CHANGE THE WORLD

UC
UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

2017 RESEARCH REPORT | KIMIHIA TE MEA NGARO

Produced by Research & Innovation, and Student Services
and Communications, University of Canterbury

Design by Student Services and Communications,
University of Canterbury

Writers: Aleisha Blake, Fiona Clayton, Sneha Johari, Kim Newth, Kirsten Wick

Photos by Duncan Shaw-Brown (unless otherwise credited)

Publication printed by Caxton

April 2017
ISSN 1176-8193

Key: when you see this symbol, read to find out the real world application of this research – how this work will improve society.

Nāia te whakamiha atu ki a koutou katoa mai i Te Whare Wānanga o Waitaha. E rongonui ana a UC mō āna rangahau e puta nei i tēnei whare wānanga. Ahakoa he iti, he iti matā, ā, ka kitea te hiranga me te kounga i ēnei kōwhiringa rangahau a UC, hei whakaaturanga hoki o ngā mahi a Te Whare Wānanga o Waitaha i te tau 2017. Ko te aronga o tēnei kohinga pūrongo, ko te mahi ngātahi me ngā hononga ā-rangahau i waenga i ngā tāura me ō rātou pouārahi.

Greetings to you all from the University of Canterbury (UC). UC is well known for its research reputation. Although this is only a small selection, the excellence and quality of UC's research can be seen through these research stories from our activities during the 2017 year with an emphasis on the work of our postgraduate students and the support and collaboration they have with their supervisors.

Doctoral student Rabia Ijaz

Fourth-year doctoral student Rabia Ijaz has interviewed representatives from over 30 small-to-medium enterprises in the Greater Christchurch area, about their experiences following the Canterbury earthquakes.

Her work looks at how business models may change following a wide-scale disaster or disruptive event. Read more on page 43.

Research Report 2017 Theme: This report highlights the contribution UC's doctoral students make to research excellence, and how UC's world-class learning environment contributes to their success.

Research & Innovation

Connecting UC's research with the world

The role of Research & Innovation is to provide services that facilitate and support all stages of research and innovation at the University of Canterbury, from initial funding of the research through to commercialisation of the outcomes, where appropriate. Research & Innovation is the first point of contact for external organisations that are interested in: discussions on how UC resources might help their organisation; assistance in accessing UC expertise and facilities; consulting services and contract research; opportunities to use or commercialise UC's intellectual property and assistance in identifying business or investment opportunities. Please contact us if you are interested in engaging with UC.

Phone: +64 3 364 2688

Email: enquiries@research.canterbury.ac.nz

www.canterbury.ac.nz/research

UC Research Profile

A showcase of UC research

UC Research Profile is a searchable website that showcases UC's research. You can search it for information about individual researchers, the projects they are working on, the research groups they belong to, the specialist equipment that they use, and their affiliations. UC Research Profile provides a comprehensive view of research at UC.

https://researchprofile.canterbury.ac.nz/

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Contents

UC Research 2017

This year's report highlights the contribution UC's doctoral students make to research excellence.

It is again a great honour, as Deputy Vice-Chancellor | Tumu Tuarua, to write the foreword to the University of Canterbury | Te Whare Wānanga o Waitaha Research Report | Kimihia te mea ngaro 2017. The report continues to highlight the evolution of UC's research portfolio, demonstrating our world-ranked research with the hallmarks of excellence and intellectual leadership, but also demonstrating relevance through direct societal benefit for both Aotearoa New Zealand and within international arenas.

UC understands the long-term significance and benefit of nurturing and mentoring doctoral students, the new generation of "thought leaders", so they can make a difference in the future in their chosen field. An invaluable focus of many modern universities is the connection between teaching and research, which in turn generates new knowledge and innovation. This symbiotic relationship is most clearly seen with our doctoral students, who are by definition undertaking original research with the generation of new ideas and insights, but are doing so with the support and supervision of established academics. Accordingly, this report is themed around UC's doctoral students who are undertaking a wide range of research across our colleges of Arts, Business and Law, Education, Health and Human Development, Engineering, and Science. UC takes great pride in having had more than 1000 Doctoral

students enrolled in every academic year since 2013, with a balanced inflow of new students and successful doctoral completions. Doctoral students are the most discerning student cohort, wanting to study at UC and work alongside our academics who are international research leaders in their respective fields, and where the university remains a well-recognised international research destination.

We know also that the vast majority of our doctoral graduates, use their research expertise in private business, central and local government policy development, social and community enterprises, private and government research institutes, and sector interest groups amongst other entities, contributing widely across large swathes of our society. The stories in this report highlight a representative selection of our doctoral students across the five colleges that not only describes their specific research topics, but their personal stories of what motivates them, the challenges they have had to overcome whilst doing their research, and their aspirations for the future.

Various metrics underline our continued research success. In 2017, total external research income competitively awarded was $63.2 million, which included $28.8 million of PBRF income. Our success in the Marsden and Endeavour research funds in 2017 underlines our proven ability to conceive and deliver ground-breaking research.

Our University Council has again recognised excellence and innovation in 2017. Distinguished Professor Geoff Chase, Mechanical Engineering, was awarded the University of Canterbury Research Medal for his outstanding contributions to healthcare through engineering, particularly around the clinical application of model-based therapeutics, improved clinical practice of glycaemic control in neonatal care, and novel, early, low-cost diagnosis of diagnosing Type Two diabetes. These clinical advances have either become standard protocols for care, or are in clinical trials nationally and internationally. Associate Professor Ekant Veer was awarded the University of Canterbury Teaching Medal for his innovative teaching in marketing, with a very strong emphasis of applying theoretical knowledge to real-world problems where students create marketing solutions for companies. To complete the suite, Dr Laurie McLay, School of Health Sciences, won the Early and Emerging Career Researcher Award for her research on the efficacy of behavioural interventions for children and young people with autism spectrum disorder, with particular emphasis on sleep disturbance. Elsewhere, UC researchers continue to be recognised through national and international peer recognition for contributions to their research fields including Royal Society Te Apārangi fellowships, Royal Society Te Apārangi medal winner, James Cook Fellowship, Rutherford Discovery fellowships, and numerous discipline and professional body awards.

This was also a pivotal year in the ongoing transformation of UC's teaching and research infrastructure. The Engineering Precinct has been completed and commissioned, and the Engineering Core welcomed its first students at the start of 2017. Four extensive laboratory wings were also fully refurbished as part of this project. The University re-established a presence in the central city with the relocation of UC's Music and Classics programmes, along with the James Logie Memorial Collection of classical antiquities to the Arts Centre's restored Chemistry building. These significant investments enhance UC's commitment to research through its own academic staff, international visiting researchers, and Doctoral students.

Tēnā koutou katoa.

Professor Ian Wright
Deputy Vice-Chancellor | Te Tumu Tuarua

Miracle material a potential lifesaver

While undertaking a doctorate is never a solo experience, some research projects have a particular need for a multidisciplinary, collaborative approach. This is the case in a study looking into antimicrobial ceramic coatings.

Professor Susan Krumdieck from the College of Engineering | Te Rāngai Pūkaha is leading a multi-disciplinary group of various academics, doctoral students and master's students from Biological Sciences (including microbiology), Chemistry and Mechanical Engineering.

Professor Krumdieck says that, according to the Centers for Disease Control and Prevention (CDC), hospital-acquired infections in the United States of America cause more deaths than auto-accidents, breast cancer and AIDS put together.

"There is a huge problem of people getting sicker in the hospital than when they went in due to infections which aren't in their normal biome. Part of the reason is that the ecosystem of microbes in the hospital is building up resistance to antibacterials, antibiotics and cleaning agents. So we are looking at creating a surface that doesn't allow bacteria to live there for very long – not because it is getting poisoned, so it doesn't trigger resistance, but because it is a hostile environment.

"The photocatalytic ceramic, titanium dioxide, is the best candidate coating material. Under UV light it produces radical oxygen species – a chemically reactive chemical species containing oxygen, which is why it is used on self-cleaning glass. The challenge is to employ novel nanoengineering to enhance the performance in indoor light."

Professor Krumdieck currently has two doctoral students working on this project, Rukmini (Minni) Gorthy and Johann Land.

"Minni and Johann have complementary roles and are quite unique in the way they work together. One is working on how to make the materials and the other one is working on why the materials work," she says.

> 'Being able to engineer the environment to cut down cross-contamination is an amazing capability'

A novel process

The research team is using a novel chemical vapour deposition (CVD) process that allows the researchers to produce light-capturing and highly efficient nanostructures inside the solid coating material.

"The unique process uses pulses of vapour, which generates new crystal structures but also reduces cost and complexity of the coating process."

"With the right process controls, we can expose different crystal facets inside the material but we don't have to make nanoparticles. It is a solid, robust coating, so the material itself is doing the job – killing the bacteria in invisible light.

"Because of the way we make the material, we can slip some carbon into the structure, which lets it absorb visible light. The carbon acts like a light-catcher, feeding the photons into the TiO2."

Professor Krumdieck says how the coating is made is also a big breakthrough.

"I had the idea to do the coating process differently, to be able to coat things like a door handle, so Johann is working on the engineering of that process – to fine-tune the material and optimise the process for manufacturing. This will provide us with the competitive advantage as well as the route to market.

"We are working with industries to develop a whole range of products that hospitals can use to help reduce transmission. Being able to engineer the environment to cut down cross-contamination is an amazing capability."

Johann says he was drawn to the opportunity to spend three years working on a process he could go commercial with and where he could be part of the entrepreneurial group building the company.

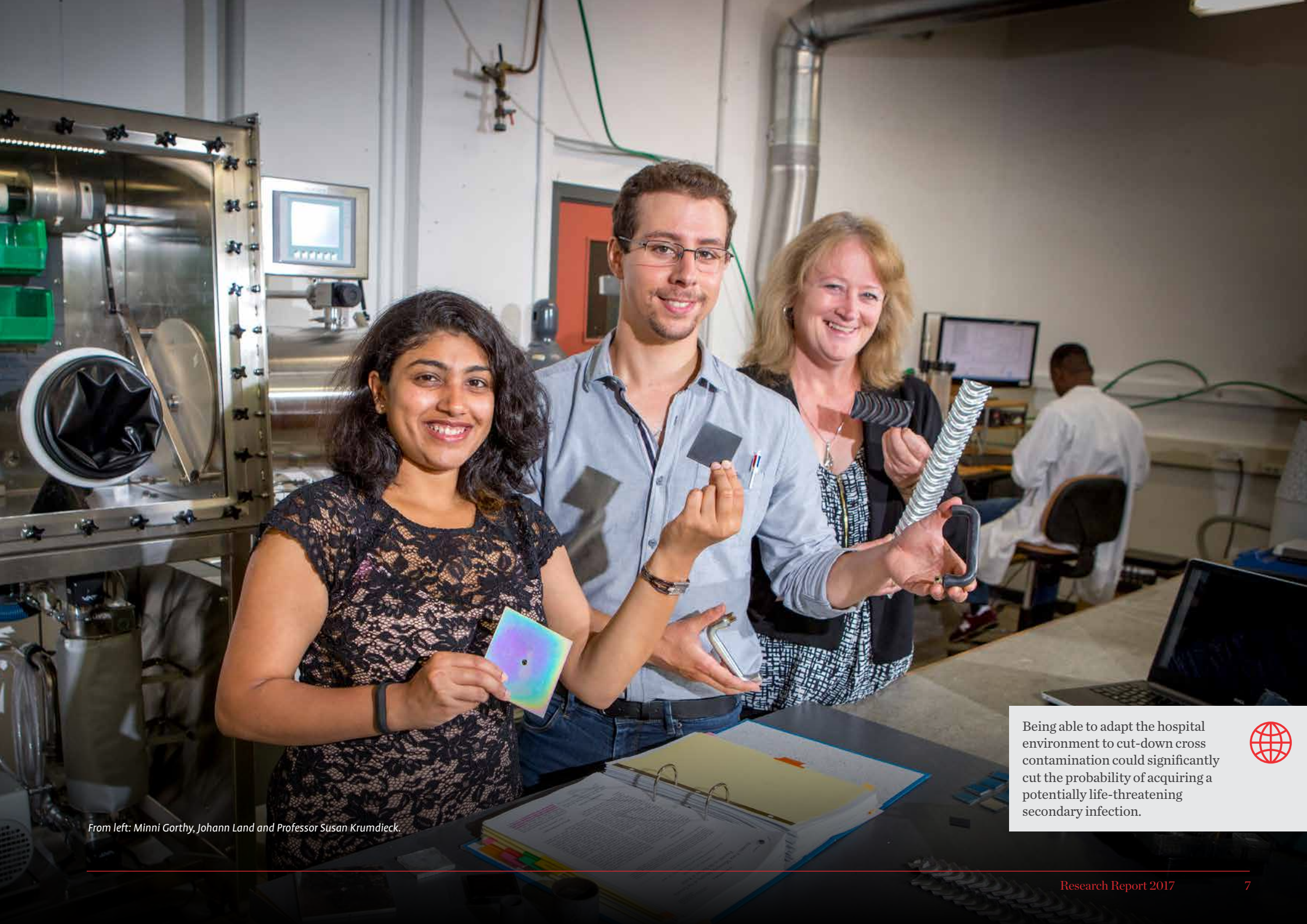
"I want to be able to bridge the gap between research and industry."

"The challenge is that we need to be able to make this material not just on a bigger, industrial scale, but also in a way that we can completely control the process to ensure quality and consistency. It's exciting to be working on something big, which could be such a breakthrough industrially."

What caught Minni's interest was the opportunity to deal with a material that is hard to characterise. Advancing her ambition to eventually work in a forensic laboratory or museum, this project gives her that technical characterisation background.

"Being a very curious person, I have always wanted to work in an area that would require exploration as the main research tool. I cannot imagine anything better than a doctorate in a field that combines the most innovative aspects of mechanical engineering with materials science," she says.

Along with Dr Sarah Masters from Chemistry, Professor Krumdieck and Dr Catherine Bishop from Mechanical Engineering are funding the research through a Ministry of Business, Innovation and Employment (MBIE) | Hīkina Whakatutuki grant. For the lifetime of the project, Professor Krumdieck has received MBIE Endeavour Research Programme funding, a Marsden Fund grant, FRST funding, a subcontract by Lincoln Agritech, and support from Koti Technologies and Powerhouse Ventures.



From left: Minni Gorthy, Johann Land and Professor Susan Krumdieck.

Being able to adapt the hospital environment to cut-down cross contamination could significantly cut the probability of acquiring a potentially life-threatening secondary infection.

This project will challenge assumptions around disability and ground social advocacy in rigorous research to encourage community inclusion of wheelchair users in the long term following a natural disaster.

Dr Johnny Bourke (left) and Professor Phillip Schluter.

Evidence-based advocacy for people with disabilities

A desire to challenge assumptions around disability and ground social advocacy in rigorous research led Dr Johnny Bourke to his doctoral research. It focuses on the community inclusion of wheelchair users in the long term following a natural disaster.

His thesis *Community inclusion of wheelchair users during the long-term recovery phase following the 2010/2011 Canterbury earthquakes*, stands out from other research in the field due to his focus on the longer term and also his methodology.

Dr Bourke says other studies have looked at disability and disaster recovery after a disaster, but usually only focusing on the weeks or months following.

"Even internationally, there hasn't been any longer-term research, so Christchurch post-earthquake was a perfect opportunity to extend the literature in the field and also see how one section of our society was recovering. My research focuses specifically on the community inclusion experience of people in the first four years after the Canterbury earthquakes who use wheelchairs."

Dr Bourke utilised the novel mixed methods approach, drawing on his strengths along with those of his primary supervisor, Professor Philip Schluter from UC's College of Education, Health and Human Development | Te Rāngai Ako me te Hauora, and supervisory team Associate Professor Jean Hay-Smith and Dr Deborah Snell, both from the University of Otago.

"The mixed methods approach came from my main research question, but also our respective research experience. My background was in qualitative research, but Philip taught me about the merits of quantitative research and how the two methods can build on each other and strengthen the rigorous process of research for the better.

After beginning with a qualitative approach to hear what the issues were, Dr Bourke was then able to quantify those data using descriptive epidemiology. The research also included another first for disability research: adapting respondent-driven sampling.

> 'This research provides a massive opportunity to realise some policies around disability rights and human rights.'

In the first phase, 13 people who used wheelchairs were asked about their experience with the community and community inclusion in the years after the earthquakes and how that compared with the previous years. From this, five themes emerged: earthquakes had magnified barriers; negotiating barriers exhausted people; social connections were really important; the recovery was an opportunity found; the recovery was also an opportunity lost.

These themes were then used to create a survey of 64 wheelchair users living in Waitaha Canterbury. Dr Bourke, who identifies as Ngāi Tahu, says he took care to try to include a diverse group of people as part of his quantitative data.

"I took community domains such as access to footpaths, shops, public places, carparks and asked people to rate their difficulty in accessing those places at three different time points – six months prior to the September 2010 earthquake, six months after, and then in 2015. What was really interesting was that it was least difficult prior, most difficult after, and then it dropped – but not as far as the base-line. So not only had the level of difficulty not gone back to normal, it had not improved."

Findings – a fundamental shift

"One of the key findings was that disaster recovery for people living with disability at a wider level needs to move from the individual vulnerability model to how society as a whole can make the life of people with physical impairment easier, improving social structures.

"Another finding was that we need to co-produce outcomes, to create a partnership between people living with a disability and decision-makers so they know what is required from a user perspective."

Professor Schluter says Dr Bourke's research has significant international ramifications, for a number of reasons.

"People with disabilities are a marginalised group. We also have a growing ageing population, who have accessibility issues and our infrastructure hasn't been geared to this. In addition, we are having higher rates of geographical disasters, and while there is a big interest in recovery directly after a disaster, Johnny is also one of the first people to take a long-term research approach. This research provides a massive opportunity to realise some policies around disability rights and human rights."

> 'We are having higher rates of geographical disasters, and while there is a big interest in recovery directly after a disaster, Johnny is also one of the first people to take a long-term research approach.'

Dr Bourke's focus on evidence-based advocacy has led his to his current role as Deputy Director at the Burwood Academy of Independent Living (BAIL).

"A big part of my research was making sure that it actually has an impact, disseminating it to the right people. I have based my research on the transformative paradigm – that my research has real world outcomes and promotes social action."

Dr Bourke received doctoral scholarships from both BAIL and UC for his research.

Impiety in Egypt

Exploring what it means to be a Muslim in the context of contemporary Egypt is a key theme driving the UC doctoral research of Egyptian scholar Wael Alsoukkary. While social and state pressures encourage piety, Wael suggests the reality of everyday life is messier and more complex than the sanctioned ideal associated with being 'a good Muslim'. His study into impiety is revealing a reality that is deeply heterogeneous.

It doesn't take a lot to break the state-sanctioned mould of being a good citizen in modern Egypt. Wael found this to be true, to his cost, after becoming involved with the Egyptian heavy metal music scene by performing with his band and organising metal events. In 2007 the Egyptian State Security police detained him and questioned him about these activities.

"Turbulent and complex" are the words Wael uses to describe what it is like to live in a society that, on the one hand, encourages conformity to pious ideals yet, on the other, gives rise to much more messy realities on the streets of its capital, Cairo.

Before starting his doctorate at UC's College of Arts | Te Rāngai Toi Tangata in May 2017, Wael completed a master's degree at the American University in Cairo and wrote a thesis on atheism as a social experience in Egypt. This laid the groundwork for his current doctoral research to examine not just atheism in Egypt but also homosexuality, capitalist consumerism, the heavy metal scene and other everyday ways in which people both deviate from, and conform to, Islamic notions of moral goodness.

It would have been difficult for Wael and his family to have stayed in Egypt while undertaking research of this nature, which is why he elected to study outside his own country. He chose UC because of the support and interest he received from day one, starting with his initial contact with Associate Professor Lyndon Fraser at UC's Department of Sociology and Anthropology.

"He has a background in teaching music and was really curious about the Egyptian metal scene. We started conversing and that's really how it all began. New Zealand was already an attractive option to me because of the support it offers international students."

Wael's primary supervisor is UC social anthropologist Dr Piers Locke, whose principal research interest lies in human–animal interactions. While Wael's research falls outside that area, Dr Locke says he is excited to be assisting on this ground-breaking project and is impressed by Wael's credentials and commitment.

> 'Wael's project is really about a society that is grappling with being in some ways secular but also religious. This is very difficult research with very demanding ethical implications.'

"This is the first time I've been involved in supervising a student whose experiences have brought them into proximity with security services and where their safety and wellbeing has been put in jeopardy," says Dr Locke.

Demanding ethical implications

"I'm interested in what it means to be religious in a secular society and Wael's project is really about a society that is grappling with being in some ways secular but also religious. This is very difficult research with very demanding ethical implications."

Part of Wael's research to date has focused on homosexuality, involving interviews with informants.

"What struck me about this is how difficult it is for homosexuals in Egypt to even talk to a researcher in private. The stories they tell are truly heart-breaking, such as people being completely disowned by their families," Dr Locke says.

Going mainstream

Dr Locke is encouraging Wael to look at developing some of his material for publication in mainstream media.

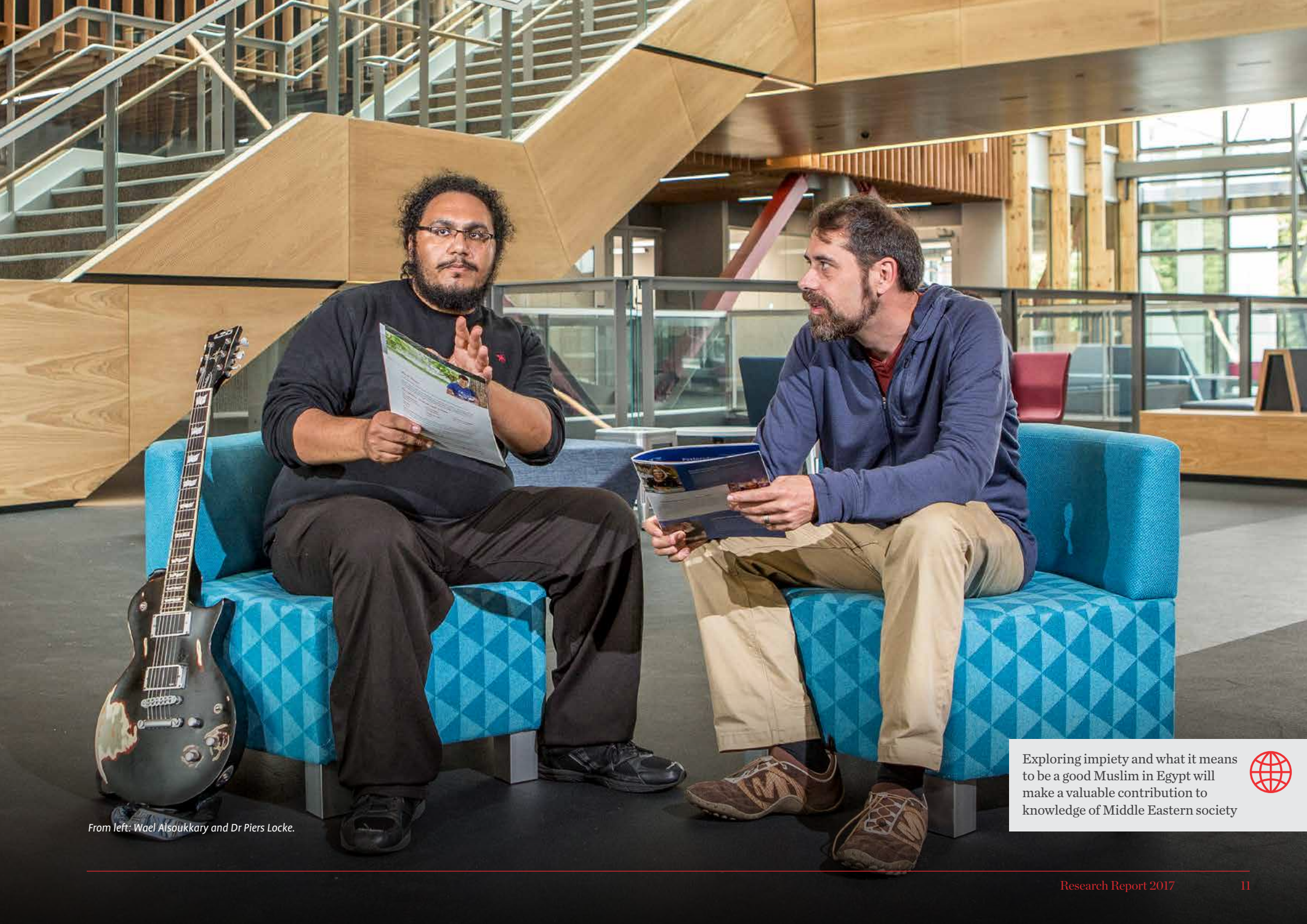
"This topic is so significant and so important that it needs to get out to a broader audience. As a supervisor, I am confident that Wael is going to make a valuable contribution to knowledge of Middle Eastern society."

By studying how everyday reality deviates from traditional pious practices and understandings of Islam, Wael hopes to show there are many sides to being Muslim. Ultimately, his research could help lay the groundwork for a more inclusive future for Egypt. His research also challenges Western caricatures of what it is to be a Muslim by demonstrating the messy and contested realities of Muslim identity in a modern Islamic society.

"Being Muslim is not just one thing – there are so many ways to be a Muslim and to be a citizen," Wael says.

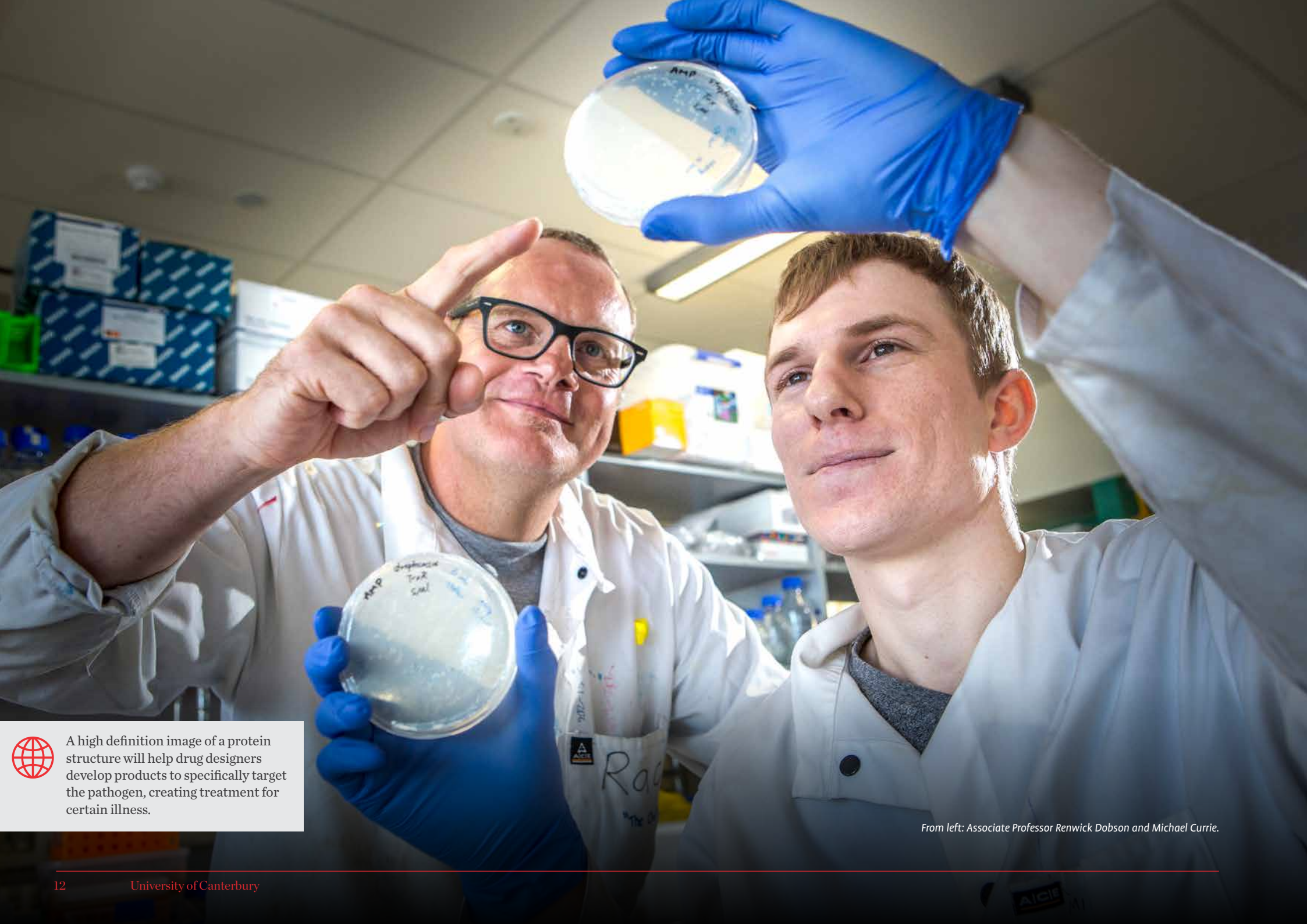
In the meantime, UC is providing academic freedom and a place where he and his family feel safe and supported.

"I have peace of mind and this means I can work better. To me, Christchurch is such a clean, friendly place – it's great."



From left: Wael Alsoukkary and Dr Piers Locke.

Exploring impiety and what it means to be a good Muslim in Egypt will make a valuable contribution to knowledge of Middle Eastern society



A high definition image of a protein structure will help drug designers develop products to specifically target the pathogen, creating treatment for certain illness.

From left: Associate Professor Renwick Dobson and Michael Currie.

Analysing proteins for better drug design

A high definition image of a protein structure will help drug designers develop products to specifically target pathogens, creating treatments for certain illnesses.

College of Science | Te Rāngai Pūtaiao doctoral student Michael Currie's research is focused on membrane proteins. These proteins, in the outside membrane of a cell, convey messages to the inside of the cell, transport food and resources into the cell, and excrete what is not needed.

Unlike the many proteins that function in the watery environment within a cell, membrane proteins perform their duties when embedded within the fatty membrane that separates all cells from their environment. Due to this, the proteins can become unstable, changing state and shape when they are isolated for analysis. This means they are understudied, despite up to 70% of today's drugs acting on these types of proteins.

Michael is working with membrane proteins that bacteria use to import sialic acid, a sugar humans make that is often taken advantage of by pathogens.

"Pathogenic bacteria scavenge sialic acid and use the membrane proteins to bring them into their cell," Michael says.

"They do this for energy, or they coat themselves in the human-derived sialic acids to cloak themselves from the human immune system, which sees these acids as 'self'. The ability to scavenge sialic acids during infections provides an advantage over other non-pathogenic bacteria to colonise easier and persist.

"The problem I'm trying to overcome is how to purify the membrane proteins that bacteria use, which requires the development of new methods."

Currently, Michael is developing ways to suspend the membrane proteins within nanodiscs in preparation for structure analysis.

"Nanodiscs are comprised of a small patch of phospholipids encircled by a belt made of protein. Phospholipids are a main component of cell membranes, that act as a barrier between cells and the environment. Nanodiscs are made by adding phospholipids and belt protein together in specific ratios.

"Ideally we want a high resolution image of the protein structure to see what it looks like so drug designers can start designing specific molecules that block its function."

Michael is supervised by UC's School of Biological Sciences | Te Kura Pūtaiao Associate Professor Renwick Dobson, who is also Co-Director of the Biomolecular Interaction Centre. Associate Professor Dobson received Marsden funding to undertake this research.

"Once these proteins are understood, we can design and develop molecules that inhibit their function and stop bacterial growth and persistence. This is of great importance in pathogens such as MRSA where the efficacy of antibiotics is severely reduced," Associate Professor Dobson says.

'Once these proteins are understood, we can design and develop molecules that inhibit their function and stop bacterial growth and persistence. This is of great importance in pathogens such as MRSA where the efficacy of antibiotics is severely reduced.'

Michael is the only one in the research group using nanodiscs to study membrane proteins, a relatively new idea. Nanodiscs make the protein more stable than the commonly used detergent technique that can interfere with instrument readings during analysis, says Michael.

"A nanodisc reflects a more naturally occurring environment for membrane proteins. The belt of protein used to ring the nanodisc binds lipids and within that we can suspend a membrane protein for analysis.

"The discs are about 10 billionths of a metre across and can only be studied under the most powerful electron microscopes."

Associate Professor Dobson also agrees nanodisc technology offers a significant advantage over other techniques.

"Nanodisc technology is relatively new in the structural biology field but presents advantages over using other techniques. We are very excited to use and develop this new technology to uncover the molecular basis by which these molecular machines work."

Collaboration with other academics and universities is vital to this project given the equipment needed to analyse the proteins.

"The research labs at UC have a great range of equipment that enable us to understand our proteins of interest. The Biomolecular Interaction Centre has strong relationships with Australian researchers and facilities that enable us to access specialised and highly desired equipment," Associate Professor Dobson says.

Michael is the recipient of the 2018 Roper Scholarship for study towards a doctorate in the College of Science | Te Rāngai Pūtaiao. The scholarship is offered to the first-ranked candidate of the College.

Biodiversity – Māori perspectives and practice

Māori customary approaches to managing biodiversity are essential to sustainable environmental management, says second-year doctoral student in the College of Business and Law | Te Rāngai Umanga me te Ture Corinne Bataille.

She also notes that it is crucial that the attitudes and beliefs of various interest group members are understood so that iwi can be responsive to them. Her research on attitudes and beliefs towards Māori management of biodiversity is based on case studies around waterfowl, waterways and wetlands in Te Wai Pounamu the South Island of New Zealand, including Te Waihora Lake Ellesmere near Ōtautahi Christchurch.

Te Waihora is considered by many to be an ecologically and culturally important site and the largest lake in Waitaha Canterbury. Originally named Te Kete Ika o Rākaihautū The Food Basket of Rākaihautū, the area is considered to be a major tribal resource and taonga by Ngāi Tahu.

The project is supported by Te Rūnanga o Ngāi Tahu and is part of a larger research programme under the umbrella of the Biological Heritage National Science Challenge, hosted by Landcare Research | Manaaki Whenua.

Over time, biodiversity in Aotearoa New Zealand has been significantly threatened by various factors, such as land use and pollution. The study is focusing on wetlands because of their importance to Māori for mahinga kai — customary harvest — and because these significant ecosystems have been dramatically reduced through drainage following European settlement in Aotearoa New Zealand.

Corinne's research employs a socio-cognitive approach to investigating what Māori and stakeholder attitudes, beliefs and values are and what factors might influence them. She is also considering what enables Māori management of biodiversity, and what barriers exist.

A major aspect of the research is to follow Kaupapa Māori Research principles, which assume early and ongoing consultation with, and guidance from iwi.

"I am immensely grateful for the guidance I am receiving from Te Rūnanga o Ngāi Tahu."

Corinne also received support from UC to start learning te reo Māori to facilitate her work with Māori participants.

"I love te reo Māori and see it as a crucial vehicle of transmission of Māori culture."

Already holding a Masters in Applied Psychology, she specialises in intergroup relations.

"It's very important to understand people's attitudes and beliefs so we can understand their decision-making process and it will help iwi to be responsive to various viewpoints. It also helps to identify common ground and ways of working together to reverse the decline of biodiversity."

In addition to advancing theory on attitude processes, the research could inform policy so that iwi-based practices for managing habitats may be facilitated, she says. Her case study is specifically with Māori, but beyond the context of Aotearoa New Zealand, she says it could be used to inform policy in countries with indigenous cultures.

> 'It's very important to understand people's attitudes and beliefs so we can understand their decision-making process and it will help iwi to be responsive to various viewpoints'

Primary supervisor Dr Sanna Malinen says considering multiple stakeholder perspectives in a bicultural context is a novel aspect of Corinne's research.

"Her work will inform iwi of these multiple viewpoints, including areas of common concerns and goals. Corinne is finding, for example, that there is willingness to work together, regardless of group membership, towards conservation goals, and that the concern over the wellbeing of Te Waihora is ubiquitous."

Connection and meaning

A range of interest groups that associate with and/or interact with waterfowl, waterways and wetlands are being interviewed using a semi-structured interview format. The over 40 participants include tangata whenua from various Ngāi Tahu papatipu rūnanga, stakeholders including members of Crown entities, and land owners or users.

She asks what issues they might encounter in managing waterways or waterfowl, or what people think might help facilitate Māori approaches and practices.

Past literature and interview findings will be used to build a theoretical model of potential influences on attitudes towards Māori management of biodiversity.

Having already worked with her primary supervisor as a research assistant, she says working with her again was a natural progression.

"Dr Sanna Malinen has done extensive work in psychology around exploring people's attitudes, and is supported by Dr Phil Lyver from Manaaki Whenua Landcare Research, who brings experience working in the ecological science and indigenous knowledge space."

Principal Advisor Mahinga Kai at Te Rūnanga o Ngāi Tahu Nigel Scott, facilitates the Ngāi Tahu Advisory Committee (NTAC) which was created specifically to provide advice and guidance to the research team. NTAC was created specifically to provide advice and guidance to the research team.

"It's great to work in such a multi-disciplinary team. Both my supervisors and Te Rūnanga o Ngāi Tahu are hugely supportive," says Corinne.

Corinne Bataille at Te Waihora Lake Ellesmere.

Māori customary approaches to managing biodiversity are essential to sustainable environmental management.

This research will help inform Nigeria's montane forest managers on how best to manage rats, in turn aiding passive restoration and sustainable management of the forests.

Biplang Yadok (holding camera) and field assistants setting up camera traps in Ngel Nyaki forest, Nigeria. Photo: Biplang Yadok

Rats to the rescue in Africa's montane forests

Through the Nigerian Montane Forest Project, the School of Biological Sciences | Te Kura Pūtaiao Koiora is promoting African montane forest conservation and fostering related postgraduate research.

Having grown up in Nigeria as the child of a forest botanist, evolutionary ecologist Associate Professor Hazel Chapman has long had a fascination with the plants and animals of Nigeria's montane forests, but has also seen the biodiversity of these forests shrink alarmingly over the past 30 years.

Following a survey of Nigeria's montane forests in 2001, Associate Professor Chapman decided to take action. With the help of the local Nigerian community and funding support from Chester Zoo, the World Wildlife Fund (WWF) and Nexen Nigeria, a field station was built on the edge of Ngel Nyaki Forest Reserve in Nigeria's Taraba State. This marked the start of UC's ongoing relationship with the reserve and the founding of the Nigerian Montane Forest Project (NMFP).

The goal has been to combine scientific research with field education in order to promote sustainable management of Nigeria's montane forests. Since 2005, 23 postgraduate students from Nigeria and Aotearoa New Zealand have graduated. The project is also linked into the international research community through the Smithsonian Institute.

Even though Aotearoa New Zealand is a long way from Nigeria, UC doctoral student and Nigerian ecologist Biplang Yadok did not hesitate about taking the opportunity to pursue doctoral study at UC under the supervision of NMFP founder Associate Professor Chapman. Previously, he had studied at Nigeria's A.P. Leventis Ornithological Research Institute and had met Associate Professor Chapman before getting involved with NMFP's conservation work.

"It has provided me with a unique opportunity to study ecology in my home country, and at the same time have access to key researchers at UC and Landcare Research,"says Biplang.

The role of rodents

Since commencing his doctorate in February 2015, Biplang has focused on exploring the potential of rodents to act as secondary seed dispersers. This is of critical importance to forests such as Ngel Nyaki, where elephants are now locally extinct and very few chimpanzees remain. These animals dispersed the large seeds of several tree species, by eating their fruit. Research conducted by a former doctoral student, Babale Aliyu, identified a large rodent – the African giant pouched rat (*Cricetomys* sp. nov.) – as a potential substitute seed disperser.

In the Neotropical realm – South America, Central America, and the Caribbean – where most megafauna went extinct about 10,000 years ago, it is already established that rodents effectively disperse large seeds through scatter hoarding.

Biplang used a variety of methods to study the ecology of *Cricetomys* and how it may serve as an agent for montane forest conservation. Interestingly, some techniques used to measure rat density were developed in Aotearoa New Zealand and Australia and are new to Afrotropical research.

His results are significant, showing that this African rat is very much a forest dweller and the seed predation/dispersal ratio is unaffected by season, seed size or seed species. The one factor driving seed fate is nutrient content.

"Of note is that the species with the highest fat content is *Carapa oreophila*, adapted for dispersal by now locally extinct elephants," says Biplang.

While much remains to be learned about Cricetomys, Biplang hopes his research will help inform forest managers on how best to manage these rats so that they aid passive forest restoration.

Along with Associate Professor Chapman, Biplang's supervisory team includes pest specialist Dr Roger Pech of Landcare Research Lincoln | Manaaki Whenua, Dr Daniel Gerhard of UC's Department of Mathematics and Statistics, and French natural historian Professor Pierre-Michel, an international expert on scatter-hoarding rodents.

Global awareness

Biplang says studying at UC has been a remarkable experience.

Biplang hopes his research will help inform forest managers on how best to manage these rats so that they aid passive forest restoration.

"The close relationship between postgraduate students and academic staff here is not something I could have experienced in Nigeria and I am now connected to many scientists here and around the world. Most importantly, my stay here has exposed me to research interests that have barely been investigated in Nigeria and Africa."

Associate Professor Chapman says Biplang's work is a major contribution to understanding not only *Cricetomys*' role as a substitute seed disperser but also to the overall ecology of this rodent. The research also places him at the forefront of conservation and biodiversity research in Nigeria as well.

Funding for the research came from a variety of sources including Nigerian philanthropist T.Y. Danjuma, Chester Zoo, the A.G. Leventis Foundation, Idea Wild, the Rufford Small Grants Foundation and the Animal Behaviour Society.

Exploring the taller build potential of timber

Aotearoa New Zealand's earthquake record, combined with climate change, is fuelling interest in innovative, sustainable and cost-competitive building solutions. The emergence of engineered wood products has opened the way for using timber as a key construction material in mid-to high-rise buildings. UC doctoral student Justin Brown is investigating timber's performance potential.

While working as a timber structural engineer in Vancouver, Canada, Justin became aware that much of the latest research on seismic design and timber structures was being generated from UC's College of Engineering | Te Rāngai Pūkaha. He realised there would be no better place to go than UC to study for a doctorate in his specialist field.

"I got in touch with Dr Minghao Li about what opportunities there might be and started my doctorate here at UC in September 2017."

His broad research objective is to investigate the system behaviour of all-timber solutions for taller buildings. In particular, he will be evaluating the performance of timber core-wall systems that could be used to form lift shafts or staircases. The results could help improve and guide future core-wall design for tall timber buildings.

Justin says global interest in timber buildings has resurged because of their sustainability appeal. Increasingly, the trend is also towards building taller, larger timber structures. For example, in August 2017 Sir Bob Jones announced plans to build the world's tallest wooden office building in central Te Whanganui a Tara Wellington. In February 2018 New York-based developer Lotus Equity Group announced it would be building the largest mass timber office structure in the United States.

"In my own country, there are a lot of new timber buildings going up," says Justin.

Timber transformed

Timber has been transformed in recent years into a more robust, seismically resistant construction material as engineered wood products such as cross-laminated timber (CLT) and laminated-veneer lumber (LVL) have emerged and as knowledge of energy dissipation through connection detailing has grown.

"Right now we're seeing a lot of hybrid steel-timber buildings that often still rely on steel or concrete cores to resist seismic forces. I'm exploring whether that part of the building could also be replaced with timber and to what height this is practicable and economical."

He says that, compared with traditionally constructed mid-to high-rise buildings, all-timber solutions have a much lower environmental impact. In his view, fine-tuning guidelines for practising engineers is an important step towards building momentum on all-timber construction.

The emergence of engineered wood products has opened the way for timber to be used as a key construction material in mid-to high-rise buildings.

Since starting his doctorate, Justin has been working closely with Dr Li from Civil and Natural Resources Engineering. He says his supervisor's foresight and guidance have been invaluable in helping set the research direction and goals.

"Minghao is very compassionate and available. I felt a sense of mutual respect from him straight away. It has been great to have someone to talk to who values my ideas."

Other members of the supervisory team are seismic engineering specialists Professor Alessandro Palermo and Professor Stefano Pampanin, of UC's Department of Civil and Natural Resources Engineering, and Dr Francesco Sarti, a structural engineering industry consultant with expertise in timber structures.

The first phase of Justin's research involves small-scale testing around how timber core walls are connected. Testing of components will be conducted at UC's world-class Structural Engineering Laboratory.

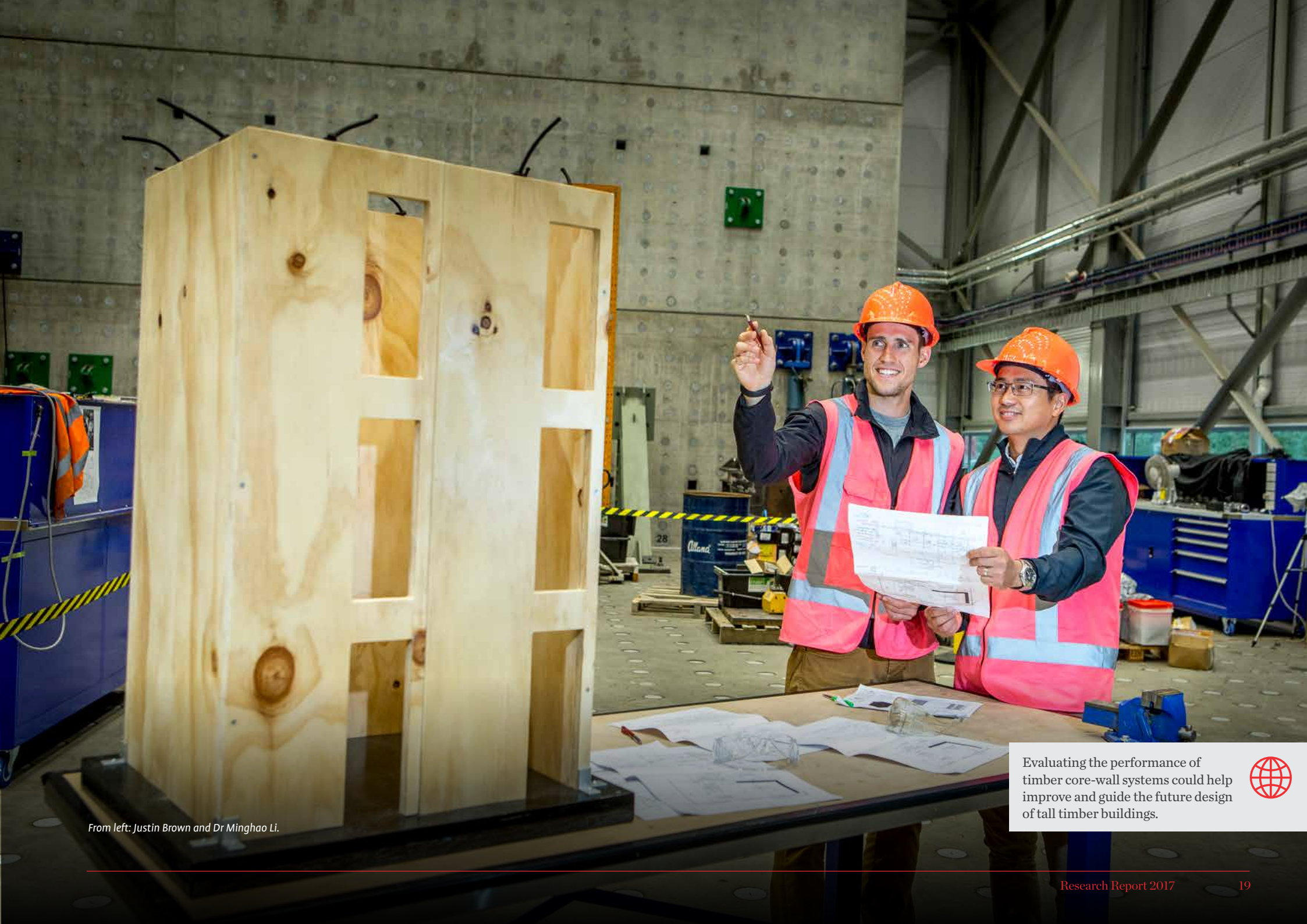
"I'll be looking at what happens when these walls are connected in certain ways and how they perform. At the end of 2018, I hope to do a large-scale test of CLT core-wall systems."

Dr Li says Justin has been proactive about communicating with staff, lab technicians, industry specialists and material suppliers to get his project started. For example, he recently arranged to go to Nelson to visit XLam, which manufactures CLT building panels for the Australasian market.

Justin has funding from the New Zealand Commonwealth Scholarship Fellowship Plan. The experimental work is being part-funded by the Australian Research Council via the Future Timber Hub, an interdisciplinary partnership committed to the future development of tall timber buildings in the Pacific region, of which UC is a partner.

"In Australia, their expertise lies in fire performance and other areas but they don't have the same level of expertise in earthquake design, so they are interested in the research we're doing at UC. We also hope to come up with some low-damage design solutions to resolve seismic issues for tall timber buildings," Dr Li says.

From an earthquake resilience perspective alone, the potential benefits of Justin's research are considerable. Internationally, UC is at the forefront of earthquake engineering research, with good research funding available to attract motivated, capable students.



From left: Justin Brown and Dr Minghao Li.

Evaluating the performance of timber core-wall systems could help improve and guide the future design of tall timber buildings.

Research on narratives and understandings of tangata whenua towards nature, the environment and non-human species will help push for positive social change.

Kirsty Dunn is using using whakapapa as the main frameworkfor her research. Photo: Sam White

Māori writing through a Māori lens

A childhood passion for storytelling and a personal ambition to learn te reo Māori have been the catalysts for College of Arts | Te Rāngai Toi Tangata doctoral student Kirsty Dunn's research into the different representations of animals in Māori fiction and poetry written in English.

The touchstone of her project titled *Ka Piki Te Pepetuna: The Pūriri Moth Rises – Representing and reimagining animals in Māori fiction* is the pepetuna or pūriri moth, which features in the creative part of her work and is a symbol for the project itself, says Kirsty.

"The main goal of my research is to look at Māori writing through a Māori lens. I'm using whakapapa as my main framework, talking about human and animal relationships, and representations of animals through this lens.

"It's really important to me that my research looks at our writing through our unique way of looking at the world as quite often things are written about us from an outsider's perspective.

"For me, this is an interesting way of thinking about our connections with animals and questioning the Western binary between human and non-human and the hierarchical relationships that eventuate because of that."

In particular, Kirsty says she is interested in literature about taniwha, well-known in Māori storytelling.

"Taniwha are really powerful de-colonial animals because they are very uniquely Māori and have been used to signify challenges or moments of great change, which is a particularly potent line of enquiry for me."

For this research project, Kirsty has concentrated on Māori literature written in English.

"I am limited to texts written in English as I am not fluent in te reo Māori. However it is my aim in the future to extend my analysis to be able to both read and write in te reo Māori, which is a parallel journey for me while doing my Doctorate."

It is also important to Kirsty to look at literature that hasn't been exhaustively analysed yet, going through anthologies of Māori writing, as well as works by well-known authors such as Patricia Grace.

"I think Māori writing, in both te reo and English, should be published more, read more, and studied more. It is my hope that my research will go some way towards pushing for change in those areas."

Another key part of Kirsty's research is to present an alternative way of thinking about animals.

"Indigenous perspectives on human and animal relationships in a lot of ways challenge Western ideas about animals as objects. This adds to a growing conversation around climate change and animal cruelty. I really want to add to the work of other indigenous scholars in this regard."

Making it personal

Kirsty says her research is purposely not objective; instead part of her project is to state who she is and where she is from, as well as how that has influenced her research.

"A lot of it is personal, talking about where I am from, listening to animal stories my whole life."

Kirsty, (Te Aupōuri,Te Rarawa) spent her childhood in Tāmaki-makau-rau Auckland and her high school years in Southland. She first studied at the University of Otago and graduated with a Bachelor of Laws in 2007. In 2015 she graduated from UC with a Master of Arts before embarking on her doctorate in English, receiving a three-year Ngata Centenary Doctoral Scholarship.

What makes UC special to Kirsty is her supervisory team of Associate Professor Annie Potts and Professor Philip Armstrong, from the School of Cultural Studies, and Senior Lecturer Garrick Cooper from Aotahi School of Māori and Indigenous Studies.

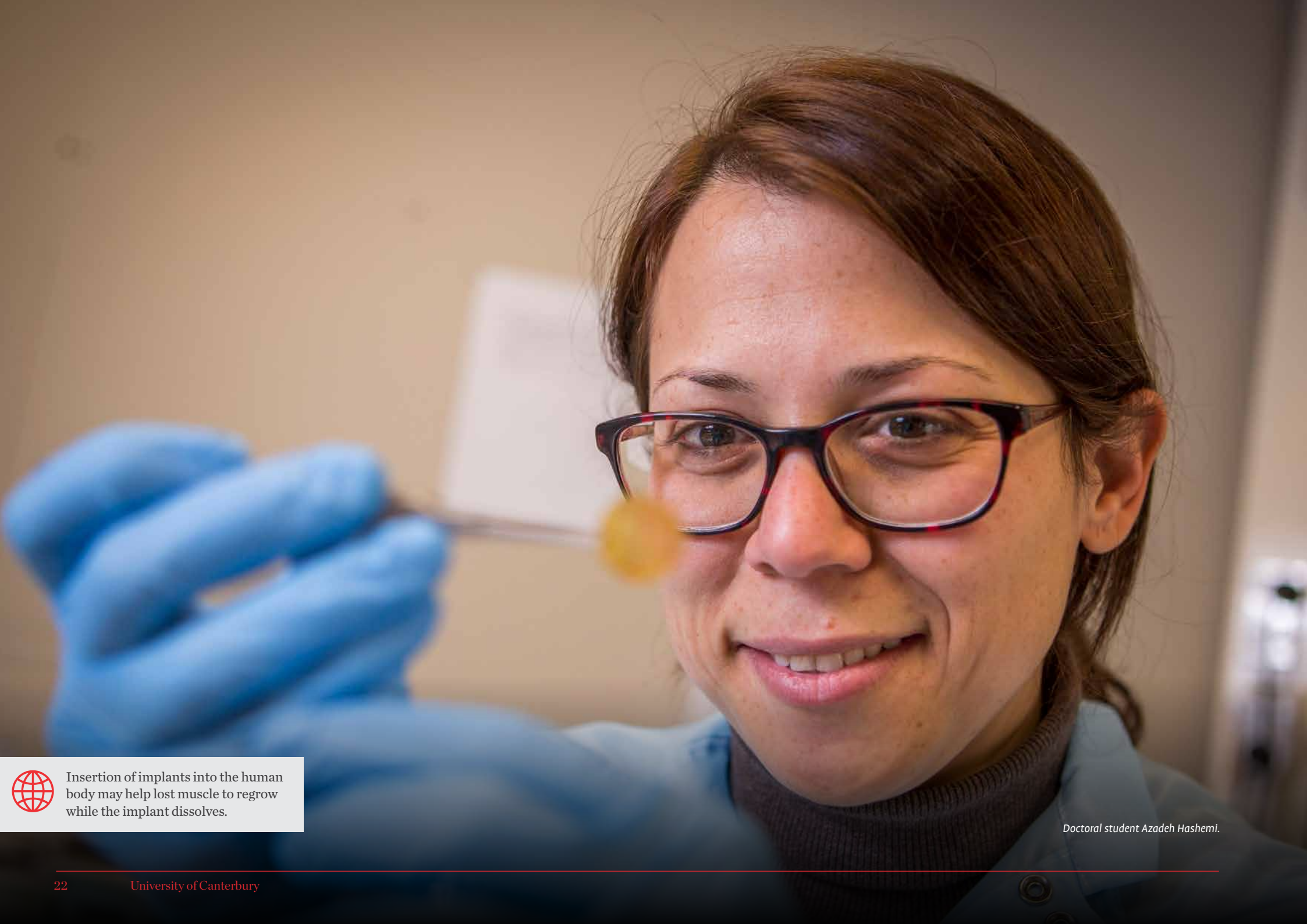
"I chose to study here because of the people. I feel so fortunate to have Annie, Philip and Garrick as my supervisors. The Māori Student Development Team also been a great source of support throughout my time at UC."

> 'Māori writing, in both te reo and English, should be published more, read more, and studied more.'

Associate Professor Potts says Kirsty's research is the first study of its kind.

"Kirsty is the ideal person to undertake this mahi as she is dedicated to tikanga Māori in her every day and academic life, and also to kaupapa Māori research ethics guiding the development and process of her project. In addition, she's one of our top scholars in Human-Animal Studies.

"It's really exciting that she's focusing on narratives and understandings of tangata whenua towards nature, the environment and non-human species, and using Māori literature as a medium to explore these issues. Kirsty is committed to writing in a way that is accessible and engaging, so her doctoral research will be of interest well beyond an academic audience, and it will be especially relevant for Māori."



Insertion of implants into the human body may help lost muscle to regrow while the implant dissolves.

Doctoral student Azadeh Hashemi.

Regrowing muscle tissue from 3D replicas of live cells

Doctoral student Azadeh Hashemi from UC's College of Engineering | Te Rāngai Pūkaha is working toward her ultimate goal of helping to replicate cells and regrow lost muscle tissue.

Originally from the Iranian capital of Tehran, Azadeh came to Aotearoa New Zealand four years ago to pursue a doctorate in Electrical and Computer Engineering. Having studied applied physics and plasma engineering in her bachelor's and master's degrees respectively, Azadeh began looking for research-based projects. She came across an interesting project by Dr Volker Nock, a senior lecturer in the Department of Electrical and Computer Engineering, whose interests included surface modification with a biological application.

Dr Nock had previously worked with Professor Maan Alkaisi and a former doctoral student, Dr Lynn Murray, to apply a technique originally utilised in an imaging tool to its current use in biomimetic cell culture substrates, which could have tissue engineering applications. Getting in touch with Dr Azam Ali from the University of Otago, who worked on demonstrating micro and nanopatterning of protein based materials, Dr Nock was intrigued by the possibility of combining bioimprinting with the protein material. This is where Azadeh's project started.

While her master's project had involved surface modification on aluminium using plasma, for her doctorate, Azadeh focused on creating a 3D imprint or replica of live cells onto films made of casein, a milk protein. Working with UC's Biomolecular Interaction Centre, she developed the processes of replicating a cell's features or bioimprints on casein films with high resolution in order to cross-link the films to make them biocompatible and allow her to put cells on them.

> 'I've loved every second of the research environment; I would never change it for the world.'

"According to some studies, cells cultured on surfaces which have cell like features behave differently," says Azadeh.

"We created these cells in the hope that we could guide the way the cells grow. Since the films – the substrate – were made of protein, they were biodegradable and would degrade after a certain amount of time, so we'd be left with just the grown tissue. If we can create cells to turn into muscle cells or skin, for example, after the substrate degraded, we'd be left with a layer of skin, so we can regrow tissues or different types of cells."

Azadeh says she has met challenges during her doctorate.

"You learn how to work independently. I had to learn a lot of biology and cell culture because I previously worked on engineering in bioengineering. But it was a huge achievement when I managed to put cells on the films," she says.

Challenges and opportunities

"I've loved every second of the research environment; I would never change it for the world. I've had wonderful supervisors, the team have been great, the people in the lab have been very helpful and I've loved being hands-on.

"My favourite part is how I've come out from the other end of the doctorate, how I deal with problems and how I think, and how I do things and overcome problems. I love who I am today and that's from what has happened in the last four years through the doctoral process."

Dr Volker Nock says that the approachability of UC's world-leading academics and their willingness to collaborate across disciplines, rather than having a protective attitude to original ideas, are an advantage. He adds that his role is to guide a person's development from being a student to an independent researcher and that, to make this transition, the student needs to discover outstanding questions and how they fit into the overall picture of scientific knowledge.

Perception of smoking in an educated population

Research into the perceptions of cigarette and e-cigarette smoking in New Zealand university students will be used to inform debate and policy makers.

While studying his Master's in Public Health in Manchester, Dr Ben Wamamili found out about New Zealand's Smokefree Aotearoa 2025 goal. His curiosity piqued, he is now studying towards his Doctorate at UC under the College of Education, Health and Human Development | Te Rāngai Ako me te Hauora.

Dr Wamamili, studying under the primary supervision of Dr Mark Wallace-Bell, is researching the perception and prevalence of smoking in university students in New Zealand and Australia, and aims to capture any changes following policy updates in Aotearoa New Zealand expected in 2019.

The proposed policy amendment will allow for the buying and selling of nicotine containing e-cigarette solutions in Aotearoa New Zealand, with the hope of encouraging current smokers to switch to using e-cigarettes, commonly referred to as vaping, with cessation as the ultimate goal.

"This research will be looking at the behavioural economics of vaping by gathering data on the impact of cost on vaping," says Dr Wallace-Bell.

To date, consistently increasing the tax on tobacco products to reduce prevalence has been one of the key strategies to meet the Smokefree Aotearoa 2025 goal. This method initially proved effective in reducing the smoking population, but has since plateaued.

Can vaping help smokers quit?

"It is indicated vaping can help people wanting to quit smoking because it offers the same habitual method in a simulated smoking experience," Dr Wamamili says.

"In the United Kingdom research is showing a reduction in cigarette smokers in favour of e-cigarettes, where consumers still get the desired nicotine without the harmful toxins and associated health implications of cigarettes."

Currently in Aotearoa New Zealand, a three-month supply of nicotine containing solution can be imported for personal use only. Following the policy change these solutions will be available for purchase under the same laws as other tobacco products.

"Even those people that vape on something that doesn't contain nicotine have a more pleasant feeling than using patches, gum or lozenges."

All eight New Zealand universities will participate in the study, and Dr Wamamili has been careful to accurately represent communities within the university population. Through working with students' associations and cultural groups he has been able to gain access to a sample reflective of the group.

The data will be collected primarily online through two surveys. The benchmark survey was conducted in March and April 2018, and asked questions relating to the smoking habits and experience of participants, their friend's habits and their perception of cigarettes and vaping, and knowledge of the Smokefree Aotearoa 2025 goal.

Through collaboration with four Australian universities, Dr Wamamili is also gathering data from students in Australia where there is no plan to change current policies on e-cigarettes.

Nine to twelve months following the policy change, the survey will be conducted again to gather data for comparison and reveal any changes in the prevalence and perception of smoking and e-cigarettes in university students.

Influencing policy

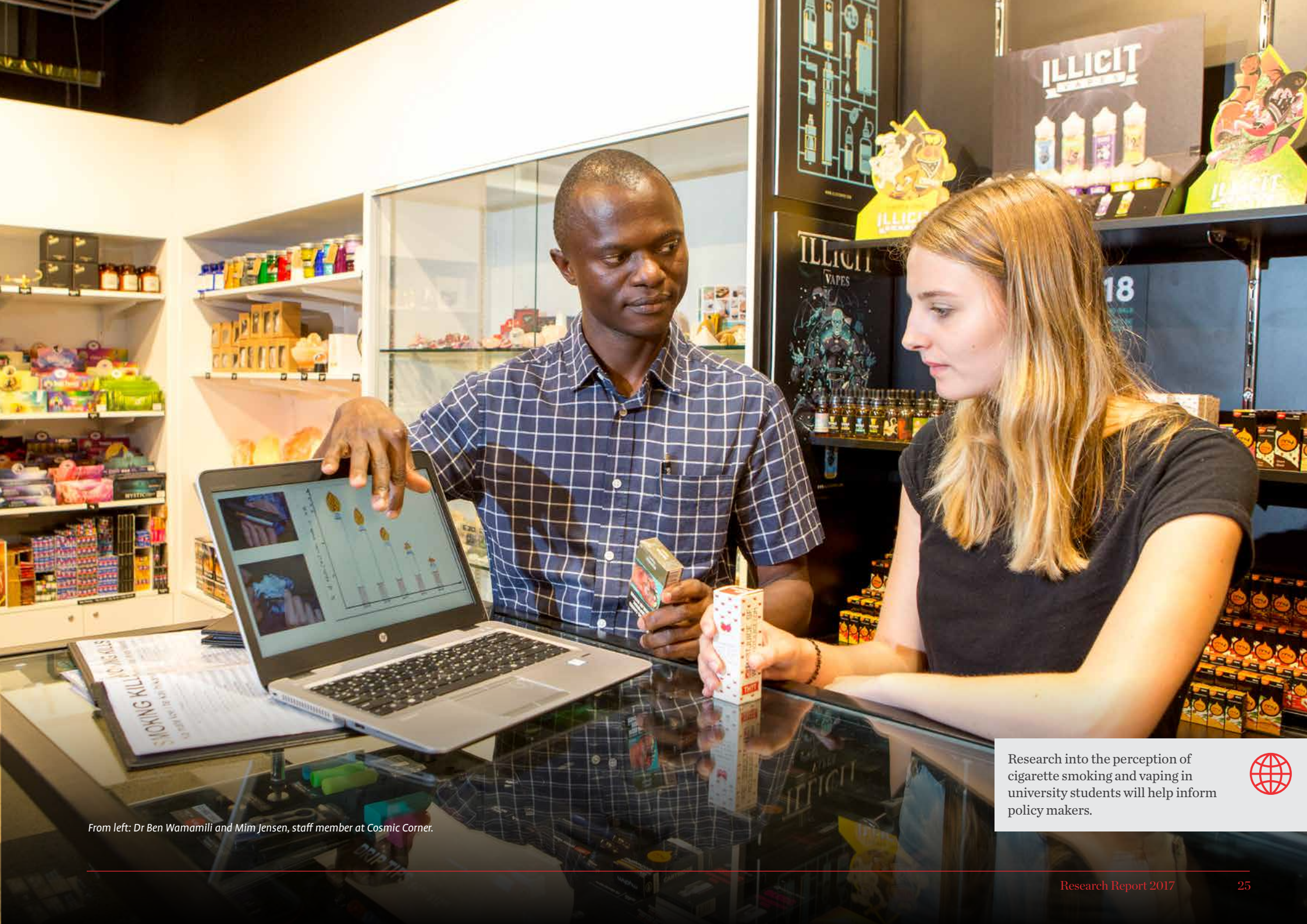
Dr Wamamili hopes his research comparing students in Aotearoa New Zealand and Australia will show the impact policy change can have on the population and will provide valuable insight and generate knowledge of vaping in an educated population – important to policy makers required to make evidence-based decisions.

"There is no data available on the use of vaping products in the university student population. The benefits of researching this population are mainly that they are a stable and accessible population," says Dr Wallace-Bell.

"UC, the greater New Zealand research community and Ben's supervisors are leaders in this kind of research. New Zealand is at a critical juncture with regards to smokefree policy and we have a real chance of achieving the 2025 goal."

'It is indicated vaping can help people wanting to quit smoking because it offers the same habitual method in a simulated smoking experience.'

The Smokefree 2025 goal was set in 2011 with the aim of reducing death and disease caused by smoking in New Zealand. The goal aims for less than 5% of the population smoking.



From left: Dr Ben Wamamili and Mim Jensen, staff member at Cosmic Corner.

Research into the perception of cigarette smoking and vaping in university students will help inform policy makers.

This research examines ways in which perspectives of iwi and hapū provide crucial perspectives and contributions to the historic record.

From left: Madi Williams and Associate Professor Te Maire Tau.

Cultural amnesia – the price of lost perspectives

Ignoring iwi and hapū perspectives in historical accounts of Aotearoa New Zealand risks cultural amnesia and the erosion or even destruction of identities.

Doctoral history student and recipient of a prestigious Canterbury Doctoral Scholarship and Ngāi Tahu Research Centre Doctoral scholarship, Madi Williams (Ngāti Kuia, Ngāti Koata, Ngāti Ngāti Apa ki te Rā Tō), is considering ways in which perspectives of iwi and hapū provide crucial perspectives and contributions to the historic record.

Her doctoral thesis, *Perceiving the Past: The Relevance of History in Aotearoa* critiques existing narratives and explores alternative views of history, particularly those of iwi and hapū.

A student in the College of Arts | Te Rāngai Toi Tangata, Madi considers her research to be laying a foundation for future change, including how history is taught in the education sector.

"There is a prevailing one people narrative where the past is seen as irrelevant, we are all just New Zealanders now, regardless of where we came from in the past.

"This current approach of promoting particular aspects of our past since 1840 has sought to erode any other historical experiences. Iwi and hapū experiences have been ignored and the 'Māori' story has been created and woven into the New Zealand story."

Her exploration of historical accounts over time include how early amateur historians in the 1800s focused on a narrative of exploration and settlement for Māori, prior to contact with Europeans. Likewise accounts of Gallipoli and a narrative around nationhood has perpetuated this sense of a singular sense of nationhood, she says.

A significant aspect of her research is the role of the Waitangi Tribunal | Te Rōpū Whakamana i te Tiriti o Waitangi.

She notes the importance of the huge body of research gathered for the Tribunal.

"The Tribunal is a really interesting entity. Its goal is to redress the wrongs of the past, which has sometimes been perceived as creating a progressive history of biculturalism. However, it has created a huge source of information that means alternative views of history within iwi and hapū can be explored.

In 2010 Ngāti Kuia and the Crown signed a Deed of Settlement. Madi will be conducting a number of interviews to hear their perspective on the process and what they feel is needed moving forward from the historical narratives of the iwi.

"We need to apply a different lens. How do you consider a sense of iwi history without considering whakapapa? Ideas of time and myth have immense value. Views of history by iwi and hapu don't have the same sense of time as a Western sense of linear or chronological history."

Madi's primary supervisor Associate Professor Rawiri Te Maire Tau, who is also director of Kā Waimaero | Ngāi Tahu Research Centre (NTRC), says Madi's research has the potential to connect New Zealanders to their ancestry, be it Māori, or European.

'There is a prevailing one people narrative where the past is seen as irrelevant; we are all just New Zealanders now. Iwi and hapū experiences have been ignored and the 'Māori' story has been created and woven into the New Zealand story.'

"The danger in New Zealand currently is that our identity flies too freely, like a kite in the wind. It needs to be grounded by string, or it floats away. This is what history can do for New Zealand, it can be the string to the kite."

Associate Professor Tau says all NTRC students are encouraged to get in touch with their iwi, hapū and whānau, as there is a lot to be learned from the older generations.

Madi says she has had a highly positive experience as a postgraduate student.

"There's such a good support system. Other postgraduate students provide a sense of community and I can call on academic expertise at any time."

She says that as well as being given a significant degree of academic freedom she has been given many opportunities to attend national and international conferences and to publish academic articles.

Associate Professor Tau says UC is unique for Māori students.

"UC offers unique world class opportunities to Ngāi Tahu and Māori students and those researching indigenous based topics. The Ngāi Tahu Research Centre is a world class indigenous research leader.

Students have the opportunity to attend the annually held First Nations' Futures Programme at Stanford University. It is an unrivalled opportunity for aspiring Ngāi Tahu leaders and other Māori postgraduate students to gain access to leading international research and thinking within a uniquely indigenous context.

"NTRC and UC have a range of Māori and indigenous scholarships available, and offer support and supervision from our top lecturers and researchers," Associate Professor Tau says.

Madi's key research questions are:

- How is the past perceived in Aotearoa New Zealand by Māori, by Pākehā, and by the nation?
- What is the role of the historical accounts from the Treaty Settlement process? How were they negotiated?
- How can we perceive the past to increase its relevance?

Planning for resilient communities

What can be learned from how suburban Ōtautahi Christchurch responded to the sequence of Canterbury earthquakes that began in September 2010? Dr Karen Banwell, who studied this question for her doctoral thesis, suggests 'the bumping and gathering places' of everyday life are profoundly important for building community resilience and socially connected neighbourhoods.

After the devastating earthquake of 22 February 2011, the city's informal networks sprang into action with neighbours helping neighbours and people reaching out for help within their own communities.

For social geographer Dr Banwell, who had worked on the city's Urban Development Strategy (UDS) before the earthquakes, studying the collective action of suburbs after the earthquakes has yielded some fascinating insights on what factors contribute to community resilience.

Informal bumping and gathering places

In her doctoral research with UC's Department of Geography, Dr Banwell explored how features of the built environment and social infrastructure fed into how people communicated with and helped others in post-earthquake Ōtautahi Christchurch. Informal bumping and gathering places, such as schools, small local shops and parks, proved invaluable for literally laying the groundwork for local interaction and community action. Well-defined geography also helped build social connections and a sense of place. Resourceful individuals and groups were another key factor that played into the resilience of particular suburbs.

"The earthquake experience revealed what was important for everyday and for when disaster strikes," says Dr Banwell.

She is now applying aspects of her research findings in her new role as a strategic planning advisor, focused on central city regeneration, with Regenerate Christchurch | Te Kōwatawata.

She describes 'bumping places' as the sorts of informal places where people meet by accident, not necessarily by design. It could be a neighbourhood park where people regularly walk their dogs, for example, or a local dairy. 'Gathering places' such as cafes are associated with more purposeful meetings. Some places, such as public libraries and schools, can serve as both bumping and gathering places.

"Most of the post-earthquake collective action was not coordinated formally but came out of a need to be with, talk with and help others. The bumping and gathering places of everyday life helped this to happen."

Re-connecting

Dr Banwell's research, which included case studies drawn from Ōtautahi Christchurch suburbs, found that suburbs with few such places tended to be less resourceful and less able to respond to disaster at a community level. On the other hand, socially connected, walkable neighbourhoods were much more robust.

> 'I think we have a moral and social obligation to think seriously about how we enable people to reconnect.'

Her research has direct implications for community planning.

"I think we have a moral and social obligation to think seriously about how we enable people to reconnect," she says.

Leading Dr Banwell's supervisory team was Professor Simon Kingham, of UC Geography, whom she had met through her UDS work. Her other supervisors were Associate Professor David Conradson and Dr Rita Dionisio, also from the Department of Geography.

"Simon was really important in helping me set up my project and in giving me the confidence to keep on track. We know each other well enough to be honest with each other. David was great on the technical side of it and for advice on the finer details, while Rita was also very experienced, enthusiastic and kind. I was very lucky to have all three as my supervisors."

The department's pastoral support network for doctoral students, led by Dr Kelly Dombroski and Dr Deirdre Hart, was also very helpful.

Professor Kingham says Dr Banwell's research focus on building more resilient communities is "incredibly important" and its core message has been shared via presentations both in Aotearoa New Zealand and internationally.

"Karen is now working at Regenerate Christchurch and taking the knowledge she gained while studying at UC and applying it in the workplace. It's a dream outcome," Professor Kingham says.

As a university, UC is strongly committed to community engagement. Professor Kingham says a number of UC Geography students are working closely with the Christchurch City Council and Regenerate Christchurch on community-related projects.

"We also find our graduates working in the community come back to work with students. Karen is currently involved with a project involving two of our students."

Dr Banwell says it would not have been possible to do her research at any other university, given her focus on communities and the post-earthquake experience.

"I feel very privileged to have met people who had been through so much and been a part of it, just as I had."

Dr Banwell's research was funded by the Ministry of Business, Innovation and Employment | Hīkina Whakatutuki, as part of the Resilient Urban Futures project.

From left: Professor Simon Kingham,and Dr Karen Banwell.

This research examines the importance of 'bumping and gathering places' in building community resilience and socially connected neighbourhoods.

Mischief managed – the roles and benefits of online trolling

Research looking at the behaviours of online trolls has revealed the many actors involved and a surprising number of benefits to trolling – and not just for the trolls.

When doctorate student Maja Golf-Papez left a marketing career in Slovenia to start her research into mischief-making consumer behaviours among online trolls, she didn't expect to be entertained or find benefits to trolling.

Her supervisor Associate Professor Ekant Veer says Maja's research explores a relatively underdeveloped consumer practice – online mischief making.

"We know little about what motivates online mischief makers, their drivers, and the community that surrounds them, supports them and encourages them in their practices."

A postgraduate student with the College of Business and Law | Te Rāngai Umanga me te Ture, Maja initially thought trolling and cyberbullying were very similar in nature. She has come to realise they describe two distinct types of behaviours that need to be differentiated.

"Trolling is when someone is deceptive and mischievous. A troll typically has no intent to cause harm but is trying to provoke a reaction. Whereas cyberbullying is targeted with the purpose of causing harm to an individual person."

In the pursuit of understanding trolling behaviour, she sought out trolls to interview. As she did so, she was trolled many times and found trolls had been removed or banned from pages before she got a chance to interact with them.

"Good trolls are elusive and, I find, highly intelligent characters. They know how to look after themselves and operate within but on the fringes of the law."

Once she tracked them down, Maja started her data collection by interviewing celebrity trolls. As with other groups in all areas of society, a certain level of celebrity has been attached to individuals in the trolling community. Some of these trolls have half a million followers, who are eager to see what they'll do next, encourage their behaviour, dress themselves as targets and 'reward' trolls in the online currency of likes, comments and reactions, both negative and positive.

From these interviews, five case studies were established highlighting different types of trolling behaviour across different channels.

As another part of her research, Maja interacted with some targets, bystanders and online moderators, and conducted more than 300 hours of online observation of trolling across different channels, including gaming platforms, forums, social media channels and news platforms. Currently writing up her findings, Maja has been surprised by the benefits of trolling she has found.

A number of trolls are gaining financial benefits from view rates and advertising space as well as conventional business transactions, she says.

"Some more risky brands are paying trolls to pose as customer service reps to respond to complaints and questions in a way the brand couldn't or wouldn't usually."

In a society constantly in need of entertainment, Maja's research considers whether trolling has become just another form of entertainment. While audience members find trolling amusing, some trolling acts cause problems for the targets, firms and online moderators.

Maja hopes her findings will help to differentiate the behaviours of trolls and cyberbullies, inform education around what, if anything, targets or online moderators should do in response to online trolls and ultimately inform policy makers when they are writing laws around online behaviour.

Associate Professor Veer says Maja's work has the potential to show not only that actor network theory can play a real role in understanding online phenomena like trolling, but also that trolling is a multifaceted practice that has both positives and negatives.

"Her work is already challenging the way trolls are defined and the way in which they are different from cyberbullies or other online negative behaviours.

"UC has provided a place and space for innovative, alternative and often risky research like this, which will mean our researchers will continue to achieve more than in a restrictive system."

Some finer details of this story have been changed to protect the interviewees.

Maja's research is challenging the way trolls are defined. The findings could be used to inform education and provide evidence for policy makers around online behaviour.

Photo: Maja Golf-Papez, left, with Associate Professor Ekant Veer.

Preventing ciguatera poisoning

When a student studying clams in the Cook Islands told Phoebe Argyle, now a third-year doctoral student at UC's College of Science | Te Rāngai Pūtaiao, that ciguatera was an important topic that few people were studying at the time, Phoebe's interest was piqued.

Ciguatera is a type of food poisoning that occurs when a person eats fish contaminated with ciguatoxins produced by microscopic algae. Its symptoms include nausea, vomiting, diarrhoea, headaches, muscle aches, numbness of the mouth and lips, and sometimes reversal of the cold and hot sensation. It is common in the Pacific Islands region and the Caribbean.

Phoebe's research work provides the first description of the toxic algae in Tonga, detailing which species are present and where. She hopes to find out what sort of habitats support *Gambierdiscus*, the microalgae group that produces the ciguatoxin – findings that, for example, the Ministry for Primary Industries | Manatū Ahu Matua could use to assess areas of higher-risk algal blooms. This research could also be applied to other Pacific countries, including Aotearoa New Zealand, where it has already been detected in Northland and will likely spread due to rising sea temperatures. Coastal fisheries could soon be at risk, she says.

To conduct her research, Phoebe collected microalgae samples in Tonga with assistants from Aotearoa New Zealand and Tonga. She also conducted habitat surveys using quadrats and water chemistry testing kits.

"The algae drift or swim and stick to artificial substrates made of fibreglass mesh that we keep in the ocean for 24 hours, weighted off the bottom, since the algae are benthic," she says.

Phoebe worked with Dr Tuikolongahau Halifihi, the chief executive of the Ministry of Fisheries in Tonga and a UC doctoral graduate, and fisheries officers to select her sites. Sites included sheltered seagrass and algae beds used for fishing, as well as exposed algae and coral dominant sites in order to assess a range of different habitat types and detect patterns in the growth of the microalgae.

She then picked individual cells and grew them to make clonal cultures for species identification.

"We need DNA techniques like qPCR and meta-barcoding to identify the microalgae because different species in the same genus look the same under a microscope, which is a big problem for ciguatera researchers. There are at least 15 algae species related to ciguatera which all have differences in toxicity and growth, so being able to detect them individually is essential to understand ciguatera and assess future risks."

Phoebe's ultimate goal is to be able to prevent ciguatera poisoning.

"This would be through a monitoring programme for toxic algal blooms and supporting research to develop fish testing kits which would test fish before consumption. However there is a long way to go at this stage. Continuing to develop molecular and chemical tools for toxic species and toxin detection is extremely important."

The UC Connect Doctoral Scholarship programme was a key driver behind Phoebe's decision to study at UC.

"UC has a great research environment, and the biology department is very supportive of postgraduate students. I have had a lot of opportunities to gain teaching experience, acquire my own funding for my second trip to Tonga through the MFAT [Ministry of Foreign Affairs and Trade] NZAid program Postgraduate Field Research Award. I have attended both national and international conferences, including going to Tahiti for the 2017 Indo Pacific Fish Conference to present my research, thanks to a Claude McCarthy Fellowship. These experiences have given me a lot of confidence as an independent researcher."

Phoebe's supervisor, Professor of Marine Biology Islay Marsden, from the School of Biological Science, says this research will have a direct impact on the lives of the local Tongan community who worked with Phoebe.

"By understanding how toxins work, we can understand how they are transferred through the food chain and help prevent poisoning in the future. The real world impact of this research is tangible at a grass roots level, as the local community has been closely involved with Phoebe's research, and she is keen to do more work with them in the future."

The UC Connect Doctoral Scholarship is co-sponsored by UC and the Cawthron Institute. Phoebe's research comes under the MBIE funded Safe NZ Seafood research programme.

A monitoring programme for toxic algal blooms and supporting research to develop fish testing methods could help to prevent ciguatera poisoning in the future.

Photo: Phoebe Argyle collected microalgae samples in Tonga.

English testing of immigrants – an opportunity lost?

Research into the relationship between language testing and competency in the workplace may help shift perceptions among employers and immigrants.

Having taught English for 30 years, doctoral student Linda Edwards has met many adult English language learners who have migrated to Aotearoa New Zealand. She has noticed how many professionals such as engineers, teachers and doctors struggle to find employment and integrate into society.

In Aotearoa New Zealand, people seeking to live and work in a wide variety of contexts – ranging from healthcare and education to the construction industry – are currently required to take the International English Language Testing System (IELTS) exam.

By viewing this requirement through a range of participants' lenses —of both native English speakers and non-native English speakers — Linda's research examines the realities of these groups as they seek immigration status in Aotearoa New Zealand.

High stakes to gain entry

In her study of those undertaking high-stakes language assessments to gain entry into Aotearoa New Zealand, Linda will investigate if the reasons for taking language assessments are changing. In doing so, she will compare the skills on which those assessments focus and the skills that are needed for a person to be viewed as competent in the workplace.

Linda considers the globally employed IELTS exam to be highly reliable.

"It is a standardised test, which presents the opportunity for fairness for those who are tested around the world.

"However, my research to date suggests that New Zealanders who are native speakers of English who take the test can't get the necessary scores required for employment. For immigrants taking the test, this may mean we're disregarding people who have a lot of talent."

Her methodology includes a new aspect – testing native English speakers using the IELTS. In the first phase of her research, she asked a range of native English speakers of different genders and ranging in age from 19–60 years to take the test.

Linda says a score of seven is needed for many professions. However, many of the native English speakers in her study only scored 6.5 on the listening and reading test, and in the writing test scores were as low as four and six, including results from a university lecturer and an IELTS teacher.

"What is expected from non-native speakers is arguably a lot higher than English speakers in society. Yet people in some jobs, such as those in the software industry, don't use complex sentences. Why are we asking non-English speakers to reach a band score that English native speakers can't reach?"

She notes that recently the Australian Linguistic Society wrote to the Australian Government pointing out that if the IELTS band score was set at six, seven million Australians would be excluded from employment in the country if they took the test.

> 'Do people who make decisions really know what is involved in language testing and that it tests for a highly proficient user of English?'

Decision makers – understanding the test

She says employers or government agencies who are decision makers, such as Immigration New Zealand, and professional bodies, such as the Nursing Council | Te Kaunihera Tapuhi o Aotearoa and the Education Council | Matatū Aotearoa, may not understand the difference between IELTS proficiency and English in everyday use.

"I need to find out from the decision makers what they think of or know about IELTS tests. Do they understand the definition of what it is to be proficient as it applies to the test and as it applies to the workplace? Do people who make decisions really know what is involved in language testing and that it tests for a highly proficient user of English?"

Her background reading suggests that decision makers set scores based on standards from overseas.

"They are, after all, not language experts. They don't know what is required to score highly," she says.

She is also hopeful that the test creators will provide more information about what the band score means for competence in society and the workplace.

In her preparation for doctoral study, Linda found an invaluable resource in the form of research hubs provided by the College of Education, Health and Human Development | Te Rāngai Ako me te Hauora. Through these research hubs, doctoral candidates can critically examine examples of doctoral theses. It gave her the opportunity to analyse and critique them and consider what approach would fit her personality.

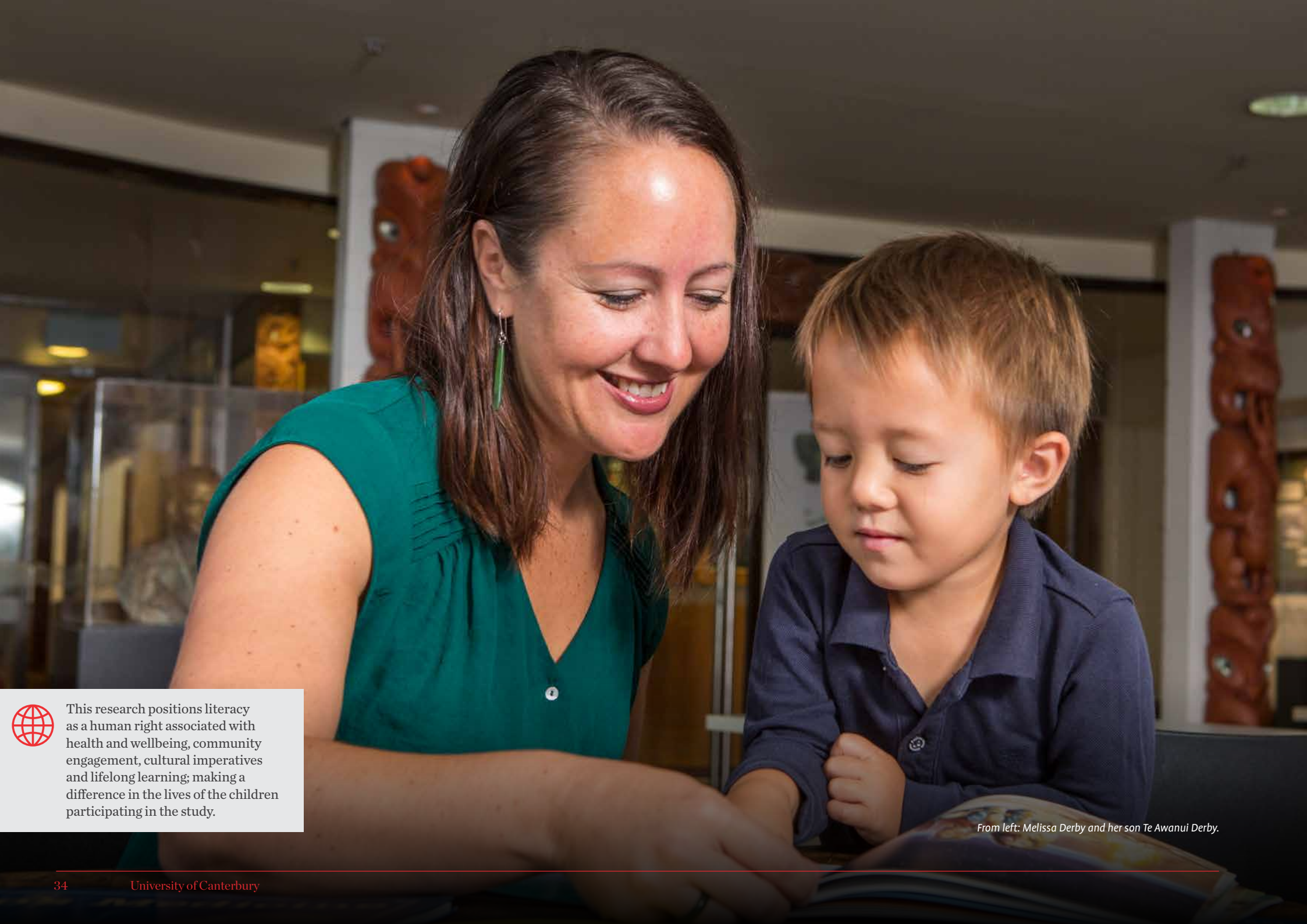
Primary supervisor, Associate Professor in Literacy Education Jo Fletcher says the College is a highly sought-after provider for doctoral supervisions, nationally and internationally.

"Within the College are internationally renowned leading academics in areas such as education, health, literacy, e-learning, educational policy, leadership, teacher education, Māori and Pasifika, and sports education.

"This wide range of expertise provides exciting opportunities for cutting-edge doctoral research supervision. Our large cohort of doctoral students is provided with mentoring, often through involvement in a variety of research hubs."

Linda Edwards wants to find out from decision makers who use IELTS tests what they think of or know about the tests.

Research into the relationships between language testing and competency in the workplace may help shift perceptions among employers and immigrants.



This research positions literacy as a human right associated with health and wellbeing, community engagement, cultural imperatives and lifelong learning; making a difference in the lives of the children participating in the study.

From left: Melissa Derby and her son Te Awanui Derby.

Restoring Māori literacy narratives in early childhood

Melissa Derby's lifelong passion for reading, coupled with her strong interest in Māori development and human rights, has culminated in her doctoral research.

As part of a National Science Challenge, A Better Start E Tipu e Rea, Melissa's work explores emerging literacy in bilingual (te reo Māori and English) preschool children.

Melissa has co-constructed a culturally-responsive literacy intervention grounded in Māori pedagogy and epistemology, which is designed to support phonological awareness (the ability to hear and decode sounds in words) and vocabulary knowledge. Both skills are widely recognised as key predictors of children's later success in reading and writing. She is trialling the intervention with participants in her study, and preliminary results are positive.

"We know what skills children need to be strong in before they learn to read so I am very happy to be employing a strengths-based approach in my study. I am working with preschool children to develop their skills so that they start primary school with the best possible chance of success in reading and writing."

Melissa has given her thesis the working title *Ko te kai a te rangatira he kōrero: Restoring Māori literacy narratives to create contemporary stories of success.*

"When the written word first arrived in Aotearoa, Māori were enthusiastic, exuberant and extremely successful in adopting this new skill," says Melissa.

"I am drawing on this narrative of success in order to offer an alternative to the deficit discourse that is so often used in relation to Māori education and achievement."

Cultivating self-determination

Melissa believes literacy plays a key role in cultivating self-determination for Māori.

"My thesis is also unfolding as a platform to promote global human rights and self-determination, particularly for Indigenous people. I argue that literacy is a human right that is key to accessing other human rights associated with health and wellbeing, community engagement, cultural imperatives and lifelong learning. Ultimately, it is my hope that my research makes a difference in the lives of the children who are participating in my study, and that they will find enjoyment in reading just like I did as a child."

> 'Literacy plays a key role in cultivating self-determination for Māori.'

A student at the College of Education, Health and Human Development | Te Rānga Ako me te Hauora, Melissa is working with supervisors Professor Gail Gillon, Associate Professor Sonja Macfarlane and Professor Angus Macfarlane.

She describes Professor Macfarlane as the biggest drawcard to UC, having long-admired his work in Māori communities and schools.

Professor Macfarlane , who received the UC Students' Association Supervisor of the Year award in 2017, says Melissa's research will be in high demand.

"At the end of the scholarship journey, this thesis will show mastery of the relevant information in its area, as well as the methodology adopted – and will be highly sought after," says Professor Macfarlane.

"It will be a reflection of a student who has the ability to interact with the theoretical positions that emerge from Māori and Western streams of knowledge, to engage with Treaty partners through the data-collection phases and, more importantly, to understand tamariki and whānau dispositions."

From Tauranga Moana, Melissa has strong associations with the Ngāi Tamarāwaho hapū of Ngāti Ranginui. She grew up in Ōtautahi Christchurch and completed her Master of Arts in Māori Development at Auckland University of Technology | Te Wānanga Aronui o Tāmaki Makau Rau, where she was awarded first-class honours and made the Dean's List for Exceptional Theses. She also completed a Graduate Certificate in Indigenous Studies at Columbia University in New York.

In 2017 Melissa was awarded UC's prestigious Brownlie Scholarship, which she says was a surprise and very humbling.

"For me to receive this top award is a huge honour. I am extremely grateful for UC's support."

Assessing injury risk through GPS

Working with Canterbury United Football Club and studying under the College of Education, Health and Human Development | Te Rāngai Ako me te Hauora, doctoral student Chris Bacon is seeking to validate injury risk and enhance optimal performance in individual players.

His work involves collecting internal and external data to build a picture of each individual player and establish when they are performing at their optimal workload and when they face an increased risk of incurring an injury.

Chris's supervisor, Dr Carl Petersen, understands the challenges of individually assessing an athlete.

"The problem has been that there is no easy measure of how much an athlete should train. Everyone responds differently so it is important to look at both internal and external measures of workload," he says.

Pocket-sized Global Positioning System (GPS) units provided by STATSport fit in the vests players wear and measure metrics such as total distance and high-speed running. Combined, these measures make up the external workload of each individual player.

Alongside these measures, an internal factor is established using the Borg Rate of Perceived Exertion (RPE) and a set of six wellness questions. The questions focus on sleep quantity and quality, stress level, muscle soreness, nutrition and level of fatigue. Each player answers the wellness questions at the start of each training and game. Chris then quantifies their RPE at the end of the session or game.

"Currently I have internal and external figures for each individual player and I am working on combining and validating this into a single figure that indicates a player's risk of injury or what they have left at optimal performance for the week," says Chris.

The Goldilocks zone

The aim is to keep each player working within what he calls the 'Goldilocks zone'.

"To adapt physically, you need to be at a nice, even level and balanced; too little and you're never pushing your body to adapt; too high and the body doesn't get the chance to rest and recover fully."

Over the course of a four-week period Chris establishes each player's 'Goldilocks zone' – or green zone – which indicates their optimal level of performance. Working 30-50% above this zone significantly increases the probability that a player will be injured. The zone will fluctuate based on changes in the player and ensures they are adapting physically while also getting the rest and recovery needed to reduce the probability of injury.

> 'Technology is always getting better and that's the exciting part – there are just so many areas for expansion.'

The data Chris is collecting is highly individualised, an aspect of athlete analysis that is still taking shape.

"Previous work in this area has not taken into account the different workloads of different players. My research individualises each player and allows for the different work load of a striker and goal keeper, for instance."

Chris aims to turn his research into a commercial product that is accessible to different areas of sport, incorporating elements of GPS, RPE and wellness data. As part of the UC Centre for Entrepreneurship (UCE) Summer Start Up programme this year, he started working on commercialising his research into an athlete monitoring platform called STATisfying Sport, and was awarded Best Pitch at the UCE EY Summer Startup Annual Showcase.

"The cost of an injury is huge, both financially and also in terms of winning competitions. Having software that enables workload to be more effectively tracked and monitored may help clubs keep a greater proportion of their athletes off the injury list," says Dr Petersen.

In the meantime, Chris is continuing to validate the data he is collecting and will work with his co-supervisor Dr Brett Smith, sport scientist for the Waikato Chiefs, during the 2018 Super Rugby season to continue to collect player data.

"UC is a great place to work with motivated athletes. Being a small country you can easily create key contacts high up within various sporting codes," says Dr Petersen.

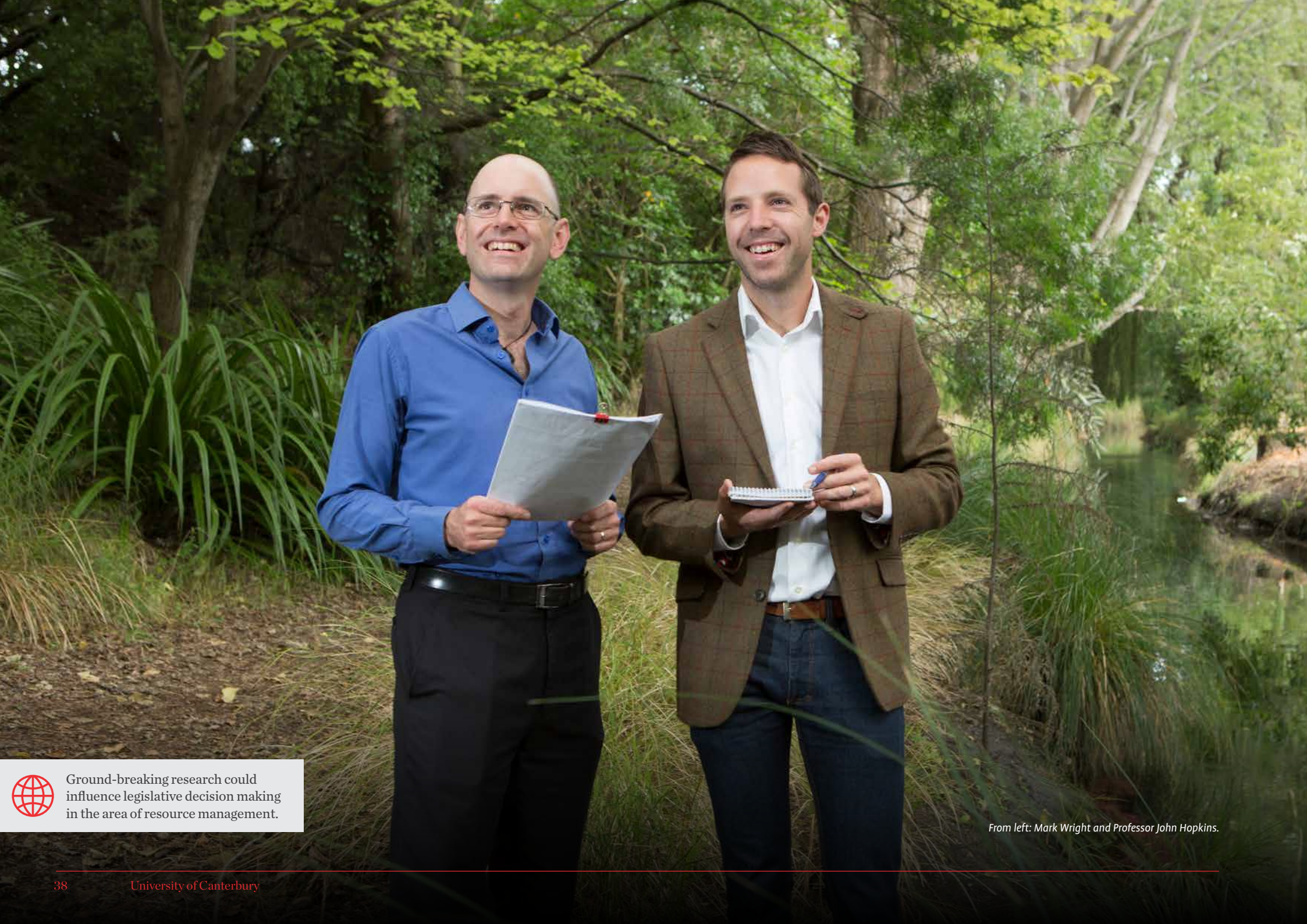
Chris speaks passionately about his research and what his ambitions are for the future.

"Technology is always getting better and that's the exciting part. GPS is still in its infancy and we don't fully understand its capability – there are just so many areas for expansion."

STATSports is a world-leader in player-tracking technology. The company provided $75,000 of tracking equipment to this study.

Chris Bacon monitors players wearing GPS units.

Research measuring the risk of sports injury will be made into a commercial product accessible to all athletes, reducing the burden of injury.



Ground-breaking research could influence legislative decision making in the area of resource management.

From left: Mark Wright and Professor John Hopkins.

Towards reform of the RMA's sanctioning regime

Enacted nearly 30 years ago, the Resource Management Act 1991 (RMA) continues to generate debate, yet one largely overlooked aspect is the legislation's reliance on criminal prosecution to deter people from breaking its rules.

College of Business and Law | Te Rāngai Umanga me te Ture doctoral student Mark Wright is critically reviewing the current sanctioning regime and exploring potential alternatives.

Whether it's assault, burglary or a breach of the RMA, it is deemed a criminal offence under Aotearoa New Zealand law. Yet the likelihood of being prosecuted for the latter is considerably less than for other crimes.

Mark says it is striking that the same system used to punish assailants is also used to punish people who have broken RMA rules. Equally, from experience, he knows the system can play out substantially differently in each instance of an RMA breach. He has worked both as a Crown prosecutor in Tāmaki-makau-rau Auckland and Rotorua and as a lawyer prosecuting environmental non-compliance cases in Tauranga.

"There is a difference between the law itself and how it works in practice. There are thousands of breaches of the RMA every year, yet under 100 prosecutions a year. In addition, every council has a different approach to prosecution.

"Criminal law can be a very effective deterrent as it can result in large fines and the offender being sent to prison, but it's also a very expensive and time-consuming tool. Some of the smaller councils would never consider taking a prosecution. What it leads to is a system where there are not many prosecutions being undertaken."

Using deterrence theory, Mark is exploring how well the current system is working to discourage breaches of the rules. If rates of prosecution are low, he suggests the deterrent effect is also likely to be diminished. As well, he plans to investigate the deeper question of whether it is even appropriate for RMA breaches to be called criminal offences.

"Should every breach potentially result in criminal proceedings? What is the best way to deal with people who breach RMA rules?"

He suggests the RMA's reliance on monetary penalties and the criminal law is now out of step with international regulatory approaches.

Part of Mark's doctoral research will involve looking at how other countries sanction breaches of environmental law and considering what alternatives may exist. He is also reviewing the history of the RMA and how its sanctioning regime evolved. The final step will be to look at options for possible sanctions reform.

This ground-breaking research could ultimately influence legislative decision making in this area.

Mark commenced his doctoral research at UC in December 2016, after successfully applying for a doctoral scholarship advertised by UC's School of Law | Te Kura Ture. He was also awarded a UC Doctoral Scholarship and a New Zealand Law Foundation Doctoral Scholarship.

"To have received these scholarships has been an amazing privilege. I grew up in Christchurch and think very highly of the University. I'm very thankful for the support of my co-supervisors, Professor John Hopkins and Professor Elizabeth Toomey."

'Should every breach potentially result in criminal proceedings? What is the best way to deal with people who breach RMA rules?'

Monthly meetings take place with his supervisors at UC's School of Law | Te Kura Ture. Professor Hopkins specialises in public law, while land law is one of Professor Toomey's particular fields of research.

"Our role is to keep students focused and to make sure what they are doing is rigorous and logical. When Mark came to us, he already had a really clear aim so we've just been giving guidance and encouragement and helping point him in the right direction. I think the ideas he will present will be really innovative," Professor Hopkins says.

As well as being able to draw on the expertise of his supervisors, Mark is grateful for UC's well-resourced law library facilities, including its many database collections.

"Everything I need is so accessible – everyone is really helpful."

Mark sees UC as the ideal place for him to complete his Doctorate as the next step towards achieving that goal.

"It's great to have supervisors who keep pushing me to ask the hard questions and pointing me towards the areas where I need to go."

The science of insect conservation

Invertebrates make up the vast majority of Aotearoa New Zealand's biodiversity, yet insects are often seen as "the awkward kid sister" of conservation, says doctoral student Jennifer Schori.

Jennifer is currently studying Brachaspis robustus – the 'robust grasshopper' – a nationally endangered species of grasshopper endemic to the Mackenzie Basin. Her research focuses specifically on translocation methods and monitoring of the threatened braided-river invertebrate.

In December 2017, Jennifer completed a key component of field work, attaching transmitters to 20 grasshoppers in two different locations. The transmitters emit a beep at a certain radio frequency every three seconds. Using an aerial and radio transceiver, Jennifer was then able to track the grasshoppers for between three and twelve days, depending on the battery life of each transmitter.

"The transmitters were attached to the pronotum – the hard bit of the exoskeleton behind the head – like a backpack," says Jennifer.

"This has provided us with information on their daily movements, and will allow us to determine what size area they will need for future translocations. It also means we can make estimates about the kind of area we should be implementing mammalian predator control over in order for it to be beneficial. Pairing this study with other parts of our research has meant we have learnt a lot about this species, including about its development and life cycle."

A passion for conservation led Jennifer to study for a degree in ecology, which led her to find out about the diversity and importance of insects.

"I have a real passion for conservation science and preserving the endemic species of Aotearoa New Zealand. Insect science in conservation is hugely under-represented – I once heard it referred to as the awkward kid sister of conservation – but insects play such an important role in our ecosystems."

Dr Murray, from the School of Forestry | Te Kura Ngahere, says that as an endangered species, the grasshopper is in critical need of conservation action.

"The robust grasshopper has the same threat classification as kea, two species of kiwi and the hoiho. It is more threatened than four other kiwi species, the hihi, whio and North Island kōkako. However, few people could name a threatened insect and little research has been conducted on how to manage this declining species or practically any other threatened insect.

"There are 779 insects listed as threatened or at risk in New Zealand and hundreds more we don't know enough about to rank. Focusing on them could allow us to save more species than ever before, while at the same time educating future generations on the value of insects both in natural ecosystems and for production land. This will have a significant impact on protecting New Zealand biodiversity."

The project has strong links to the issues around invasive predators in Aotearoa New Zealand so is of particular relevance given the national goal of Predator Free 2050, says Dr Murray. The robust grasshopper was also selected as a priority species in DOC's draft Threatened Species Strategy released in 2017.

Dr Murray's research group is gaining national and international interest, turning her lab into the place to go for insect conversation research.

"My relatively new research lab is focused on developing a robust scientific framework for insect conservation and is currently centred on how to effectively monitor small, cryptic and very rare insects, so we can then understand the impacts of any conservation management applied."

An opportunity to make a difference

Dr Murray says only a few individuals are working on insect conservation management nationally. This presents an opportunity to develop a niche research group at UC and attract doctoral students who have a desire to make a real difference at the forefront of conservation science.

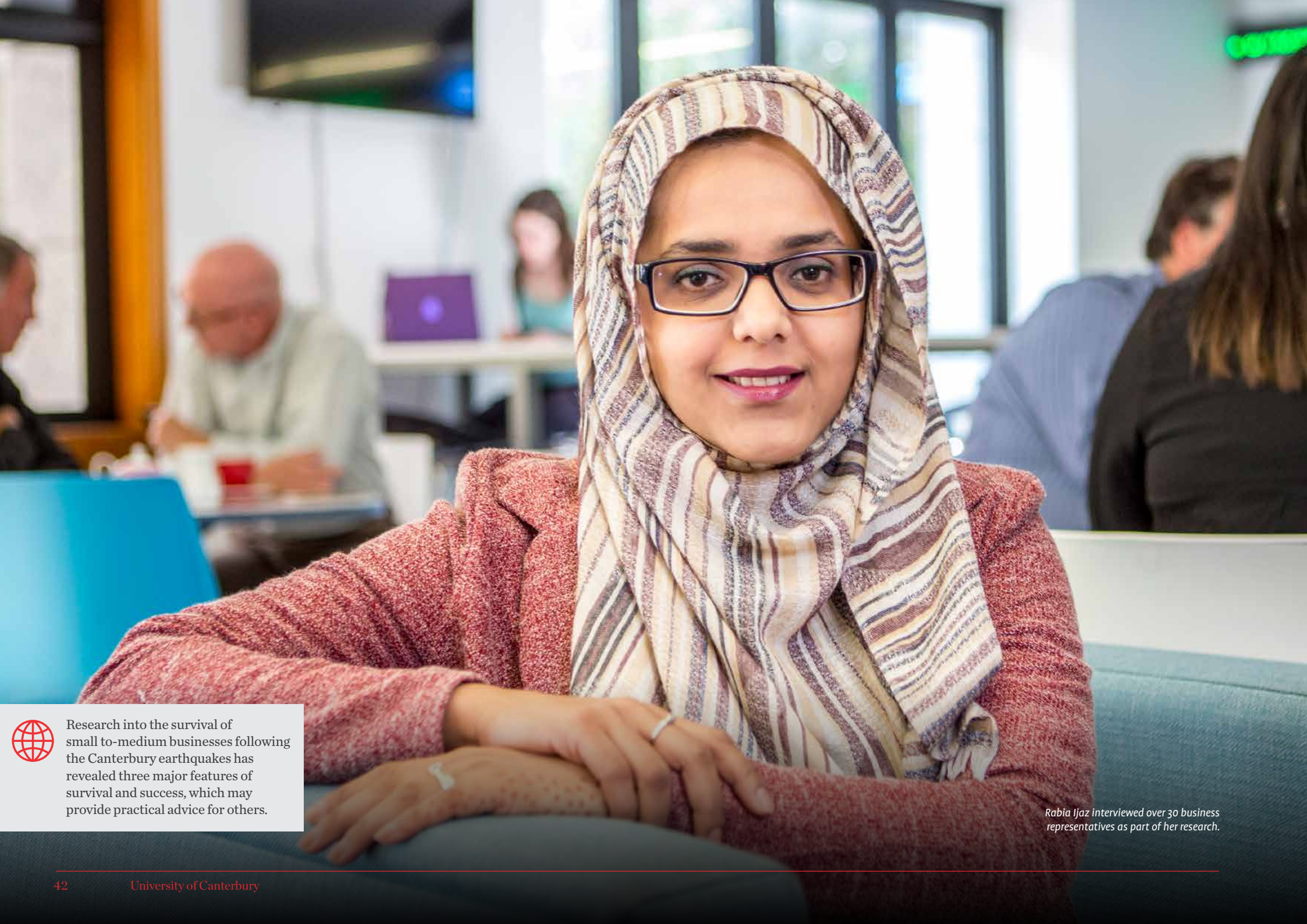
Jennifer is co-supervised by Associate Professor Tammy Steeves, from the School of Biological Sciences | Te Kura Pūtaiao, who heads a dynamic research group developing conservation genetic management strategies for species at risk.

'The robust grasshopper has the same threat classification as kea, two species of kiwi and the hoiho. It is more threatened than four other kiwi species, the hihi, whio and North Island kōkako.'

The project has received funding from Environment Canterbury | Kaunihere Taiao ki Waitaha Department of Conservation | Te Papa Atawhai (DoC). Jennifer has also received a UC Doctoral Scholarship, the Stocker Scholarship and support from the JS Watson Trust fund, administered by Forest & Bird | Te Reo o te Taiao. In addition, she was the recipient of the Sadie Balkind Award from the New Zealand Federation of Graduate Women. The transmitter research was made possible after primary supervisor entomologist Dr Tara Murray was awarded a grant from Holohil systems – a Canadian organisation that builds transmitters to support wildlife research around the world – and a UC strategic grant.

Photo (inset): Transmitters were attached to 20 grasshoppers in two different locations to track their daily movements. (Photos supplied by Jennifer Schori)

As an endangered species, research in to the 'robust grasshopper' will help protect the threatened invertebrate and New Zealand's biodiversity.



Research into the survival of small to-medium businesses following the Canterbury earthquakes has revealed three major features of survival and success, which may provide practical advice for others.

Rabia Ijaz interviewed over 30 business representatives as part of her research.

Secrets to post-quake success revealed for small-to-medium businesses

Research into the survival of small-to-medium businesses following the Canterbury earthquakes has revealed three major features of survival and success, which may provide practical advice for others.

Fourth-year doctoral student Rabia Ijaz, in the College of Business and Law | Te Rāngai Umanga me te Ture, has interviewed representatives from over 30 small-to-medium enterprises (SMEs), in the Greater Christchurch area, about their experiences following the Canterbury earthquakes. Her work looks at how business models may change following a wide-scale disaster or disruptive event. She is compiling an in-depth account of the challenges that confronted those businesses, the ways in which they responded, and the outcomes that resulted.

Rabia says her findings have been intriguing.

"My research found three major features that characterised successful businesses. Firstly, they had strong social capital, with networks which included friends, family, neighbours and business partners. Secondly, they were skilled at adaptive coping, and were able to take corrective actions, and rapidly adjust to sudden change. Thirdly, the business owners had a particular cluster of factors that created a business approach of optimism.

"With these elements business owners could foster an attitude that allowed them to take risks, think strategically, learn from their mistakes and importantly, they could develop and grow their network."

A number of the businesses challenged her assumptions. The first was that the businesses often did not think of themselves as operating strategically – they were simply going about their everyday work. Yet, the three characteristics in common still emerged.

She also noted that in order to succeed, it was not enough to adapt or have the factors supporting an optimistic strategy.

"You need to have those factors and be adaptable, but you won't succeed unless you have networks, the social capital you can use."

"I was not expecting people to go to their extended network, to make the most of their social capital to the extent that they did. The community, neighbours and friends were all prepared to immediately help businesses."

When all three elements were present, the successful businesses were prepared to take risks even though the stakes were high. One business had been at the original location for 40 years so bore a significant risk when it had to move.

A distinctive feature of small business was that the owners and the businesses were so interlinked that the owner's personal characteristics defined the business model. There was a lot at stake too; the owners were responsible for making the business succeed, and this directly affected their own income and wellbeing. Consequently they were deeply invested in the need to succeed.

Rabia's supervisor Associate Professor Bernard Walker (co-supervising with Associate Professor Venkataraman Nilakant) says the value of Rabia's research comes from what it can tell us about

'With these elements business owners could foster an attitude that allowed them to take risks, think strategically, learn from their mistakes and importantly, they could develop and grow their network.'

how small businesses cope with a major natural disaster.

"It's an area where there has been limited research. Traditional disaster research and models of organisational coping don't really apply well to small businesses.

"Understanding small-to-medium business dynamics will help policymakers, planners and business owners to be better prepared for a range of complex, rapidly changing settings. The small businesses she studied were dealing with rapid change and uncertainty. Those same features are increasingly present in the business world, with sudden, unpredictable changes that result from disasters, new technology and competition from across the globe."

Ultimately, Rabia is keen to produce practical advice for SMEs. She points out that the model would apply to other disasters or events which disrupt small businesses such as a financial crisis or sudden changes from technology.

"My supervisors have always been guiding me through each stage of the development of my research, with the preparation, collecting the data, and then making sense of it all in the analysis. It would have been a lot harder if it was not for my supervisory team."

Associate Professor Walker says Rabia is one of a group of students who have been surrounded by practitioners and researchers working in the areas that she is studying.

"She mixes with consultants, academic researchers and practitioners working in resilience and recovery. She is part of a tight-knit team of fellow doctoral students working in these areas. This networking and experience adds immense value to her own work and professional development."

Three characteristics of successful small-to-medium businesses were identified:

- Strong social capital through extended networks
- Adaptive coping – the ability to adjust to change
- An optimistic mind set

Inside whitebait's 'black box'

Whitebait are iconic in Aotearoa New Zealand, yet until recently very little was known about their early marine life cycle, before they appear in spring as juveniles to swim upriver. By studying whitebait ear bones, freshwater ecologist Dr Eimear Egan was able to go inside this marine 'black box' in search of answers.

Having previously studied juvenile salmon and trout in Ireland, Dr Egan leapt at the opportunity to travel to Aotearoa New Zealand in 2013 to explore the early life history of whitebait as a doctoral student in UC's School of Biological Sciences | Te Kura Pūtaiao.

The University's Marine Ecology Research Group (MERG), led by Distinguished Professor Schiel, advertised internationally to find the right student to explore the mystery of what happens when newly hatched whitebait go to sea.

"I was in the UK when I saw the position advertised. I did a Skype call in the middle of the night with Dr Mike Hickford from the School of Biological Sciences. The topic fascinated me, as so little was known about these galaxiid fish."

Earbones reveal mysteries

Working under the direction of Dr Hickford and her primary supervisor Distinguished Professor David Schiel, Dr Egan started filling in the blanks by studying the tiny otoliths, or ear bones, of Aotearoa New Zealand's most abundant whitebait species, inanga *(Galaxias maculatus)*.

"These ear bones are like a fish diary. They record their life in high resolution, by putting down a ring every day. By examining the distance between the rings, you can figure out how fast they grow per day and how they are growing in the marine environment. So when you capture them, as they move into a river, you can reconstruct what has happened during their marine life cycle."

Dr Egan says it is virtually impossible to reconstruct this information any other way as young whitebait are simply too small to be tracked or monitored using other methods.

Her doctoral research, supported by joint funding with the National Institute of Water and Atmospheric Research (NIWA) | Taihoro Nukurangi, revealed surprisingly strong regional differences in whitebait marine growth rates, as well as variances in age. While the average age of entry into rivers is 124 days, some come in at 60 days and others at 200 days.

"What this suggests is that we need to start managing the whitebait fishery on a local basis, rather than relying on a broad-based national model," says Dr Egan.

Dr Hickford guided her field research in the Bay of Plenty, Golden Bay, the West Coast and Ōtautahi Christchurch and provided assistance on how to prepare and examine otoliths.

"For graduate students, UC has traditionally offered great opportunities for field ecology. Eimear spent a number of nights at our Westport field station, which was of real benefit to her research," Dr Hickford says.

Her primary supervisor Distinguished Professor Schiel provided invaluable support on critical analysis and critical thinking, while technicians and other staff went out of their way to help and offer encouragement when needed.

Distinguished Professor David Schiel's key role with MERG is to keep doctoral projects on track and ensure they are completed on time and to a high standard.

"Mike and I put a huge amount of time into student projects: we come up with the precis, go into the field with students and help them in the lab," Distinguished Professor David Schiel says.

"This is a major investment so we make sure they keep going, write their thesis and get it published.

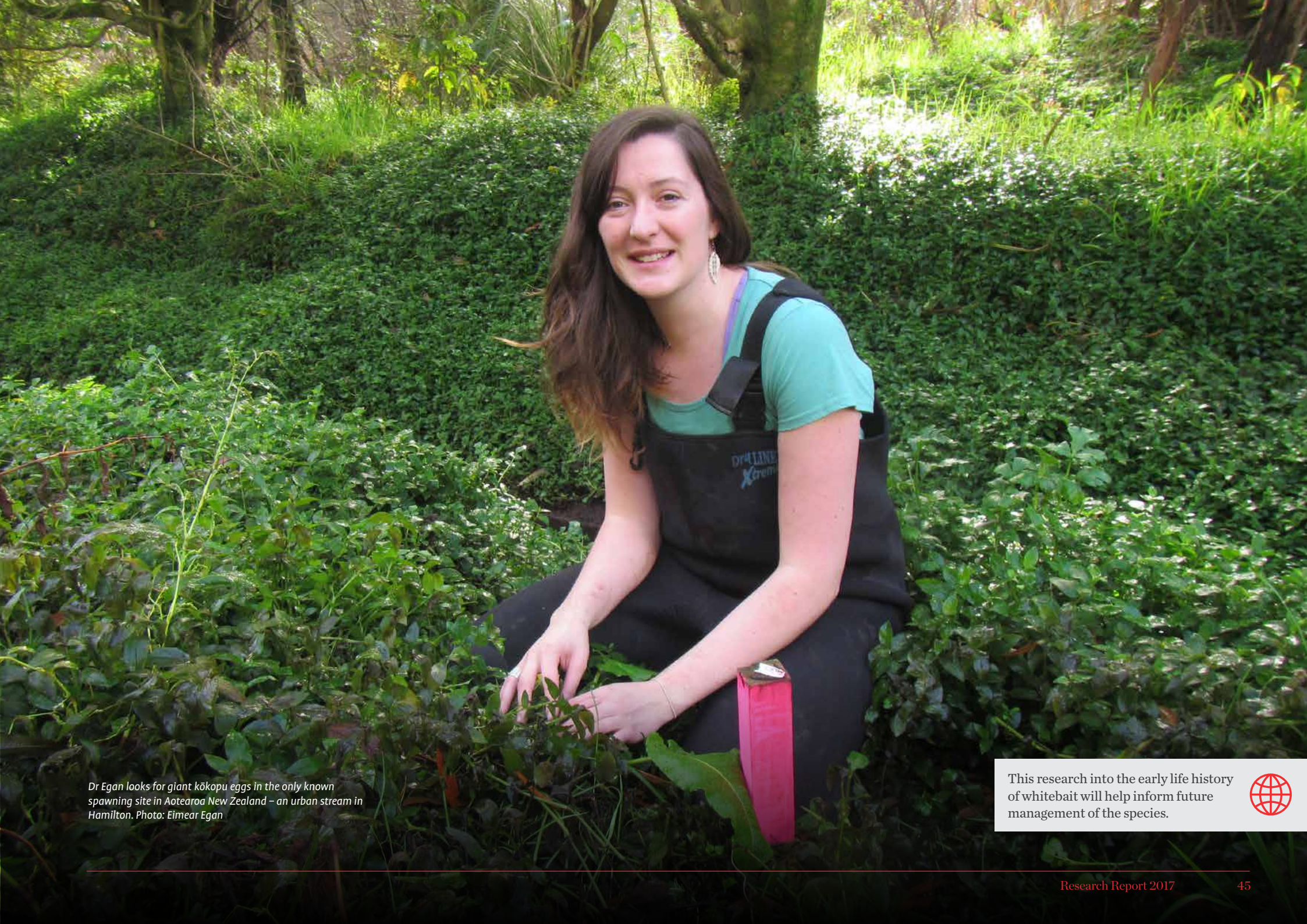
"Once Eimar got onto her thesis, she pursued it relentlessly and was very diligent. This is hugely important research as none of the information she uncovered had existed before this."

Dr Egan's findings have been shared with the Department of Conservation | Te Papa Atawhai, regional councils and NIWA scientists. Her work also featured in a recent episode of Coast New Zealand.

Today, Dr Egan is working on post-doctoral research as a freshwater ecologist at NIWA in Hamilton, looking at the effects of climate change on eel growth, again using ear bones.

"I'm building on the skills and techniques that I learned at UC and I'm also investigating non-lethal ways of looking at growth rates and ages of rare whitebait species such as giant kōkopu (Galaxias argenteus) using fins."

'We need to start managing the whitebait fishery on a local basis, rather than relying on a broad-based national model.'



Dr Egan looks for giant kōkopu eggs in the only known spawning site in Aotearoa New Zealand – an urban stream in Hamilton. Photo: Eimear Egan

This research into the early life history of whitebait will help inform future management of the species.

A new trial will determine whether micronutrients can offer a simple solution to help reduce the number of people suffering from mental health problems.

Meredith Blampied hopes to recruit 200 adults, who are experiencing particular symptoms,to take part in her study.

Using nutrition in the fight against depression and anxiety

A new trial aims to find out if micronutrient supplements can improve the symptoms of functionally impairing depression and anxiety.

College of Science | Te Rāngai Pūtaiao doctoral student and clinical psychologist Meredith Blampied's research is driven by the need to develop further treatment strategies for depression and anxiety, and protect the scarce resource of psychologists and psychiatrists.

"As a medical professional, while I have seen huge benefits from medication, I have also seen really horrible side effects in patients. Is there something before psychotherapy and medication that could improve anxiety and depression?" Meredith says.

While there is an emerging body of research which indicates micronutrients can benefit mood and wellbeing, this is the first time a trial has been conducted primarily in the community on the effects of micronutrients on depression and anxiety, Meredith's supervisor Professor Julia Rucklidge says.

"Meredith's study is bringing our research directly into the community to attempt to address a significant treatment gap. We aim to determine whether micronutrients can offer a simple solution to help reduce the number of people suffering from mental health problems," says Professor Rucklidge.

The study will include a ten-week randomised controlled trial (RCT) in which half the participants will take the micronutrient supplement and the other half will take a placebo. Questionnaires will be conducted frequently during the RCT period to measure outcomes. After twelve months, participants will be contacted to assess the long-term effects of the micronutrients or to establish reasons why the treatment didn't continue.

Meredith started recruiting for participants in March 2018 with the help of general practitioner liaison Dr Rebecca Nichols. In total, she intends to recruit 200 adults aged 18-65 years who are experiencing functionally impairing symptoms of depression and anxiety to take part in the study.

Effectiveness will be measured weekly during the trial, while extensive baseline testing will take place at the beginning of the trial, at the end of the RCT period and at the end of the twelve-month period.

Baseline testing will look at diet, lifestyle, social phobia, general wellbeing and specific anxiety and depressive difficulties. It will also draw on the referring GP's knowledge of the patient, clinical judgement performed by Meredith in her capacity as a clinical psychologist, and the patient's own judgement.

Weekly data collection will be a shorter process, in which patients rank how they are feeling against a set of questions on standard questionnaires: Patient Health Questionnaire (PHQ9), Generalized Anxiety Disorder (GAD7) and the Modified Clinical Global Impression.

Historically, finding participants for a study of this nature can be challenging if they aren't guaranteed the opportunity to try the treatment, but that is where this study is different, says Meredith.

"The difference in our trial is, if you take part you will get the opportunity to try the micronutrients. We have a randomised control phase where you won't know which group you are part of, but at the end we will offer everyone the micronutrients."

The micronutrient product, Daily Essential Nutrients, has been donated to the trial by Canadian company company Hardy Nutritionals - though Meredith and Professor Rucklidge emphasise they are researching an idea, not a product.

Challenging the status quo?

"Long term, if this treatment is proven successful, we hope that micronutrient treatment becomes one of the options available to people with depression and anxiety.

"The idea that nutrition is relevant to the expression and reduction of mental health problems does not always sit comfortably with the medical model of illness. It may take time for this approach to gain wide acceptability. Other challenges include the cost of the nutrients for those people who have received benefit from them.

"If it is proven to be efficacious I would love to see this approach subsidised by the government and supported by the medical profession as a method of treatment."

Young researchers tackle global sustainability issues in UK

A group of UC postgraduate researchers has taken part in an international workshop in London aimed at sharing new research approaches to studying sustainable prosperity.

Dr Sylvia Nissen, and doctoral candidates Mehedi Hasan and Geoff Ford, from the College of Arts | Te Rāngai Toi Tangata, are members of the Sustainable Citizenship and Civic Imagination: Hei Puāwaitanga research group led by UC political scientist Associate Professor Bronwyn Hayward.

The 40 international students at the workshop exchanged research insights into cutting edge-approaches to living more sustainably while achieving community wellbeing. The workshop was funded by the United Kingdom Economic and Social Research Council as part of the Centre for Sustainable Prosperity (CUSP) international research consortium, of which UC is a partner.

The three-day workshop was held in Cumberland Lodge, a 17th-century royal retreat now gifted for sustainability research and postgraduate conservation, and the grounds of Windsor Great Park, close to Windsor Castle. When not involved in intensive research method discussion, the workshop participants made the most of the picturesque setting, including going on 'walking conversations' that helped researchers mingle and promoted wider interdisciplinary connections.

Prosperity, economics and wellbeing

In her thesis, post-doctoral fellow Dr Sylvia Nissen combined politics and sociology to examine levels of student debt and its implications for student political engagement, wellbeing and achievement.

Dr Nissen says she was excited to have the opportunity to connect with researchers from around the world and across disciplines to share the latest insights into sustainable prosperity.

"Understanding how we can live well within environment limits is one of the most urgent challenges confronting our societies and economies."

Geoff Ford is a doctoral candidate in politics and linguistics who has used his background in software development to build and analyse large data-sets based on millions of words of parliamentary debates and hundreds of hours of talk radio, with the aim of understanding contemporary ideas about the economy.

"My doctorate is focused on everyday thinking about the economy in New Zealand and this was a great opportunity to explore the wider implications of my work by engaging with leading researchers working on sustainability and economics".

Doctoral student Mehedi Hasan is studying politics and geography to understand how young people's experience of wellbeing and physical security can be enhanced by access to green space in the rapidly urbanising context of Dhaka, the largest city in Bangladesh.

"I was delighted to be able to participate in the research workshop with top international scholars as it provided an important foundation to understand how rapidly growing cities like Dhaka can develop sustainably."

Cutting edge of new thinking

Funded by the Economic and Social Research Council of England, the researchers participated in the Centre for Understanding Sustainable Prosperity (CUSP) UK doctoral workshop on new research techniques and ideas, at the University of Surrey. They also took part in the launch of a new international study, led by Associate Professor Hayward with CUSP and seven international research teams, which is examining how cities, businesses and communities can make sustainable differences to the quality of young people's lives and wellbeing.

"These doctoral scholars are a credit to UC and New Zealand. They are working at the cutting edge of new interdisciplinary thinking about what it means to live well on a finite planet, and how we meet the needs of growing populations without constantly using material resources will require rethinking our political economies and our lifestyles. In addressing these questions, these researchers in particular are drawing not only on politics but also other areas, being supervised by academics from sociology, geography, and linguistics and economics."

'Understanding how we can live well within environment limits is one of the most urgent challenges confronting our societies and economies.'

The international research group for Sustainable Citizenship and Civic Imagination: Hei Puāwaitanga, is a multidisciplinary research team and 'civics lab'. It investigates citizenship and civic governance, participation and democratic urbanisation, with a focus on sustainability and inclusion – primarily for children and youth.

(From left to right) Dr Sylvia Nissen, Mehedi Hasan and Geoff Ford are members of the Sustainable Citizenship and Civic Imagination research group led by Associate Professor Bronwyn Hayward.

UC postgraduate students are contributing to cutting edge global research about living more sustainably while achieving community wellbeing.

Findings from this research could have an impact on environmental legislation in Aotearoa New Zealand.

Dr Raj Aich prepares to go cage diving near Bluff. Photo: Raj Aich.

Relating to great white sharks

A desire to understand the tension between two different groups of 'locals' in Southland has led Dr Raj Sekhar Aich to research the impact of interactions between humans and great white sharks through cage diving in Bluff.

Dr Aich says he came to UC to understand the human condition better through anthropology, to break out of his comfort zone, to be challenged, and to work with Dr Piers Locke from the College of Arts | Te Rāngai Toi Tangata.

"I observe and practise cage diving in order to understand the relationship between cage diving, the sharks and the environment. By logging quantitative data from tourist cage diving and tourist perception of sharks, interviewing tourists, cage-diving operators, Bluff's local residents and collecting GPS data of shark movements, I can better understand the impact of cage diving."

Dr Locke, senior lecturer in the Department of Sociology and Anthropology, says that he sees Dr Aich's work as bringing clarity to the practice of cage diving and addressing the misunderstanding and the clash between fishers and tourism operators in Aotearoa New Zealand through anthropological analysis and ethnographic description.

"A particularly interesting aspect of Raj's work, drawing on his expertise in psychology, is his investigation of the affective dimension of encounters with great white sharks – an experience that elicits awe in the sense of respectful wonder rather than fear."

Dr Aich's quantitative research also shows that divers had a positive attitude towards great white sharks, which increased significantly after encountering them through cage diving, while neutral and negative attitudes fell significantly. Supporting this activity would encourage humans to demystify the shark and engage in cage diving. He also found that people coming to see sharks through cage diving were not always driven by adrenaline; for many, their motivations were their love of sharks and the environment and a desire to make their dream come true.

Altering the image of the great white

Multiple findings from his research could have an impact on environmental legislation in Aotearoa New Zealand ,says Dr Aich. Since Aotearoa New Zealand is already a popular tourist destination, spreading awareness and contributing to the conservation of great white sharks, including by reporting illegal killing incidents, could help to alter the image of the great white. However, Dr Aich says that it would be wise to be sensitive to all stakeholders in local regions since not all residents are motivated by economic gain through the practice of cage diving.

Dr Aich's research also finds that while young sharks are more playful, great white sharks are not generic, faceless fish.

'A particularly interesting aspect of Raj's work, is his investigation of the affective dimension of encounters with great white sharks – an experience that elicits awe in the sense of respectful wonder rather than fear.'

He says it is also important to take an inclusive attitude towards the lives of the animals, the humans involved and the culture involved to create a holistic idea of how they intersect with and impact on each other.

"This helps us to understand the conflict between humans and sharks, while also taking into account the social, economic, geographical and psychological delineation of the ocean."

"The Anthropology Department is always at the cutting edge of research. My supervisors and research assistant Soosie Lucas have helped a lot through various obstacles. In particular, Soosie helped make some of the most critical connections throughout the research process," Dr Aich says.

Mathematics making rocket launches more efficient

A new flight strategy has the potential to make launching rockets into orbit cheaper and more efficient, improving everyday technology like mobile phones and Global Positioning Systems (GPS).

A major challenge of launching rockets is fuel movement within the tanks affecting the trajectory of rockets through resonance. Heavy mechanical rings inside fuel tanks, called baffles, are the favoured solution to dampen the slosh of fuel and its effects on flight trajectory.

Philipp Sueltrop, doctoral student in Electrical and Electronic Engineering in the College of Engineering | Te Rāngai Pūkaha, is working to prevent the effects of fuel slosh in rockets by using mathematical algorithms, by predicting movement and adjusting the flight movement and adjust the flight before fuel slosh becomes a problem.

"It's about performing the right movement at the right time," Philipp says.

He has observed slosh and rocket motion behaviours using a vertical wind tunnel set up on campus and real-life launches conducted in partnership with Rocket Lab. After collecting enough data to accurately predict fuel slosh under different movements, Philipp will 'on board' the algorithm into the flight control computer.

At that stage real-life launches will be used to gather data and record how the algorithm could influence the flight strategy and compare these findings to what was observed during testing in the wind tunnel to prove the effectiveness of the algorithm. If successful, this could reduce or completely remove the need for baffles in fuel tanks. Philipp recommends slowly introducing the algorithm into real flight to reduce risk.

"Making the move into real flight means fully converting the algorithm into a flight version that takes into account elements, including acceleration that is not present in the wind tunnel. The algorithm is very flexible and easily scalable."

The foundation for the algorithm was originally designed by Philipp's supervisor, Dr Chris Hann, for the medical field.

"The underlying mathematics was first developed for glucose control and cardiovascular management in the Christchurch Intensive Care Unit. It was then transferred to the field of rocketry. The analogy is that insulin is used to control glucose where in a rocket you have canards which control the direction of the rocket," Dr Hann says.

Philipp is enthusiastic about the algorithm's future prospects.

"It is a long-term solution to make it easier, faster and cheaper to launch a rocket, making technology that relies on this more accessible to everyday users," he says.

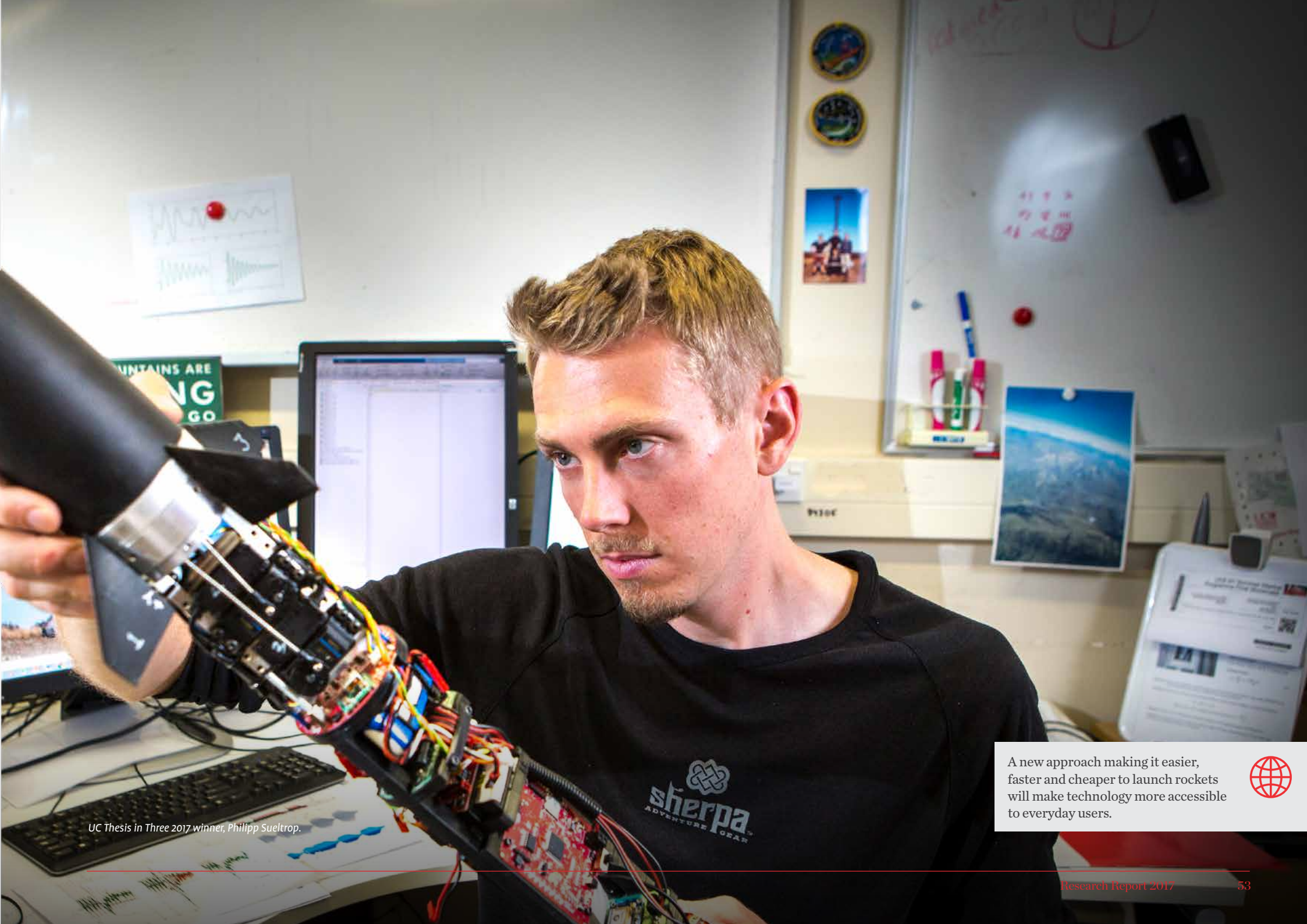
'Philipp's research has direct application to providing better control of liquid fuel orbital rockets including removing the need for heavy baffles and allowing launches in a greater range of weather conditions.'

Dr Hann adds that the research has far reaching applications.

"Philipp's research has direct application to providing better control of liquid fuel orbital rockets including removing the need for heavy baffles and allowing launches in a greater range of weather conditions. It also has application for ship-to-ship docking in the ocean and potentially developing better control systems that handle sea-ice interactions for ships in polar regions."

Philipp was also the UC Thesis in Three 2017 winner and represented UC at the Asia-Pacific competition in Brisbane, Australia during September, where he placed in the top ten. His presentation cleverly compared his research into the effects of rocket fuel movement to walking with a cup of coffee.

Thesis in Three: one slide, three minutes



UC Thesis in Three 2017 winner, Philipp Sueltrop.

A new approach making it easier, faster and cheaper to launch rockets will make technology more accessible to everyday users.

Studying the emerging non-binary dialect in its formative stages will help to identify strategies to present a non-binary identity.

From left: Professor Jennifer Hay and Jacq Jones.

Using speech patterns to present a non-binary identity

THESIS IN THREE

With a research background in speech science, doctoral student Jacq Jones is exploring what happens when a person doesn't fit into a gender binary – male or female – role from a linguistics perspective.

Jacq, originally from Canada, was awarded second place in the UC Thesis in Three finals with the presentation *Mixed Signals – unboxing non-binary speech*. Preferring to be referred to as they, Jacq says creating mixed signals is a way for a non-binary person to speak in a largely binary speech oriented world.

Jacq studied speech science at undergraduate level and wrote an honours thesis about the ways familiarity affects speech comprehension with synthetic voices. This was followed by a master's degree and research which focused on local dialects, and speech production based on personality traits.

Jacq hopes to study this emerging dialect in its formative stages and identify strategies to present a non-binary identity. A part of this work is the creation of a corpus or database of speech of non-binary and binary speakers from Christchurch. On a larger platform, Jacq hopes that the research can find new and interesting ways in which identity and language interact, with a special focus on marginalised identities.

Jacq says UC is an excellent institution for sociolinguistics. Jacq's supervisor Professor Jennifer Hay, also the director of the New Zealand Institute of Language, Brain and Behaviour (NZILBB) at UC, is world renowned when it comes to corpus linguistics and the relationship between social factors and speech production. Co-supervisor Vica Papp has also "done amazing research with the trans populations before".

Being non-binary, Jacq is aware of how gender influences interactions and how those stereotypes break down if one stops assuming that the people in the conversation are either male or female. This study also helps build on an interest in the context of conversation and how personalities and relationships alter the nuances of communication.

> 'It is impossible to know for sure exactly what percentage of the population may be nonbinary... This is exciting because it provides an opportunity to study an emerging population.'

Jacq's work involves collecting, annotating and analysing speech data from personal interviews. This includes understanding the context of who the person is speaking with, and under what context, and the person's gender history and relationship to gender. This can be transcribed and uploaded to the Language, Brain, and Behaviour Corpus Analysis Tool (LaBB-CAT) database, a linguistic research tool developed at UC.

Jacq's corpus includes both binary and non-binary speakers of similar demographic data. Speech data is analysed by comparing the differences in the speech of one person depending on if they're talking to a man, woman or a non-binary person. It also allows examination of the language differences like acoustic factors, differences in pitch in pronunciations, and in speakers of different groups.

Jacq says finding participants is challenging.

"It is impossible to know for sure exactly what percentage of the population may be nonbinary, but it is likely less than 1%. However, this is also exciting because it provides an opportunity to study an emerging population."

Professor Hay says that while a lot of work in sociolinguistics has looked at how language pronunciation can be highly gendered, and how it can be used to express and construct gender identities, this research is different.

"Earlier work has been completed with the assumption of a gender binary, with the researchers assuming that speakers identify as either male or female. Jacq's work is critically important to the field, as it looks at the language usage adopted by speakers who identify as non-binary. They've created a database of recordings, and they will be able to use methodologies we've pioneered here at UC to extract information from the acoustic signal, to explore how language is being used by different speakers, and in different contexts.

"UC is the perfect location for this work, because we have a community of scholars here with considerable experience at building and using such databases to explore patterns of language usage. Jacq's work is a natural extension of work that we have completed here in the past, but pushes it in new and exciting directions."

Understanding cascading hazards

THESIS IN THREE

In 2017, Jess McHale won third place in the UC Thesis in Three competition. Her work, titled *Cascading hazards* — the idea that one hazard triggers another, which triggers another — looks at three in-depth case studies of how farmers recovered from the 2017 Kaikōura earthquake.

Jess, who is doctoral student in the College of Science | Te Rāngai Pūtaiao, says she was in Ōtautahi Christchurch during the earthquake in Kaikōura. She noticed for months that the news coverage focused on the town and on Wellington.

“While the image of three cows trapped on a landslide island held public attention for a couple of weeks, the impacts to farms faded from view.”

Even though many geologists headed to the Hurunui District to map surface ruptures and landslides, Jess says something was missing.

“I thought there were stories and experiences which needed to be heard which were not being captured. I had been interested in researching the concept of cascading hazards for a while and thought that this focus gap and my interest could come together.”

While the phenomenon of cascading is generally understood as a phenomenon generally having a domino effect, Jess says it seems that even in 2017, scholars and practitioners had trouble with defining cascading disasters in the natural world context.

"Roughly, cascading hazards' effects increase in progression over time through secondary events and contribute to the overall lengthening of the disaster.”

According to Jess, the subject of earthquake impacts on farms has not been studied in-depth. Her study, which looks into this subject and also focuses on the farming community, could have a wide range of applications for the government, disaster management and insurance companies as well as the agricultural industry.

“Knowing how a farm is impacted by big events like this, and how they recover, can help fine-tune recovery aid plans,” Jess says.

Primary supervisor Senior Lecturer Mr Clark Fenton, from Geological Sciences, adds that hardly any studies have looked at the complex interaction of immediate earthquake effects coupled with the long-term landscape changes such as ongoing landsliding, flooding and sedimentation from river damming and subsequent dam burst.

“The research Jess is conducting will help to form a better response to the next earthquake in Aotearoa New Zealand and provide useful lessons for recovering from disasters across the world.

“The lessons should be transferable across a number of natural hazard events,” he says.

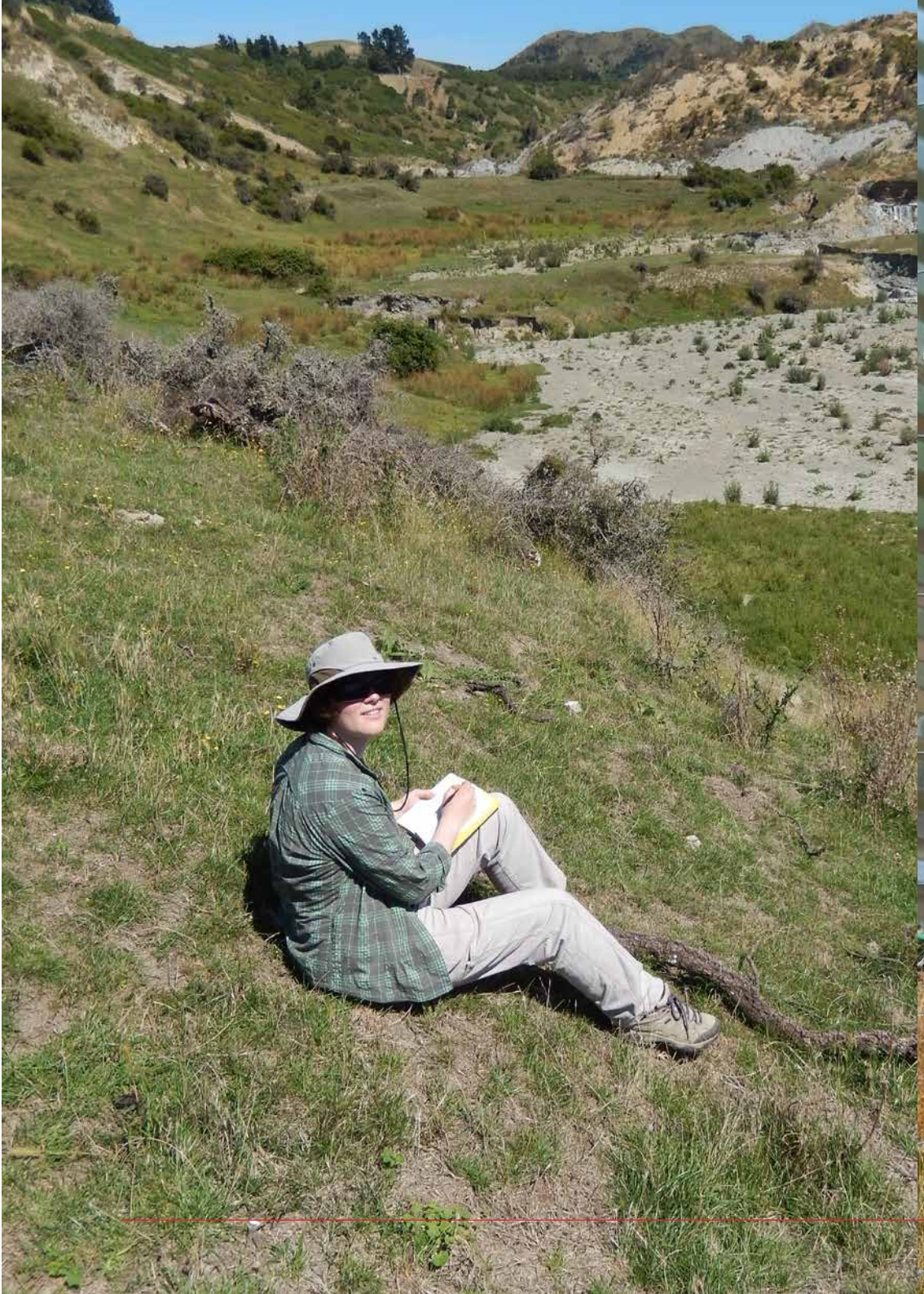
Mr Fenton says that postgraduate research gives training in asking the right questions and hopefully answering them too. He would like each student’s research project to be a step towards developing a greater understanding of the natural world’s hazards and appreciating what can and cannot be done to mitigate the effects of these events.

“As scientists, we should be seeking out answers to the questions and problems that impact the betterment of society as a whole,” he says.

Mr Fenton says that the Geological Sciences department lets the students lead the process of formulating a research idea. He adds that, within the taught postgraduate programme, the department exposes students to all of its current research with the aim of encouraging them to follow a similar path.

Jess, who is currently working on her thesis as a part of her master’s degree, chose to study at UC because it is one of the few universities that offers a degree in engineering geology (Professional Masters of Engineering Geology) in Aotearoa New Zealand.

‘Knowing how a farm is impacted by big events like this, and how they recover, can help fine-tune recovery aid plans.’



The research Jess McHale is undertaking may help in forming a better response to the next earthquake in Aotearoa New Zealand and provide useful lessons for recovering from disasters across the world.

Pioneering bioengineering research is resulting in better treatment in intensive care units.

Distinguished Professor Geoff Chase

World-class researcher awarded UC Research Medal 2017

Distinguished Professor Geoff Chase's research is far reaching across applications ranging from intensive care medicine to earthquake engineering. He has been awarded the 2017 UC Research Medal.

Distinguished Professor Chase of UC Mechanical Engineering within the College of Engineering | Te Rāngai Pūkaha specialises in dynamic systems modelling and control specifically applied to medicine and structures. He says his goal is to find more efficient ways of getting the same result.

"The motto in my research group is we don't need better medicine, we need to do medicine better. I'm looking to use the least amount of data possible to make the best physiological image of the patient."

The University's highest honour, the 2017 Research Medal recognises research excellence in the University's academic staff. The annual award goes to a UC researcher whose work has been recognised as truly world-class.

Vice-Chancellor | Tumu Tuarua Professor Ian Wright, who awarded the medal, says the 2017 medal winner is recognised as a true pioneer when it comes to dynamic systems modelling and control.

"Professor Chase has initiated, developed and successfully applied a novel area of bioengineering research with a very strong clinical applications focus called model-based therapeutics (MBT) for cardiovascular diagnostics. He is a pioneer of MBT and the first to use virtual (computer-based) trials to design a therapeutic protocol that is now a regular standard of care both in New Zealand, parts of the European Union, and Malaysia," he says.

Distinguished Professor Chase is currently working closely with intensive care units (ICUs), using modelling to efficiently stabilise patients who present with three common problems: pulmonary failure, cardiovascular failure and hypoglycaemia. With the right model of dynamics, patients can be treated and moved through ICU more quickly, reducing the use of resource and economic cost significantly.

"You want to predict what is going to happen and using the right model of dynamics is how you are going to do that. Whether it is blood flow in the body or fluid flow over an aeroplane wing, the transmission of drugs and how they move through the body through diffusion and into various intervascular spaces or the diffusion of chemicals into ground water, these are all much the same thing," he says.

"My biggest and best collaborations are with intensive care units. I happen to like it mostly because you see a result in three to five days – unlike some of my other work with diabetes where a result might be seen in 10 years. I'm not that patient."

Distinguished Professor Chase's research also finds solutions in many other areas of medicine, including clinical practice changes in the neonatal ICU for glycaemic control and novel, very low-cost methods of diagnosing type 2 diabetes, and low-cost, non-invasive means of breast cancer diagnosis.

A valued advisor to hospitals throughout Aotearoa New Zealand, Distinguished Professor Chase is an Adjunct Professor of Clinical Medicine at the Otago School of Medicine | Te Kura Hauora o Ōtākou. He collaborates with the Department of Intensive Care at the Christchurch Hospital, Auckland Medical School and Starship Hospital, as well as hospitals in Hungary, Belgium and Germany.

"This award is a statement of appreciation from the University for what has been delivered, and I know the hospitals appreciate it. I see this as a great honour to receive this award and be recognised by the University and my peers," he says.

> 'The motto in my research group is we don't need better medicine, we need to do medicine better.'

Teaching medal awarded for 2017

The UC Council awarded the 2017 Teaching Medal to Associate Professor Ekant Veer from the College of Business and Law | Te Rāngai Umanga me te Ture. The medal, the University's highest award for teaching excellence, has been awarded only nine times since the Medal was first awarded in 2002.

Professor Catherine Moran, Chair of the Learning and Teaching Committee, recommends a winner to the UC Council — Associate Professor Veer was noted as a particularly strong candidate with a proven record as an outstanding teacher.

A navigator

Associate Professor Veer's teaching style is distinctive. Formal exams have been removed from a number of his advanced classes because, in his view, they put immense pressure on students to perform in a short timeframe. In the exams that remain, song lyrics and movie quotes often feature as a way of having a bit of fun.

"I'm equal parts mad and cruel. If I can't do away with exams entirely, then I'll try and have fun with them. I love getting a reaction out of people by doing weird stuff and I like to think my students have a giggle to themselves or just a silent 'WTF' moment," he says.

"The most important aspect of teaching is making students better. I care more that they come out of my class being better people. I like to ensure my students find a way to achieve something they didn't think was possible.

"A lot of students know the answer, they're just looking for someone to confirm it. By working together it helps students to develop their ideas and knowledge and I can focus on being a navigator instead of a director."

Ask more of them

Associate Professor Veers credits one colleague in particular, Professor Avi Shankar at the University of Bath in the United Kingdom, for teaching him to get the best out of his students.

"He taught me how to push students beyond what makes them comfortable and really get them thinking, and not to be afraid of asking more of students than they're used to."

'I have to love what I do. If I don't love what I do, if I'm not passionate about what I am teaching, it's very difficult to make students passionate about it.'

Among Associate Professor Veer's research interests are the use of marketing technologies in advertising, social change, consumer behaviour and wellbeing marketing. He is an advisor for a number of government bodies and non-governmental organisations, including the Canterbury District Health Board | Te Poari Hauora ō Waitaha and New Zealand Red Cross | Rīpeka Whero Aotearoa. His teaching material is also used in a number of Australian universities.

"I was that annoying student that talked a lot in class," says Associate Professor Veer.

"Straight away the lecturers knew that I had something to say and I would always talk. When I went into the industry and the real world of marketing, the university would always ask me to do guest lectures. That's where I got the bug for teaching.

"I have to love what I do. If I don't love what I do, if I'm not passionate about what I am teaching, it's very difficult to make students passionate about it," he says.

Associate Professor Veer has a track record of teaching excellence, both in Aotearoa New Zealand and prior to that at the University of Bath. He has been recognised with a previous UC Teaching Award and five Lecturer of the Year Awards from the UC Students' Association since he joined UC in 2010.

'A lot of students know the answer, they're just looking for someone to confirm it. By working together it helps students to develop their ideas and knowledge and I can focus on being a navigator instead of a director.'

Associate Professor Ekant Veer's distinctive teaching style helps students find a way to achieve something they didn't think was possible.

Professor Katie Pickles is examining heroines in modern global history and exploring the roles and status of exceptional individuals.

Prestigious fellowship allows professor to follow passion

Professor Katie Pickles has been awarded a prestigious fellowship to support research into heroines in modern global history.

College of Arts | Te Rāngai Toi Tangata History Professor Katie Pickles was awarded the 2017 James Cook Research Fellowship by the Royal Society New Zealand Te Apārangi in recognition of sustained research excellence.

The fellowship will support Professor Pickles to undertake her research titled *The heroine with a thousand faces* for two years. Through this research, she will examine heroines in modern global history and explore the roles and status of exceptional individuals, with a focus on Aotearoa New Zealand.

Professor Pickles is delighted and honoured to receive the fellowship.

"It will allow me to pursue a longstanding research and teaching interest in heroines in history. There is currently a popular and celebratory resurgence in women's history that deserves critical attention."

Professor Pickles was appointed to her dream position in New Zealand women's/feminist history in 1996. This fellowship acknowledges all of the research that she has done over the past two decades.

Her previous research work has broken new ground in gender and empire history, transnational history, and the history of the British world. She is the author of *Transnational Outrage: The Death and Commemoration of Edith Cavell and Female Imperialism and National Identity*. She has also published many chapters in books and articles in top journals about imperialism, Canadian history and Aotearoa New Zealand, Australia and Canada as settler societies.

"To date, although women's status has undergone revolutionary changes on a global scale in the past two centuries, the change is uneven and contested," says Professor Pickles.

"The revolution continues to evolve to the modern day. Aotearoa New Zealand was the first country in the world to give voting rights to all women in 1893 and is a world-leading example of rapid change.

"The country also has a proud heritage of firsts for women in areas of education, politics, governance, sport and business. Despite this, the heroic 'man alone' and the Anzac soldier remain among the most popular and researched national stereotypes."

Forgotten female heroines

With her fellowship, Professor Pickles will recover forgotten female heroines such as Grace Darling, Ada Lewis and Huria Matenga. Her research will also question what it means for diverse women to be heroic while considering masculinity, femininity and sexuality in new ways and from the perspective of different eras and cultures.

'To date, although women's status has undergone revolutionary changes on a global scale in the past two centuries, the change is uneven and contested.'

A focus will be on Aotearoa New Zealand's social makeup and women's place in the country and the world through a series of archetypes of modern global heroines: mother, warrior, queen, imperialist, technologist, politician and celebrity. The diverse and innovative themes to be uncovered include cross-dressing, glamour, spirituality and religion, death and martyrdom, domesticity, fertility and motherhood, courage, adventure, imperialism, war and governance.

In 2017 Professor Pickles delivered three international keynote addresses. They were on gender and the British Empire, Kiwiana and Aotearoa New Zealand national symbols and landscape and Ōtautahi Christchurch's dark gothic past. She has an ongoing research interest in Kiwiana.

Professor Pickles also contributes to a wide range of publications through her role as an editor. She is an Australasian section editor for the *History Compass* journal and an Associate Editor for *Kotuitui*, as well as serving on the editorial board of the *New Zealand Journal of History* and *New Zealand Women's Studies Review*. She has edited six scholarly volumes on topics ranging from women and migration, the colonial past and New Zealand's empire. Most recently, she co-edited *History Making a Difference*, which was published in 2017.

'The country also has a proud heritage of firsts for women in areas of education, politics, governance, sport and business. Despite this, the heroic 'man alone' and the Anzac soldier remain among the most popular and researched national stereotypes.'

College of Arts
Te Rāngai Toi Tangata

Professor Jonathan Le Cocq
Pro-Vice-Chancellor, College of Arts
Amorangi Toi Tangata

The College of Arts | Te Rāngai Toi Tangata continues to be among Aotearoa New Zealand's leaders in innovative research in the social sciences, humanities and creative arts.

In 2017 the standing of our academic staff was reflected in the award of James Cook Fellowships, Marsden Fund grants, Fulbright scholarships and election to Fellowship of the Royal Society of New Zealand | Te Apārangi. The diversity of our research is captured in a sample of our book titles published in 2017: *Women, Monstrosity and Horror Film* (Erin Harrington – English); *Sea Change: Climate Politics and New Zealand* (Bronwyn Hayward – Politics and International Relations); *The Turing Guide* (Jack Copeland – Philosophy); *Criminal Justice: A New Zealand Introduction* (Jarrod Gilbert and Greg Newbold, eds – Sociology); *Magna Carta and New Zealand: History, Politics and Law in Aotearoa* (Chris Jones, co-editor – History); *New China Eyewitness: Roger Duff, Rewi Alley and the Art of Museum Diplomacy* (Richard Bullen, co-editor – Art History and Theory); and *Black Flu 1918: The Story of New Zealand's Worst Public Health Disaster* (Geoff Rice – History).

Outreach and collaboration were prominent themes in 2017. The community dimension of our research was reflected in our return to the Arts Centre in the central city. The new Teece Museum of Classical Antiquities and the Music performance space enabled upwards of 10,000 visitors to experience our We Could Be Heroes exhibition, hear a musical performance or enjoy a public lecture in this iconic location.

Equally prominent were various forms of collaboration within and beyond the College. UC Music, UC Classics and the Teece Museum presented the remarkable Oresteia Experience as part of the Christchurch Arts Festival 2017.

The School of Humanities and the English Department hosted Harvard Professor Stephen Burt, one of the world's leading literary critics and poets, who presented in the city's WORD festival. UC Art History and the Macmillan Brown Centre for Pacific Studies staged the exhibition Constructing Memory: Samuel Hurst Seager and New Zealand's First World War Battlefield Memorials.

The Oceanic Memory: Islands, Ecologies, Peoples conference, hosted by Humanities and the Macmillan Brown Centre, brought scholars from the Pacific and all over the world to Canterbury. Senior Lecturer in Music Justin DeHart's recording Beyond, with the celebrated Los Angeles Percussion Quartet, appeared in two top 10 Classical Music Album lists for 2017.

College of Business and Law
Te Rāngai Umanga me te Ture

Professor Sonia Mazey
Pro-Vice-Chancellor, College of Business and Law
Amorangi Umanga me te Ture

Academics and postgraduate students within the College of Business and Law | Te Rāngai Umanga me te Ture continue to engage in national and international (interdisciplinary) collaboration and produce high-quality research outputs.

The UC Business School | Te Kura Umanga has maintained its wider research strengths, including in business education, entrepreneurship, experimental economics, financial risk management, gender and diversity issues, information systems, management, marketing, social and environmental accounting, taxation and tourism. Highlights for the year included the establishment of two research groups, Leading and Managing Resilient Organisations and the Q21 Research Group, Ann-Marie Kennedy (Management, Marketing and Entrepreneurship) winning the School's Early Career Research Award, and the School hosting the 20th Academy of Marketing Science's World Marketing Congress -Marketing Transformation: Marketing Practice in an Ever Changing World.

Significantly, The Trading Room | Te Wāhi Hokohoko was established to support high-quality teaching and research. Opened by the Right Honourable Sir John Key on 16 October, The Trading Room is equipped with 12 workstations, a live stock ticker display, a live market wall display, news data feeds, Bloomberg terminal access and simulation trading tools.

The School of Law | Te Kura Ture spans a wide variety of research interests, such as gender, human rights and indigenous peoples, surrogacy, media, copyright and privacy law, disaster management, domestic and international environmental law, ocean governance, employment, land, insurance, public and criminal law, civil procedure, clinical legal studies, medical, trade, company and insolvency law. Several members of staff (two as co-editors) contributed to the publication *Feminist Judgments of Aotearoa – Te Rino: A Two-Stranded Rope* (Hart Publishing). Law staff have successfully obtained funding from a variety of organisations, including the New Zealand Law Foundation, the Tertiary Education Commission and the Royal Society of New Zealand Marsden Fund.

The UC Centre for Entrepreneurship (UCE) had another productive year, stimulating the development of entrepreneurs through a combination of research, teaching and community engagement. The UCE supports students participating in a variety of competitions at local, national and international levels.

College of Education, Health and Human Development *Te Rāngai Ako me te Hauora*

Professor Letitia Fickel
Acting Pro-Vice-Chancellor, College of Education, Health and Human Development
Amorangi Ako me te Hauora

Researchers in the College of Education, Health and Human Development | Te Rāngai Ako me te Hauora have published a diverse range of high-quality research in 2017, highlighting the strengths and impact of our scholarship in teacher education, health sciences, human development, educational studies, leadership, sport and physical education.

This year, we are especially proud of Associate Professor Sonja Macfarlane, who was awarded the Te Tohu Pae Tawhiti Award from the New Zealand Association for Research in Education (NZARE) | Te Hunga Rangahau Mātauranga o Aotearoa in recognition of her original contributions to Māori and Indigenous education and whānau-orientated research.

We are also very proud of our Kaiārahi Pasifika Tufulasi Taleni, who received NZARE's Rae Munro Award for excellence for his master's thesis on effective leadership for lifting Pasifika achievement.

Among the significant outputs during 2017 are seven books authored or edited by our academics that offer critique, analyses and insights on significant issues, or support the transfer of knowledge to practitioners in the field. These outstanding works on nationally and internationally relevant topics include digital technologies and change (Professor Nikki Davis); Olympic education (Professor Ian Culpan and colleagues); motivating children with learning difficulties (Professor John Everatt and colleague); positive pedagogy for sport coaching (Professor Richard Light); experiences of teen parents (Associate Professor Annelies Kamp and colleague); phonological awareness (Professor Gail Gillon); and teaching forensic science (Dr Chris Astall and Dr David Winter).

Scholarship generated by the College contributed valuable evidence and insight, informing policy and practice across the education, sport and health sectors. Examples include tertiary student stress and coping (Dr Valerie Sotardi); teacher emotional self-regulation (Dr Veronica O'Toole); culturally responsive tertiary programmes (Associate Professor Eileen Britt, Professor Angus Macfarlane and colleagues); inclusive practice (Dr Trish McMenamin); behavioural assessments for children's sleep problems (Associate Professor Karen France, Dr Laura-Lee McLay and colleagues); attracting men to nursing (Dr Thomas Harding and colleagues); leading change in flexible learning spaces (Associate Professor Julie Mackey, Associate Professor Fletcher and colleagues); and place-consciousness and Aotearoa New Zealand history in schools (Dr Richard Manning).

We also achieved new records in the number of doctoral candidates (144) and the number of Doctoral candidates who completed their doctorates (17).

College of Engineering *Te Rāngai Pūkaha*

Professor Jan Evans-Freeman
Pro-Vice-Chancellor, College of Engineering
Amorangi Pūkaha

Research in the College of Engineering | Te Rāngai Pūkaha covers an enormous breadth of subjects and physical sizes – from research into huge structures like bridges and roads to nano-scale microscopic structures - all supported by both theory and practical experiments.

Our research has real world impact and societal benefit – from developing safer buildings, new advances in medical technology and imaging, research into big data, and modelling of biodiverse lineages.

We had a very successful year for funding and awards. The UC Quake Centre received $12 million in funding from the 2017 Ministry of Business, Innovation and Employment (MBIE) Partnerships Scheme for the project Building Innovation: Infrastructure Systems Engineered for Improved Value and Resilience.

With colleagues from Germany, the US and the UK, Professor Rick Millane was awarded a NZ$2 million research grant by the Human Frontier Science Program to develop a method for imaging individual biomolecules with atomic resolution.

Dr Allan Scott won an MBIE Smart Ideas grant to investigate mineral recovery from olivine basalt, and several large Earthquake Commission and GNS Science grants were awarded to staff in Civil Engineering. A large Marsden Fund grant went to Dr Brendan Creutz in Mathematics to study Brauer groups, degree and rational points on algebraic varieties; he was also awarded the Early Career Research Award from the New Zealand Mathematical Society. Professors Charles Semple and Distinguished Professor Mike Steel were awarded a Marsden Fund grant for a three-year project on the combinatorics of reticulate evolution.

Also recognised were Professor Conan Fee and Dr Tim Huber, who developed technology to create high-performance heat exchangers using 3D-printing technology, while Professor Rick Millane was elected as a Fellow of the Royal Society Te Apārangi. The winner of the 2017 Campbell Award of the New Zealand Statistical Association, a whole-of-career award, was Professor Jennifer Brown. For his work in developing new technology for earthquake-safe buildings less likely to require repair after large earthquakes, Associate Professor Geoff Rodgers received the Cooper Award from the Royal Society Te Apārangi. Distinguished Professor Geoff Chase won UC's 2017 Research Medal for his pioneering work with real world impact in topics as diverse as intensive care medicine for babies, and earthquake engineering.

College of Science
Te Rāngai Pūtaiao

Professor Wendy Lawson
Pro-Vice-Chancellor, College of Science
Amorangi Pūtaiao

In the College of Science | Te Rāngai Pūtaiao, 2017 was another exciting and productive year for research. A particular feature of our ongoing success, which reflects the growing recognition of the quality and value of our research, is that our total amount of external research funding continues to increase: in the last five years, it has increased by nearly 50%.

In 2017 our College Emerging Researcher Award | Tohu Mātātupu, which recognises our excellent early career researchers, was won by Dr Kelly Dombroski of the Department of Geography. Dr Domboski is a cultural and economic geographer, specialising in alternative economies and social change for sustainability. The settings for her work are in Aotearoa New Zealand, as well as in China's far west and in Australia.

A highlight of 2017 – indeed, it will be a highlight over the longer term too – is that in December we began our long-awaited move into our new Ernest Rutherford building. This new facility, one of very few completely new science laboratories to be built in Aotearoa New Zealand in the last few years, is specifically designed to enable and promote interdisciplinary science, and to be a hub for a range of partnership-based research projects.

Staff, students and external partners will be able to work seamlessly and shoulder to shoulder across the science disciplines. Interdisciplinary teams of researchers will convene in the specially designed collaborative spaces before embarking on their experiments: here, they will share perspectives and ideas, challenge each other and work in teams to finalise research plans. Visitors to the building will be able to see the science research going on in the labs, as we have designed the building to allow us to showcase some of our key technologies and processes. Our new building represents the future of science; we are excited to be at its leading edge.

Overall, 2017 reflected significant progress in our aspiration to conduct impactful interdisciplinary research that is excellent and world leading. To find out how we can help you or your organisation address a research-related problem, please do not hesitate to get in touch with me at wendy.lawson@canterbury.ac.nz

University Statistics

Academic staff[1]		749
Adjuncts and research fellows[2]		291.83
Post-doctoral fellows[3]		49
Outputs		3320
Postgraduate degrees completed	PhD	184
	DMA	1
	MA	31
	MAntaStud	1
	MAud	14
	MCom	18
	MCouns	3
	ME	21
	MEd	6
	MET	1
	MFA	3
	MForSc	2
	MGIS	6
	MHealSC	9
	MHIT	2
	MLing	4
	MSc	99
	MURR	3
	MWaterRM	13
Research Income		$34,418,639

1 Annualised FTE of academic staff
2 Annualised FTE of research fellows and adjunct staff
3 Annualised FTE of post-doctoral fellows

Research Institutes and Centres

Biomolecular Interaction Centre (BIC)

The Biomolecular Interaction Centre (BIC) is a national research institute dedicated to understanding and engineering biomolecular interactions, which is central to a range of fundamental sciences and engineering applications.

The Centre was founded in 2007 at UC. It has a unique blend of researchers from across Science and Engineering, and partners with several Aotearoa New Zealand Crown research institutes, universities and Callaghan Innovation.

There are nine principal investigators, based at three Aotearoa New Zealand universities, and more than 35 associate investigators, based nationally and internationally. These investigators are supported by experienced post-doctoral fellows and a large number of postgraduate students researching biomolecular interactions. Flagship projects include engineering biotechnology, evolving and engineering biomolecules, and chemical biology. BIC supports a dynamic research environment for both staff and students. Researchers are also well placed to explore the commercial applications of their science.

www.canterbury.ac.nz/bic

Electric Power Engineering Centre (EPECentre)

The Electric Power Engineering Centre (EPECentre) is Aotearoa New Zealand's Centre of Excellence for electric power engineering, established in 2002 as a joint initiative between the electricity industry and UC. Linking the electricity industry and academia, it has three core areas of operation: research and innovation, industry-academia collaboration, and education. The Centre has over 30 industry partners through the Power Engineering Excellence Trust (PEET) and ongoing research projects, as well as a network of over 700 industry and research contacts – both local and international.

The EPECentre employs high-calibre researchers, engineers and support staff in management, technical and educational roles to achieve its objectives. It is funded by the Aotearoa New Zealand electricity industry via PEET, research funders (government and industry) and consultancy work.

The EPECentre's vision is to carry out electric power research that is of national significance and internationally recognised, and to produce a sustainable stream of high-calibre electric power engineering graduates who move from university to industry and research each year.

www.epecentre.ac.nz

Gateway Antarctica

Gateway Antarctica is a centre for Antarctic studies and research at UC.

Its purpose is to contribute to greater understanding and more effective management of the Antarctic and the Southern Ocean. It does this by being a focal point and a catalyst for Antarctic scholarship, attracting national and international participation in collaborative research, analysis, learning and networking.

www.canterbury.ac.nz/spark/anta

Geospatial Research Institute Toi Hangarau (GRI)

The Geospatial Research Institute | Toi Hangarau is a multidisciplinary research centre dedicated to outward-facing, collaborative geospatial research and innovation. It aims to substantially increase geospatial research output and be deeply involved in connecting this research to the outside world through commercialisation, social and educational research, as well as outreach programmes.

www.geospatial.ac.nz

Human Interface Technology Laboratory (HIT Lab NZ)

The Human Interface Technology Laboratory New Zealand (HIT Lab NZ) | Hangarau Tangata, Tangata Hangarau is a dynamic human–computer interface research centre hosted by UC. It is focused on supporting people in performing real-word tasks by applying advanced interface technology.

The HIT Lab NZ is revolutionising the way people interact with computers by creating cutting-edge interfaces to:

- enhance human capabilities
- compensate for human limitations
- assist people to better perform tasks at work and in their daily lives.

The HIT Lab NZ's multidisciplinary approach to research and education facilitates an entrepreneurial environment, which fosters a wealth of innovative ideas, leading to an improved economic climate in Aotearoa New Zealand. Currently, the HIT Lab NZ is working on a range of projects in collaboration with industry, academia and government partners from around the world.

www.hitlabnz.org

Macmillan Brown Centre for Pacific Studies

The Macmillan Brown Centre for Pacific Studies was founded through a bequest by Professor John Macmillan Brown (1846–1935). A founding professor of UC and a former Vice-Chancellor of the University of New Zealand, he spent considerable time travelling in and studying the countries of the Pacific Islands region. Under the terms of Professor Macmillan Brown's will, the centre was established in 1988 at UC to facilitate the "investigation and research of the history, traditions, customs, laws, and ideas of the peoples of the Pacific generally".

www.canterbury.ac.nz/mbc

National Centre for Research on Europe (NCRE)

The NCRE is Aotearoa New Zealand's premier European Union (EU) tertiary-level think-tank. It undertakes both academic and outreach activities, involving a variety of public diplomacy roles and mechanisms.

Since 2006 the NCRE has managed the EU Centres Network of New Zealand, incorporating all eight of the country's universities. It has also established formal links with similar EU centres in the Asia–Pacific region, including: RMIT University in Melbourne; the Australian

National University in Canberra; Chulalongkorn in Bangkok; Waseda in Tokyo; Korea University in Seoul; University of Malaya in Kuala Lumpur; and Tsinghua University in Beijing.

As a designated Jean Monnet Centre of Excellence, it also involves Fudan University in Shanghai, Chulalongkorn University in Bangkok and the University of Kent in the United Kingdom.

The NCRE offers incoming and outgoing internships – most notably with the European Parliament and the Asia–Europe Foundation – and has a range of teaching and exchange programmes with other EU studies programmes in our region.

The main focus of the NCRE is on the European Union's impact on the Asia–Pacific region, with special emphasis on foreign policy, media perceptions, development policy, trade and regional integration.

www.canterbury.ac.nz/ncre

New Zealand Institute of Language, Brain and Behaviour Te Kāhui Roro Reo (NZILBB)

New Zealand Institute of Language, Brain and Behaviour | Te Kāhui Roro Reo is a multidisciplinary centre dedicated to the study of human language. Coming from a wide range of disciplines, its researchers forge connections across linguistics, speech production and perception, language acquisition, language disorders, social cognition, memory, brain imaging, cognitive science, bilingual education and interface technologies. This highly interdisciplinary team is working together toward a truly unified understanding of how language is acquired, produced and understood in its social and physical contexts.

www.canterbury.ac.nz/nzilbb

Ngāi Tahu Research Centre Kā Waimaero (NTRC)

Ngāi Tahu Research Centre | Kā Waimaero was established in August 2011 as a joint initiative between Ngāi Tahu and UC. Its purpose is to be a leader in Indigenous scholarship and to provide a centre for the intellectual capital and development of Ngāi Tahu, the principal iwi of Te Waipounamu.

www.canterbury.ac.nz/ntrc

QuakeCoRE: New Zealand Centre for Earthquake Resilience

QuakeCoRE is a national Centre of Research Excellence (CoRE) of earthquake resilience researchers. It leverages strengths across the country and internationally, working collaboratively on integrated multidisciplinary programmes of world-class research. Its aim is to support the development of an earthquake-resilient Aotearoa New Zealand where thriving communities have the capacity to recover rapidly after major earthquakes through mitigation and pre-disaster preparation.

www.quakecore.nz

Spatial Engineering Research Centre (SERC)

Spatial Engineering Research Centre (SERC) addresses the engineering problems of modern-day navigation and remote sensing geo-referenced data collection. Investigations into the linkages between positioning and data collection form the fundamental baseline for many geospatial sciences, and developing new ways to navigate in environments starved of the Global Navigation Satellite System (GNSS) is essential for complete geographic data coverage.

The multidisciplinary SERC team specialises in wireless systems, global navigation satellite systems, computer machine vision and inertial navigation. SERC supports geospatial science research in conjunction with industry, Crown research institutes, other universities and UC students. SERC can also provide commercial remote sensing services to large and small companies.

Among its many areas of work, SERC specialises in photogrammetry and aerial photography, with a special interest in aerial thermal imaging. Its navigation engineering skills enable indoor navigation research and the design and control of unmanned aerial vehicles (UAV). A further UAV activity involves administering a 100-square-kilometre UAV flight test site.

In addition to catering to its own postgraduate engineering students, SERC contributes towards teaching the Master of Geographic Information Science programme. SERC, in close collaboration with the Wireless Research Centre, has started active research in the areas of autonomous vehicles, the Internet of Things, and terrestrial sensors for satellite communication.

UC Quake Centre (UCQC)

The UC Quake Centre is a dynamic partnership between the engineering industry and UC. It has developed strong collaborations with the University of Auckland and other partners, including the learned societies, architects, local government, consultancies, large asset owners, the construction sector and overseas institutions, to provide world-class knowledge, research and solutions related to seismic issues.

Focus areas for the UC Quake Centre are training and fostering expertise, supporting and encouraging the best professional practices, keeping individuals and groups informed about ongoing work and research within the sector, identifying the levels of risk facing communities, and looking at ways to provide innovative and commercially viable solutions in response to those risks.

The Quake Centre is committed to using the unique events in Ōtautahi Christchurch's recent history to inform its research and recommendations for the future and, ultimately, to providing proven solutions that help make individuals, businesses, governments and communities more resilient to future earthquakes.

www.quakecentre.co.nz

Waterways Centre for Freshwater Management

A joint venture between UC and Lincoln University | Te Whare Wānaka o Aoraki, the Waterways Centre for Freshwater Management is a focal point for improving knowledge-driven water resource management in Aotearoa New Zealand. The centre offers undergraduate courses and postgraduate degrees in water resource

management, to help meet the ever-increasing demand for graduates in this field.

By maintaining a strong connection with private sector and water research organisations, the centre ensures the skills, knowledge and awareness conveyed in the classroom are relevant to the whole water sector. It also acts as first point of contact for external groups seeking research expertise and community or professional development education in the field.

The centre is an example of the strong cooperation that occurs between Waitaha Canterbury's two universities, leading to better educational outcomes for the country.

www.waterways.ac.nz/

Wireless Research Centre (WRC)

Wireless Research Centre (WRC) is responsible for driving research and innovation at UC within the field of wireless communication. Its purpose is to secure the continuing presence of a strong and successful industry knowledge base in wireless communications in Aotearoa New Zealand. The key goals of the centre are to assist Aotearoa New Zealand industry by de-risking the early stages of product development in the wireless space and by providing innovative wireless solutions for niche applications tailored to the specific needs of industry partners.

The centre plays a key role in maintaining Aotearoa New Zealand expertise at the forefront of international telecommunications research and development, measured by the graduation of high-calibre students, economic impact, publications and patents. It has extensive knowledge and experience of working with emerging wireless standards, including the 4G and 5G cellular (mobile phone) family of standards, low power wide area (LPWA) standards, and local area and personal-area networks.

Specific technologies of expertise include multiantenna systems (MIMO), error control coding, diversity systems, relaying, scheduling and the application of combinations of wireless and geospatial technologies such as indoor logistics and intelligent transport systems.

WRC, in close collaboration with the Spatial Engineering Research Centre, has started active research in the areas of autonomous vehicles, smart cities, sensors for intelligent transportation the Internet of Things.

www.canterbury.ac.nz/wrc

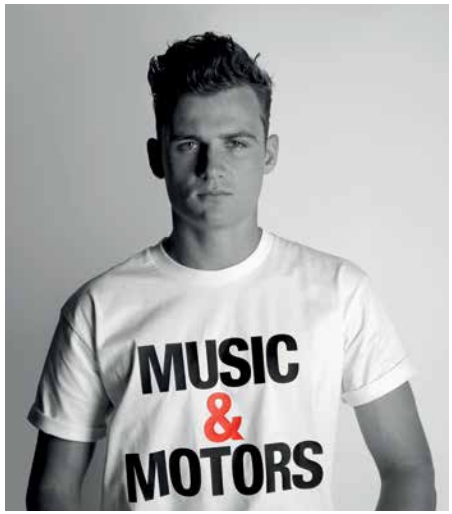
Research supporters*

** Please note: These are some of the organisations that supported the research featured in Research Report 2017.*

UC7

UC is a truly holistic place of learning, made up of Seven outstanding dimensions that will prepare you to change the world.

1 UC Academic

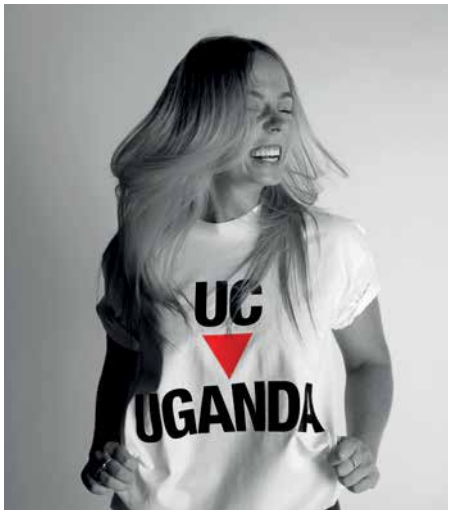


Did you know UC is ranked in the top 3% of universities worldwide? Founded over 140 years ago, our legacy of celebrated graduates has shaped the world we live in today. Here, you'll learn from passionate lecturers in over 100 programmes of study. You'll have a chance to be part of groundbreaking research at our research centres and field stations. Best of all, you'll graduate with an excellent academic qualification under your belt.

Thomas, Bachelor of Engineering (Hons).

'I've really enjoyed my first specialist year. It's been very hands on and I've done some really creative design projects.'

2 UC Community



The city of Ōtautahi Christchurch is a growing hotbed of opportunity. Developments and initiatives are popping up at a rapid pace and our graduates are perfectly poised to access these opportunities. Over the last few years our students have earned an international reputation for their community involvement. Get involved by joining the Student Volunteer Army or connect with a range of local organisations — Ōtautahi Christchurch is a great place to be!

Laura, Law and Health Sciences.

'I am establishing an organisation for international volunteer trips. Over the year students fundraise and collectively the money raised will pay for the building of a structure at the end of the year.'

3 UC Bicultural

At UC we are committed to biculturalism. That's a good thing for Aotearoa New Zealand, and a good thing for you too. As part of this commitment we work with Ngāi Tahu, the tangata whenua in our region. At UC you'll gain bicultural perspectives and experience in your courses of study through engaging with course content, ideas and activities in your chosen subjects. You can also take specific courses on Māori language, culture, art, and Te Tiriti o Waitangi.

Eden, Bachelor of Engineering (Hons).

'I grew up with a mainly Pakeha background but at Ngā Manu Kōrero it was awesome to see so many fluent te reo speakers thriving in one place.'

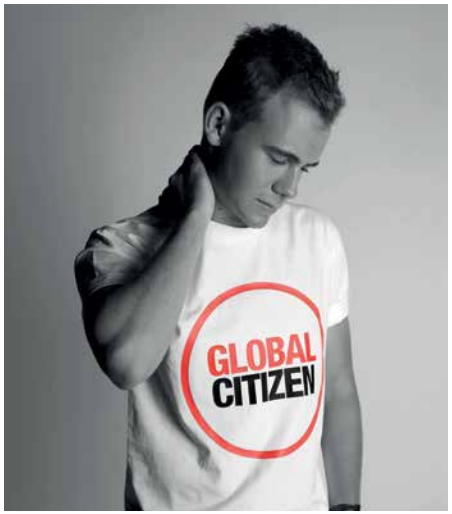
4 UC Global

Come to UC and get ready to see the world. We have exchange agreements with over 50 universities worldwide in North America, Europe, Asia and Australia. We also bring the world to UC. Our unique Erskine Fellowship programme brings 75 international academics each year to teach at UC. We don't just promise a global perspective, we deliver a global experience.

Natalija, Master of European Studies.

'The exchanges are one of the best opportunities you can get to travel and study. You can go to heaps of places – England, France, China, Asia, anywhere!'

5 UC Active



From the sea to the mountains and everything in between, UC is on the doorstep of a massive outdoor 'playground'. Grab your snowboard/surfboard/mountain bike/trail shoes and give it a go. On campus you'll have your choice of high-end accommodation and all the amenities of a fully equipped student village. At its heart, UC features a thriving student association plus over 130 student-led clubs covering every interest under the sun!

Robert, Arts and Law.

'You can finish class at 4pm and be mountain biking in the hills or swimming at the beach half an hour later.'

6 UC Enterprise

Get switched on, get hands on. Over 35% of our courses will get you out into the workplace or the community. The result? When it comes to interview time, you'll have the kind of real experience employers are looking for. Budding entrepreneurs will have the chance to shine with entré, UC Innovators and the UC Hatchery, which are dedicated to supporting innovation and student start-up ventures. At UC you'll create connections that count.

Tori, Bachelor of Criminal Justice.

'The cool thing about UC Enterprise and entré is that it's like doing a degree without doing a degree. It's getting me into the entrepreneurship side of things.'

7 UC Support

What are your strengths? Your interests? Your learning style? At UC you'll have a dedicated support system to help you find your way and make the most of uni life. From your first week you can pair up with a second or third year "student buddy" who will show you the ropes and make sure all your questions are covered. Approaching graduation your Co-Curricular Record — an electronic record of verified extra-curricular activities — will add that real-world edge to your CV.

Fa'amele, Bachelor of Arts.

'It's really good being able to show people the resources available, especially for those who haven't felt comfortable asking for help.'

We have a vision of people prepared to make a difference – tangata tū, tangata ora.

Our mission is to contribute to society through knowledge in chosen areas of endeavour by promoting a world-class learning environment known for attracting people with the greatest potential to make a difference.

We seek to be known as a University where knowledge is created, critiqued, disseminated and protected and where research, teaching and learning take place in ways that are inspirational and innovative.

Looking towards 2023, the 150th anniversary of our founding, the primary components of our strategy are to Challenge, Concentrate and Connect.

University of Canterbury Statement of Strategic Intent

An electronic copy of this publication and details of our 2017 research outputs are available from the Research & Innovation website www.canterbury.ac.nz/research

University of Canterbury
Te Whare Wānanga o Waitaha

Private Bag 4800
Christchurch 8140
New Zealand

Telephone: +64 3 369 3999
Facsimile: +64 3 364 2999
Email: info@canterbury.ac.nz

Donate
www.canterbury.ac.nz/alumni/give

Learn
www.canterbury.ac.nz/news

Connect
www.canterbury.ac.nz/ucconnect

www.canterbury.ac.nz/research

UC
UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND