovering hidden pathways of cardiac sugar toxicity	Dr KM Mellor	$956,000
22-UOA-164	HUM	The University of Auckland	A Public Law Theory of Economic Regulation	Dr EM Willis	$360,000
22-UOA-168	SOC	The University of Auckland	"It binds us together": Netball's enduring role in the intergenerational health and wellbeing of Aotearoa women	Professor T Bruce	$870,000
		The University of Auckland		Dr MA Henley	
22-UOA-171	EIS	The University of Auckland	Waste to Resource; Is a Wastewater-derived Biopolymer a Good Firefighter?	Dr NK Kim	$360,000
22-UOA-172	EHB	The University of Auckland	Understanding the sounds of te reo Māori in an acoustically varied world	Dr CTJ Hui	$360,000
22-UOA-175	BMS	The University of Auckland	Tumour-targeting bacteria as immune stimulants for cancer immunotherapy	Dr AM Mowday	$360,000
22-UOA-177	CMP	The University of Auckland	What makes the heart fail when it beats like a metronome?	Dr JC Han	$934,000
22-UOA-182	MIS	The University of Auckland	Federated Nearest Neighbour Search: Theory and Practice	Dr ND Pham	$360,000
22-UOA-184	EHB	The University of Auckland	Shining a light on the past: improved chronology for Aotearoa-New Zealand using tree-ring based radiocarbon and stable isotope science	Associate Professor IG Boswijk	$870,000
		University of Wales Swansea		Professor NJ Loader	
22-UOA-185	EEB	The University of Auckland	Bayesian phylodynamic inference from single-cell sequencing data	Professor AJ Drummond	$960,000
22-UOA-189	CMP	The University of Auckland	Coming back to life, systems biology of organelle biogenesis in resurrection plants	Dr CJ Carrie	$933,000
22-UOA-194	MIS	The University of Auckland	Algorithms for linear groups	Dr MJ Conder	$360,000
22-UOA-201	BMS	The University of Auckland	Using plasmin, a common serine protease from human serum, to make cancer more digestible for the immune system, one bite at a time	Dr EJ Loef	$360,000
22-UOA-204	MIS	The University of Auckland	`Fingerprints' of wild chaos: from theory to practical relevance	Professor HM Osinga	$709,000
22-UOA-242	EIS	The University of Auckland	Uncovering the Secret of Oxidative Power of Bacterial Laccase Enzymes	Dr WQ Zhuang	$940,000
22-UOA-250	EEB	The University of Auckland	Is the mutualistic cheating of the strong black queen hypothesis robust to disturbances?	Dr MS Fullmer	$360,000

Project ID	Panel	Institution	Project	Principal Investigator	Funding (ex GST)
22-UOC-025	EIS	University of Canterbury	Deciphering molecular structures using diffuse X-ray scattering from disordered crystals	Dr JPJ Chen	$360,000
22-UOC-037	HUM	University of Canterbury	Can word duration in a morphologically complex language tell us if words are stored whole or constructed from parts?	Dr GH Schokkin	$360,000
22-UOC-059	SOC	University of Canterbury	Into the Deep: Analysing the Actors and Controversies Driving the Adoption of the World's First Deep Sea Mining Governance	Dr P Hatcher	$870,000
22-UOC-063	MIS	University of Canterbury	Rational points and anabelian geometry	Dr BM Creutz	$713,000
		University of Canterbury		Professor JF Voloch	
22-UOC-065	HUM	University of Canterbury	Te reo Māori vowel sequences within and across morpheme boundaries	Professor JB Hay	$647,000
22-UOC-070	ESA	University of Canterbury	What physics powers the fastest explosions in the Universe?	Dr RG Ridden-Harper	$360,000
22-UOC-076	EEB	University of Canterbury	Stuck at home: the puzzle of a locally-abundant, thermophilic bacterial genus that has not dispersed beyond Aotearoa-New Zealand	Associate Professor MB Stott	$958,000
22-UOC-079	ESA	University of Canterbury	How is Antarctic sea ice defying the odds of climate change?	Associate Professor W Rack	$929,000
		Lincoln Agritech Ltd		Dr A Tan	
22-UOC-087	EHB	University of Canterbury	Is Algebraic Structure Inherent in Perception?	Professor RC Grace	$870,000
		University of Canterbury		Professor S Kemp	
22-UOC-088	ESA	University of Canterbury	The longevity of airborne microplastic-climate forcing from legacy plastic pollution	Associate Professor LE Revell	$928,000
22-UOC-092	PCB	University of Canterbury	TRAPped in an elevator.	Professor RCJ Dobson	$937,000
22-UOC-094	SOC	University of Canterbury	Indigenous Reconstruction: Rebuilding Indigenous economies from the ground up	Dr MR Scobie	$360,000
22-UOC-102	HUM	University of Canterbury	Taniwha: A Cultural History	Dr KH Dunn	$360,000
22-UOO-003	CMP	University of Otago	Disrupting Bacterial Metal Ion Homeostasis to Break Antimicrobial Resistance	Distinguished Professor GM Cook	$934,000
		University of Queensland		Professor MJ Walker	
22-UOO-005	BMS	University of Otago	Molecular mechanisms underlying pathogen-pathogen interaction during skin infection	Dr D Pletzer	$960,000
22-UOO-011	PCB	University of Otago	Growth, life and death of a supersolid	Professor PB Blakie	$937,000
		University of Otago		Dr D Baillie	
22-UOO-015	PCB	University of Otago	A theory for coronal heating through turbulence mediated by the helicity barrier	Dr J Squire	$937,000
22-UOO-019	EHB	University of Otago	Connecting to the Colonial: Exploring the power of archaeological science to humanise the past	Dr CL King	$870,000
22-UOO-029	EEB	University of Otago	Can isotope maps and environmental DNA reveal the mysterious marine life of New Zealand eels?	Dr AJM Sabadel	$960,000
22-UOO-032	EHB	University of Otago	Counting On Your Ears	Associate Professor Y Zheng	$870,000
22-UOO-054	PCB	University of Otago	Superconductors that survive ultra-high magnetic fields: Revealing the role of symmetry	Dr PMR Brydon	$937,000

Project ID	Panel	Institution	Project	Principal Investigator	Funding (ex GST)
22-UOO-068	CMP	University of Otago	Seasonal prostate plasticity: a novel model for the regulation of cell proliferation	Dr MK Laird	$360,000
22-UOO-069	PCB	University of Otago	Covalent Biomolecular Conjugates as Potential Progenitors to Primordial Cooperative Biological Systems	Dr NJ Green	$360,000
22-UOO-070	BMS	University of Otago	Molecular and cellular organisation underlies the asymmetric regeneration of sensory axons	Dr LF Gumy	$960,000
22-UOO-087	BMS	University of Otago	Role of CK2 phosphorylation of the ryanodine receptor in seizures	Associate Professor PP Jones	$958,000
22-UOO-098	BMS	University of Otago	Exploitation of host mechanotransduction by Listeria monocytogenes	Associate Professor KP Ireton	$829,000
22-UOO-102	CMP	University of Otago	Membranes matter: how membrane lipids control Candida albicans Cdr1 structure and function	Professor RD Cannon	$934,000
		University of Otago		Dr E Lamping	
22-UOO-107	BMS	University of Otago	A regulatory role for the septin cytoskeleton in brain development	Professor SP Robertson	$960,000
22-UOO-112	EHB	University of Otago	Moa hunting, mahinga kai and Māori economic practices - 1300 to 1450 AD.	Professor RK Walter	$870,000
22-UOO-116	EEB	University of Otago	Adapting to NZ's deforested ecosystems: testing for human-driven shifts in insect colour	Professor JM Waters	$960,000
22-UOO-128	BMS	University of Otago	Targeting newly discovered biofilm-associated virulence factors of Staphylococcus aureus to treat chronic bacterial infection	Dr M Fellner	$360,000
22-UOO-138	MIS	University of Otago	3D Shape Analysis with Geometric Declarative Networks	Associate Professor SJ Mills	$723,000
22-UOO-164	ESA	University of Otago	Metal micronutrients: Major players in the Southern Ocean's carbon sink	Professor CH Stirling	$929,000
22-UOO-177	ESA	University of Otago	Pinpointing the volatile driver for sudden large-scale volcanic eruptions	Dr M Brenna	$929,000
22-UOO-205	BMS	University of Otago	Unlocking the therapeutic potential of the human cannabinoid CB1 receptor: Rational design of novel allosteric modulators	Professor M Glass	$960,000
		The University of Auckland		Associate Professor DP Furkert	
22-UOO-218	CMP	University of Otago	Building and breaking the Androgen Clock	Associate Professor TA Hore	$934,000
22-UOW-001	SOC	The University of Auckland	He Awe Māpara: The intersections of indigenous imaginings, decolonisation and mainstream sport for Māori, as culturally Māori	Associate Professor MR Rua	$870,000
		University of Otago		Dr JW Hapeta	
22-UOW-002	HUM	University of Waikato	Two languages in my kete – a developmental sociolinguistics approach to cultural nuance and social identity in everyday kiwi words	Dr AS Calude	$647,000
22-UOW-047	HUM	University of Otago	Mapping Niue texts in and beyond Aotearoa: Expanding on New Zealand Realm connections to Niue through archival texts	Dr JLP Pasisi	$360,000
22-UOW-062	EEB	University of Waikato	A complex systems approach to understanding the evolution of mating systems	Dr CJ Painting	$360,000
22-UOW-066	MIS	Victoria University of Wellington	Exploring Disagreement-Based Learning for partially labelled data stream classification	Dr HM Gomes	$360,000

Project ID	Panel	Institution	Project	Principal Investigator	Funding (ex GST)
22-VUW-003	SOC	Victoria University of Wellington	The invisibility of mothering with chronic illness: Embodied relationships, entangled feelings	Dr CM Parton	$360,000
22-VUW-010	HUM	Victoria University of Wellington	Do you have a healthy mind? The philosophy of mental health	Professor ST Keller	$647,000
22-VUW-011	PCB	Victoria University of Wellington	Unravelling the electronic structure of highly charged hydrogen- and halogen- bonds; rational chemical design and the creation of novel ionic liquid materials	Professor PA Hunt	$937,000
22-VUW-015	ESA	Victoria University of Wellington	How much are glaciers melting due to climate change?	Dr LJ Vargo	$360,000
22-VUW-021	SOC	Victoria University of Wellington	Big Things, Complex Shadows: investigating intersecting stories of place, identity, and erasure through large roadside sculptures in Aotearoa	Dr M Zonjić	$360,000
22-VUW-026	CMP	Victoria University of Wellington	What transcription factors activate expression of symbiosis-related genes in symbiotic fungi?	Dr D Berry	$360,000
22-VUW-041	EIS	Victoria University of Wellington	UV–vis spectroscopy of ultra-small scattering samples and individual micro-particles	Dr B Auguié	$940,000
22-VUW-052	SOC	Victoria University of Wellington	Empowering Indigenous knowledge: Decolonisation and Indigenisation of Gallery, Library, Archival, Museum and Records (GLAMR) institutions.	Associate Professor SC Lilley	$575,000
22-VUW-077	EIS	Victoria University of Wellington	Underpinning high temperature superconducting nuclear fusion reactor technology	Dr Z Jiang	$932,000
22-VUW-078	EHB	The University of Auckland	Cross-cultural relationships between speech and song	Associate Professor PE Savage	$360,000
22-VUW-100	EEB	Victoria University of Wellington	Virus-virus interactions: a key to unravel global honey bee colony losses?	Dr ACR Felden	$360,000
22-VUW-103	ESA	Victoria University of Wellington	Past abrupt Antarctic ice sheet melt events and impacts on sea level and climate	Associate Professor RM McKay	$929,000

This list of recipients is abridged.

For the complete list of awarded Marsden Fund investigators, including abstracts of all projects, visit: Bit.ly/MF58-80

Whakapā mai | Contact us

Marsden Fund Te Pūtea Rangahau a Marsden
Royal Society Te Apārangi

11 Turnbull Street
Wellington 6011
PO Box 598
Wellington 6140
New Zealand

+64 4 470 5799
marsden@royalsociety.org.nz
royalsociety.org.nz

Ngā tūhonohono | Connect with us

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