inSCight

Inspiring stories from the Faculty of Science

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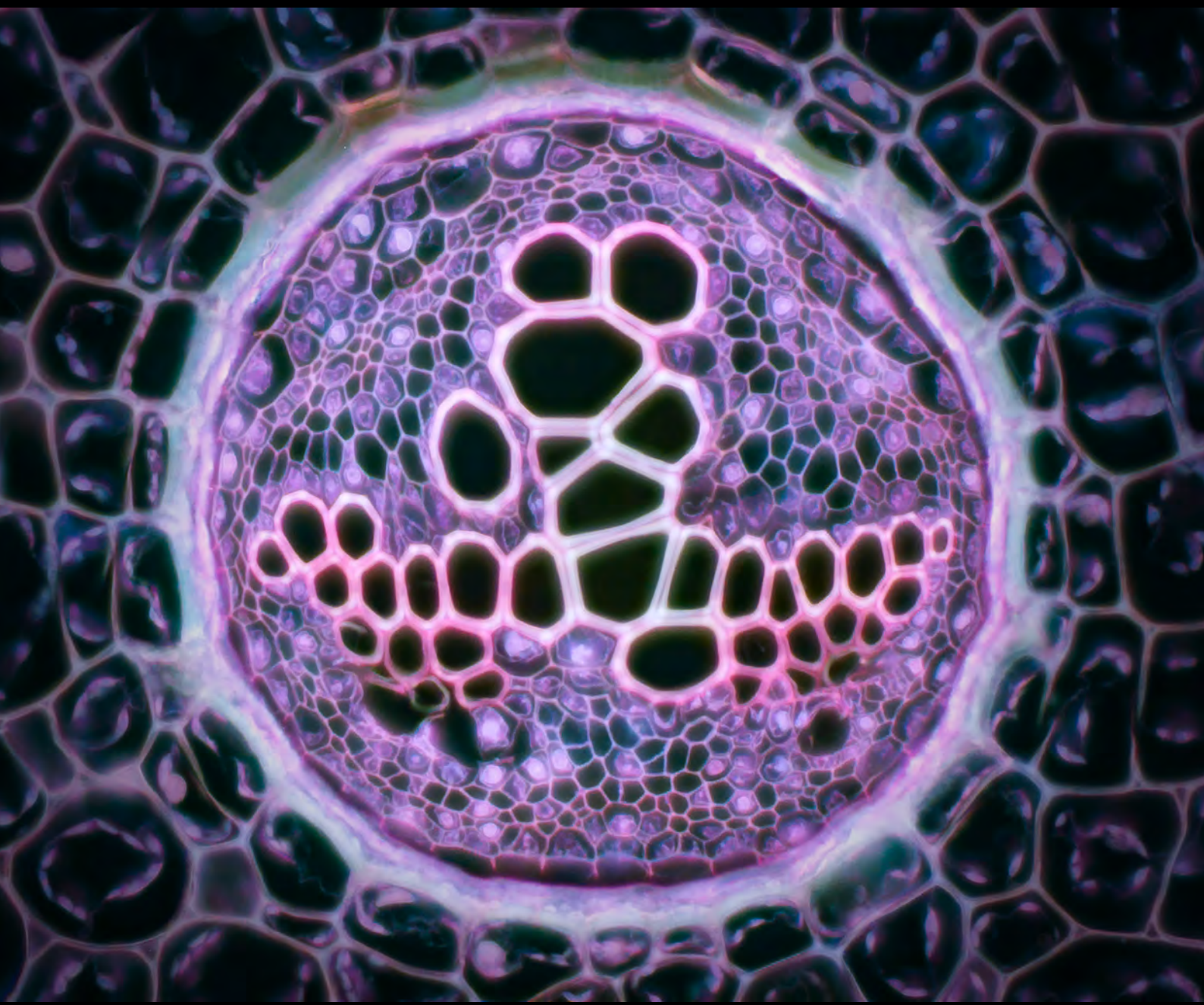

Diversity in Science

Valuing variety

Prime Minister's Chief Science Advisor Professor Juliet Gerrard reflects on her first six months in a vital role

Suffrage 125: Women in Science

We celebrate a spectacular year for our women scientists

Mātauranga Māori and science

How can we improve the way scientists connect and work with Māori?

THE UNIVERSITY OF AUCKLAND
Te Whare Wānanga o Tāmaki Makaurau
NEW ZEALAND

SCIENCE

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December 2018

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We also welcome feedback and suggestions about this publication. If there's something you would like to see in the next issue, don't hesitate to contact us.

InSCight is available digitally – please email us if you would prefer to receive the magazine in this format.

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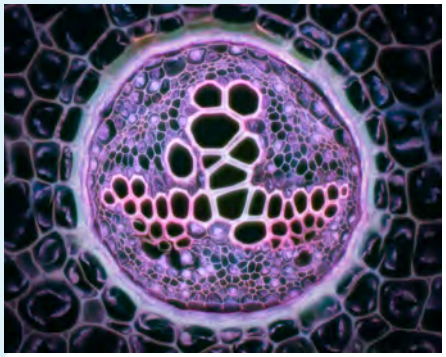
Joan Dingley, who was honoured in the temporary renaming of the School of Biological Sciences, wrote her masters thesis on wheki, the New Zealand rough tree fern. Here we see the natural autofluorescence of a fern rhizome captured using a Leica DMR microscope at x40 magnification.

Cover photo: Dr Charlotte Johnson



A word from the Dean

WELCOME TO THE 2018 EDITION OF INSCIGHT. This edition has a theme: diversity in science. As an umbrella for an inquisitive set of disciplines, science is naturally diverse. From a subject perspective alone, it is incredibly broad. Our own Faculty of Science encompasses 10 schools and departments covering an even larger number of disciplines, ranging from the mathematical and computational sciences through the physical sciences, life sciences, and aspects of the social and health sciences.

Because of this diversity, and the natural tendency for people to work with people in their own discipline, we are spending effort to break down barriers between our discipline silos.

In teaching, we have just revamped the Bachelor of Science to reemphasise the strength that its breadth embodies – a feature that many of our alumni feel has given them a competitive advantage in their subsequent careers.

Other examples are the creation, some years ago, of the Institute of Marine Science, which is explicitly multi-disciplinary in nature, the philanthropically funded George Mason Centre for the Natural Environment, which sponsors multi-disciplinary approaches to major environmental issues, such as water pollution and microplastics (see page eight), and Te Ao Mārama, a centre to explore fundamental questions transcending discipline boundaries such as, what is the origin of life? Is our universe part of a much larger multiverse? What types of planets circle other stars?

More recently the faculty has sponsored eight multi-disciplinary research themes to answer five major University-wide challenges. The aim here is not to abandon fundamental discipline-based research, but to scaffold from that to draw on the diversity of our research strengths in order to answer larger questions.

Many approaches to scientific challenges

Another way in which our science is diverse is the differing methods and measures we use to undertake it. While all disciplines subscribe to the scientific method, that is expressed in quite different ways, including deep theoretical studies, strongly laboratory or field-based activities, model and simulation-based approaches, social science

In this issue

methodologies, through to the sorts of design, proof of concept, and evaluation approaches seen in computer science, computational statistics and advanced manufacturing approaches emerging from physics and chemical sciences.

A further variant is the incorporation of Mātauranga Māori viewpoints into our science, exemplified by the pioneering work of Emeritus Professor Michael Walker and his research on intertidal organisms, and more recent work by Centre of Research Excellence (CoRE) Te Pūnaha Matatini Principal Investigators Dr Dan Hikuroa and Dr Cate Macinnis-Ng, and Dr Tara McAllister (see page six). This diversity contributes enormously to our understanding of the world we live in.

Harnessing that methodological and disciplinary diversity can be incredibly powerful. An example can be found in another of our CoREs, the Maurice Wilkins Centre (MWC) for Molecular Biodiscovery. Scientists in the MWC connect biological understanding of diseases through to medicinal chemistry, uncovering drug candidates that may cure those diseases, passing those drug candidates on to medical researchers, who test them in clinical trials. A spin-out company, SapVax, founded by MWC investigators Distinguished Professor Margaret Brimble, Professor Rod Dunbar and Dr Geoff Williams, is commercialising a breakthrough immunotherapy technique that provides a 'personalised medicine' approach to treating cancer.

Another way of harnessing methodological diversity is to adopt techniques developed in one area of science for use in other areas. Te Pūnaha Matatini, for example, takes mathematical and statistical modelling techniques, typically used in understanding complex physical problems, and applies them to areas such as economics, healthcare, social welfare and ecology.

Increasingly, when we do science, our work is being complemented by machine learning and artificial intelligence tools and I can see the day coming when we collaborate with a diversity of artificial intelligence assistants who will magnify our ability to answer scientific questions more quickly. Some aspects of this are explored on pages 16 and 17.

A diverse community brings fresh insights

A more obvious exhibition of diversity in science is in those undertaking it. Gone are the days when scientists were bearded men in white coats, despite that still being a popular image. Our faculty's student population is now more balanced and is seeing significant growth in Māori and Pacific student enrolment and achievement, as well as a wider spread of ages, as people 'upskill' careers.

Women are still under-represented at senior academic levels, but that is rapidly changing, with the faculty Professoriate increasing from eight percent to near 30 percent women over the last 10 years. There is clearly some way to go, but we did take pride in recognising some of our early alumnae, and the glass ceilings they broke through, by temporarily renaming the faculty and its schools and departments in their honour as part of the 125th anniversary of Women's Suffrage in New Zealand. We have also permanently renamed the plaza atrium of our Science Centre to honour Kathleen Curtis, one of our early biology alumnae (see page 11).

The Kathleen Curtis Atrium: symbolic of the glass ceiling broken by our early alumnae (page 11).

Celebrating our successes

Finally, our diversity can be seen in the myriad ways in which our Science academics have had impact, including:

The late Dr Bill Ballantine, who successfully lobbied for the first 'no-take' marine sanctuary at Leigh

Emeritus Professor Philippa Black, who helped us understand the geology of Northland and New Caledonia

Professor Margie Wetherell, who helped develop discourse analysis

Associate Professor Ross Ihaka and Dr Robert Gentleman, who invented the R statistical programming language

Associate Professor Renate Meyer, who developed statistical techniques used by those who first observed gravitational waves

Distinguished Professor Margaret Brimble, who earlier this year, became the first New Zealand resident woman to be elected as a Fellow of the Royal Society

Professor Rod Dunbar, who grows skin for therapeutic use

Dr Annette Henderson, who helps us understand how children think and learn (see page 18)

Professor Juliet Gerrard, who, in her new role as the Prime Minister's Chief Science Advisor, is directly influencing the way scientific evidence is perceived by Government (see page four).

So I do hope you enjoy this issue. Science is in good heart at the University of Auckland and recognises that in our diversity, we have strength.

PROFESSOR JOHN HOSKING
Dean of Science, University of Auckland

Celebrating science in Aotearoa

Professor Juliet Gerrard's day is nothing if not diverse. A quick look at her Instagram and Twitter feeds only reinforces the broad, far-reaching nature of her role.

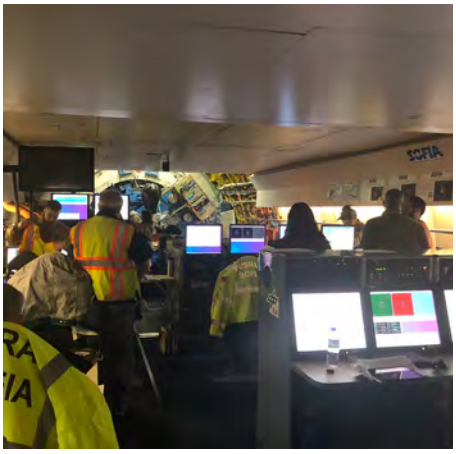
NOW, ALMOST SIX MONTHS into her new job as the Prime Minister's Chief Science Advisor, she still finds the long hours and varied schedule stimulating.

She's also managed to tick more than a few science experiences off her bucket list. One of the first was going up on NASA's SOFIA aircraft – a flying observatory.

"We flew out of Christchurch in what is just a normal aircraft. The difference is that it goes up to the stratosphere – to just above where commercial aircraft normally fly – where there is no water in the atmosphere. NASA astronomers need to get above the water vapour so they can see clear images of what they are observing through their infrared telescope.

"It felt a bit like *Star Trek* on the deck. We were observing the formation of a black hole and the polarisation around the black hole. Personally exciting for me was being able to see the Aurora Australis [the southern lights]. It's just amazing to be up there."

Juliet (right) with Prime Minister Jacinda Ardern in front of the wall of 'sticky' issues from New Zealand's research community.



Aboard the NASA SOFIA's flight deck with the infrared telescope in the background.

Value in kaupapa Māori research and diversity

Juliet says another key experience has been engaging with Māori researchers, understanding more about the kaupapa Māori research methods and seeing fantastic examples of where kaupapa Māori methods and western science have come together to really strengthen a project.

"There is a really nice example in Kaitaia where the Maurice Wilkins Centre [and Peter Shepherd in particular] has teamed up with the Moko Foundation run by Lance O'Sullivan. They are working on a community-based genetic project looking at people's levels of sugar absorption. It was a real privilege to see how they brought the whole community together and made sure all the stakeholders – Māori TV and local elders were also there – were on board.

"They started with a completely different framework than we would have used in our labs in Auckland. It was about who owns the project, who owns the data, and who wants to know the answers. It's more about the community asking science to help, rather than science telling the community what they should do. The holistic Te Ao Māori approach is a total reframe of the questions and really adds value to scientific research."

Juliet has also been working with the Ministry of Business, Innovation and Employment's (MBIE) diversity team, who released their Diversity in Science Statement in September about how to nurture more women through to senior positions; how to encourage more Māori youth to take the sciences at secondary school and beyond; and how to carve out career pathways for researchers in demographics that are currently under-represented.

"I can't do it personally from this office, but I can lend support to other initiatives that are going on in the diversity and inclusion space," she says. "We want the science community to be more representative of New Zealand's population than it currently is, and ultimately we're hoping to shift the science culture a bit."

Science issues are universal

Juliet's most immediate job has been developing a three-year working plan for the Prime Minister. She traversed the country to "scoop up" the issues the research community think is important.

"I then discussed these with the Prime Minister to see what Cabinet think is important in terms of policy – because there is no point in advising into a policy wilderness."

Her conversations culminated in a live document which was signed off early November and published online. The current projects have been split into active projects (including plastics and anti-microbial resistance) and hot topics (including 1080 and climate change) and will be updated regularly as priorities evolve.

Surprisingly – or maybe not so surprisingly – these science issues and the role of Chief Science Advisor are not unique to New Zealand. There is an international community of practice in 21 APEC countries, most of whom met at a forum in Papua New Guinea in August. Juliet says it was revealing that lots of the issues that New Zealand is grappling with, other countries are grappling with too.

"I'd imagine there would be more variety, but everyone is interested in artificial intelligence, the future of work, sustainability, agriculture, precision agriculture, climate change, antimicrobial resistance and more – the same issues keep popping up all across the world."

It was also interesting for her to see that while New Zealand is seen as conservative on issues like genetic engineering, we are leading in our approach to climate change, because the Government is relatively progressive compared to some other countries.

"And even though we are only beginning to weave indigenous thought into our scientific thinking – with organisations such as Te Kotahi Research Institute in the Waikato sharing their expertise internationally – we are also considered to be leading in this regard. People look to New Zealand to see how to do it – which is great!"

Clear, transparent communication

Juliet has not yet conducted many public forums, but considers public engagement and communication an important part of her role. She is keen to make sure that everything the office advises is done in an inclusive, transparent way and that they've got the science community behind that advice.

"I want to make this Office rigorous, transparent, inclusive and accessible. Those are the four principles published in *Nature* that make science advice useful," she explains.

"We want the public to see what we are doing and what we've advised, so our work needs to be clear and accessible to the public – not just to the Government."

With that in mind, she made a deliberate decision to utilise social media and connect people with the science she is exposed to on a daily basis.

"My Instagram is new and all about celebrating science. The Twitter account I inherited from Sir Peter [Gluckman], and I've tried to build on what he started by making it a little more interactive to reach a wider audience."

Juliet with the Hon James Shaw, Minister for Climate Change, in Antarctica.

Juliet is pleased to see that she is slowly building quite an audience of science enthusiasts. At the time of printing she has more than 6,500 Twitter followers and just over 900 Instagram followers.

There is a great deal of work to get through in the next 30 months, but Juliet is relishing the opportunity to meet head-on the challenges that will roll her way. When asked if she would be interested in staying in the role beyond her three-year term, she says it is too early to really answer that question, but admits, "I've enjoyed it so far."

When six months can take her from the stratosphere to the icy continent of Antarctica, who can disagree?

Juliet is employed by the University of Auckland and seconded to the role of Chief Science Advisor part-time for four days a week. The remaining day (20 percent of her time) she retains her position as a University professor supervising her postgraduate students. She is based in Auckland, rather than Wellington, to ensure she meets the obligations of her role as an independent advisor.

The Office of the Prime Minister's Chief Science Advisor Kaitohutohu Mātanga Pūtaiao Matua ki te Pirimia

Website https://www.pmcsa.ac.nz/
Twitter @ChiefSciAdvisor
Instagram @nz_chief_science_advisor

"I want to make this Office rigorous, transparent, inclusive and accessible. Those are the four principles published in Nature that make science advice useful"

He waka hourua rua ki te titiro ki te heke mai

A double-hulled canoe to look into the future

If ever there was a moment when two worlds collided for earth scientist Dr Dan Hikuroa it was probably at Whakatāane's Te Whare Wānanga o Awanuiārangi where he taught geology and Mātauranga – or Māori knowledge – as a PhD student. It got him thinking, "Wow, these two different ways of seeing and knowing the world were open to me and I was able to hold two opposing ideas simultaneously."

"We firmly believe that the most enduring solutions cannot be found in one body of knowledge in isolation"

FAST FORWARD TO 2018, where he is now a senior lecturer in Māori Studies at the University of Auckland, Dan is collaborating in a project funded by MBIE's Te Pūnaha Hihiko: Vision Mātauranga Capability Fund that aims to improve the way in which scientists connect – and work – with Māori.

The Mātauranga research team includes ecologist Dr Cate Macinnis-Ng and environmental scientist Dr Tara McAllister, who Dan describes as the perfect candidate to lead the project because she can happily walk in both ways of knowing. "A remarkable young woman with a PhD in science, but also strong in te reo and with a solid and growing understanding of Mātauranga."

Describing the partnership between the Te Pūnaha Matatini Centre of Research Excellence and the Canterbury-based environmental and resource management advisory firm Mahaanui Kurataiao Limited as *he waka hourua rua ki te titiro ki te heke mai* – a double-hulled canoe to look into the future – Dan says the proposal to work together with communities to identify the challenges they face came about through discussions about weaving Mātauranga and science across projects rather than just relying on scientific explanations and answers.

Collaboration is a key ingredient. As well as being a fundamental part of the University's Centre of Excellence model, it is also a fundamental principle of teaching and learning in Mātauranga Māori. So much so that Dan says researchers and scientists need to recognise that they cannot simply march in without asking what benefits the community gains from engaging in this research. "If not driven by the community, these types of projects just don't go anywhere."

Unlocking the innovation potential of Māori communities and resources forms part of Mātauranga policy and Dan says his advice is that "we must ask communities what their challenges and dreams are and then try to co-create ways forward."

As a 'team', the researchers, Mahaanui and the community will attempt to answer questions that the community wants answered drawing from all available knowledge. "If we're just looking at science," Dan says, "we don't think it will deliver us the solutions. It's our responsibility to bring together all knowledge. What's more, we firmly believe that the most enduring solutions cannot be found in one body of knowledge in isolation."

That means the researchers will draw from Kaitiakitanga (guardianship) as well as conservation ideas, cutting-edge science, and really old and new Mātauranga knowledge "because of course Mātauranga isn't static, it's dynamic, it's constantly being added to and updated and tested" says Dan.

While the project is still in its infancy, it will be conducted in a reflective way so the research team can understand what works best for the different groups involved. From Dan's perspective, tapping into Tara's previous relationship with Mahaanui is "already beginning to deliver" on the intent of the Vision Mātauranga Capability Fund.

Capability building among individuals and groups is another positive, and Dan says that asking

questions, and who gets to ask them, is important. "The mantra that I always bring to that is 'progress, not perfection'. We're always striving for it, but as long as we're making progress, getting iteratively and incrementally better."

One of the more potentially tangible outcomes is the intention to develop te reo science materials appropriate for school curricula, and kura kaupapa Māori language immersion schools, to make science more accessible to everyone. Describing rangatahi (the younger generation) as "natural scientists anyway", Dan says "we're just trying to find mechanisms to engage our rangatahi with that learning."

Another fundamental principle of teaching and learning in the Mātauranga Māori space is that success is not determined by who gets an A plus. "That wouldn't be success in a Māori sense" says Dan. Success would be "everyone gaining an increased level of understanding on a particular thing that we're interested in."

Mātauranga, he says, is a process for generating knowledge which follows the same steps as the scientific method but is packaged and codified differently – so the idea is not to introduce the word science too early. In terms of curriculum resources, Dan says "we need to tailor them to what the Ministry of Education wants them to look like but we're going to frame it from within a Māori worldview."

While he accepts that Mātauranga Māori could be described as a holistic approach which tries to understand the system as a whole, Dan resists any temptation to label it as Māori science. Wearing his 'political hat' he prefers Mātauranga because "if we call it Māori science it could be viewed as another process of colonisation ... yet all those things we like about science, that it's rigorous, that it's precise, that it's accurate, we can show that in Mātauranga as well."

As a recognised expert on integrating indigenous knowledge and science, Dan has been involved in numerous environmental projects including Te Awaroa (Voice of the River) which aims to create a national movement of Kiwis taking action to care for waterways by understanding the issue from the perspective of the river.

Above and left: Dr Tara McAllister in the field. Right: Dr Dan Hikuroa

Believing that scientific understanding is "out of balance" with Mātauranga, Dan wants to "flip how we're thinking about rivers" – from what we can extract from them, to what the river would think. Inspired by the Te Awa Tupua Act (Whanganui River Act 2017), and the National Policy Statement on Freshwater Management that embraces Te Mana o te Wai, the Te Awaroa project combines scientific expertise with Mātauranga and community stories that has created a collective voice of the river which will lead to better decisions.

"We're hoping that if we can bring together all of those voices as one and say this is what the river is saying, this is what the river wants, this is what the river needs – then we can frame it from the perspective of the river as opposed to the perspective of what humans need."

Likewise, Dan is also critical of New Zealand's approach to what some observers describe as "conservation by killing" whereby pests are eradicated and conservation land is locked up. An alternative way of thinking is the Te Pūnaha Matatini project entitled Mai i ngā maunga ki te tai (from the mountains to the oceans), which seeks to address pressing environmental issues by drawing on all bodies of knowledge rather than just relying on a scientific explanation.

According to Dan, it's time to start thinking about the kinship-based approach embodied in Kaitiakitanga. "Kaitiakitanga is about managing those relationships we have with the Taiao (natural world) in a balanced way." For those trying to fathom his philosophy on all this, the digital signature on his University of Auckland email account just might hold the key:

Whatungarongaro he tangata, toitū he whenua

People pass on, but the land is permanent

A world made of plastic

Plastic – as a fully synthetic, commercially successful substance – was invented by Leo Baekeland in 1907. In just 111 years plastic has not only been used in a multitude of products worldwide, it has also become an increasingly unavoidable environmental issue.

DESPITE EFFORTS TO RECYCLE plastic, its durable nature and slow degradation has led to mountains of waste, and the presence of microplastics in our food chain.

These tiny fragments enter the food chain via freshwater and marine ecosystems quite easily, because you cannot always see them and they are the right size for organisms to eat.

In October, a national team of 18 scientists was awarded an MBIE Endeavour Fund grant of $12.5 million to conduct a five-year research project exploring the impacts of microplastics on New Zealand.

Under the auspices of the Institute of Environmental Science and Research (ESR), the team is led by Dr Olga Pantos (ESR) and Dr Grant Northcott (Northcott Research Consultants) and includes top researchers from Scion, the Cawthron Institute, the University of Canterbury and the University of Auckland.

Each team member is responsible for different steps in the project, but together they will apply their expertise to determine if microplastic contamination poses a risk to New Zealand's unique ecosystems. The project includes a social science and Vision Mātauranga component and is guided by an advisory panel of experts. It will run until October 2023.

Seven University researchers from the Faculty of Science are involved:

- **Associate Professors Kevin Simon** and **Giovanni Coco**, and **Dr Melissa Bowen** from the School of Environment
- **Dr Gavin Lear** from the School of Biological Sciences
- **Dr Louis Tremblay** from the School of Biological Sciences and the Cawthron Institute
- **Dr Xavier Pochon** and **Dr Anastasija Zaiko** from the Institute of Marine Science and the Cawthron Institute

Associate Professor Kevin Simon says that microplastic is a popular issue with the public and the number of studies addressing plastic is growing exponentially, as researchers focus more on plastic pollution.

Associate Professor Giovanni Coco agrees that wherever you go, people want to know how much microplastic is being accumulated – and where.

"It's normal to want to know these things because the problem with microplastics – and the reason why we are all worried – it that it is starting to enter the food chain. That is the issue and because not a lot of work has been done we have to attack it from all sides to grow our understanding."

"Plastic is a wonder substance, really, it's hygienic and it's waterproof. There are a lot of advantages to using it, you just have to figure out how to use it wisely"

– DR MELISSA BOWEN

Along with colleague Dr Melissa Bowen, they will be focusing their components of the project in Auckland, primarily because of the strong link between the city and marine environment, and the hundreds of streams within Tāmaki Makaurau that flow into estuaries and on to the ocean.

"There is a very big knowledge gap in documenting what plastic is in our freshwater and marine ecosystems in Auckland," Melissa says. "We need to be thinking about who is producing it, where you find it, where it is ending up, and how it is affecting different parts of our environment."

Working as a team

Melissa and Giovanni will concentrate on the accumulation and distribution of microplastics in the Waitemata Harbour. They are building hydrodynamic models – mathematical models based on measuring real water flow – to figure out where the microplastic is coming from, how the water is moving microplastics around and where they are going.

"We are looking at the 'near field', as people think a lot of the plastic is not going very far, and instead coming right back onto the shore," Melissa explains. "We hope to find out if this true."

Melissa will be doing all the measurements and will 'ground-truth' the model. Then Giovanni will develop the set of equations that will create the model and describe how water moves. The modelling component of the work will be supported by a PhD student before it is tested and validated.

Another PhD student will work on a different component looking at more of the ecological effects of plastic and the ecotoxicological implications for freshwater biota, as well as food webs and what kinds of microplastic organisms are ingesting.

"It's a multi-faceted question," Kevin says, "but we are intending to tease that apart by working with individual species in the lab, testing the effects of different types of microplastics and plastic contaminants, and what happens when organisms consume them."

Work will start in simple laboratory systems at Cawthron and the University of Auckland, then shift to the Auckland Ardmore Field Station where they can create artificial ponds to replicate different treatments and environmental conditions. Tests will expose individual species to different plastics – with and without other contaminants.

"Eventually we want to scale it up to more complex systems in which we will have not just

PhD candidate Nadia Dikareva (Environment) is sampling plastics in freshwater and estuaries and looking at the spatial distribution of plastic, as well as the historical accumulation of plastic across different time scales. Her current work will inform and provide some of the groundwork for the Endeavour Fund project.

Microplastics are tiny pieces of plastic fragments less than five millimetres in length. They include plastic film, beads and thread from cosmetics, textiles, industrial processes and the degradation of larger plastic products.

single species but everything from algae up to fish – entire mini-ecosystems – so we can run more intricate experiments," Kevin explains.

Other components of the Endeavour project involving faculty researchers include: investigating microplastic-associated microbes and their role in biodegradation (Dr Gavin Lear); whether the plastisphere poses a biosecurity threat (Dr Xavier Pochon and Dr Anastasija Zaiko); and assessing the toxicology responses of organisms exposed to microplastics and their associated contaminants (Dr Louis Tremblay).

Meeting some of the challenges

Melissa and Giovanni are anticipating a number of challenges as they work out how to create a realistic model that simulates the flow of microplastic through an estuarine environment.

"There is some uncertainty around how we work out how water would carry and disperse microplastic film and fibres," they say. "We need to find a way to measure it accurately and have results that are sensitive enough to accommodate changes in the model so that it can be applied in different locations."

One of Kevin's initial challenges is simply where to start, because the research is still new and there are a lot of variables to deal with, like finding out which plastics are causing the biggest problems.

"There are all sorts of different plastics, different sizes and chemical formulations, new versus weathered plastic, lots of different contaminants that can be absorbed onto them and certain types of plastics may release chemicals in certain conditions," he says.

"Once we find out what types of microplastic we actually see in places, and what types organisms ingest or interact with, we can use that information to develop our toxicity tests in the lab."

An overarching challenge facing all researchers is the speed with which this field of research is rapidly changing and advancing.

"A big chunk of what we are doing is trying to come up with standardised methods, so that what we do across all the lab groups in this project is consistent, but is also internationally compatible and up to date with emerging technologies," Kevin explains.

Giovanni adds, "There are many interesting projects going on in many countries. For example, researchers at the University of Sydney are looking at video imaging and detection technology that will distinguish between sand and microplastics in the water.

"And there is a lot of willingness to share knowledge. We need to meet and discuss our work as an international network of microplastic researchers, so we can advance things together, rather than separately."

What more can we do?

The issue of plastic and microplastic, and what to do about both, is extremely complex.

"At the moment we cannot answer the questions that people are asking us," Kevin says. "We are in the difficult position of supposedly being 'the authority', but we haven't done the work, so we can't provide the answers.

"By taking full advantage of the funding that is available for plastics research and building the evidence-based body of knowledge around microplastics, hopefully we will be able to tell people 'we should not use that stuff' or 'it's not a problem'."

The trio envisage that when their components of the project are complete they will have contributed to the methodology to model microplastic accumulation and dispersion patterns in our environment and support local authorities to regularly monitor microplastics in their waterways.

"If we find out certain types of plastic are a big problem, then we will have the methods and information to guide environmental or food safety testing, for example," Kevin says. "Or maybe – through our research on microbes – we will find organisms that can degrade plastics, or develop technologies that can accelerate plastic degradation."

Our Endeavour researchers believe solutions are always going to involve a combination of approaches:

- Good filtering systems to capture microplastic before it enters our waterways
- Clean-ups targeted towards the source of microplastic in streams, rivers and estuaries
- Avoiding using certain kinds of plastics, and certain kinds of plastic compounds once we know they are problematic
- Biodegradable options, such as paper, to replace single-use plastic items

"Getting rid of shopping bags is great," Kevin adds, "But maybe we'll find out we are focusing on the wrong plastic and some other type of plastic is more of an issue.

"That's part of what we want to find out: which microplastics are causing the problem. Because we are not just going to stop using every type of plastic right away. It is going to take time.

"In the long term, it's about making smart decisions about what plastics we choose to use and how we deal with microplastics."

There are other research projects focused on microplastics taking place within the Faculty of Science. In 2017, the George Mason Centre for the Natural Environment awarded funding to 'Plastic pollutions and solutions' – a project studying the impact of microplastics and associated chemicals that leach from plastics products – involving Associate Professor Kevin Simon, Dr Gavin Lear and PhD candidate Nadia Dikareva. More recently, Dr Julie Hope from the Institute of Marine Science was awarded a 2018 Marsden Fund grant for 'The sticky link between microalgae, biofilms & microplastics: An interdisciplinary approach to understand the resuspension and transport of microplastics'.

Developing policy and driving decisions

Physics and Mathematics alumnus Duncan Matangi has absolutely no regrets about swapping from Engineering to a Bachelor of Science so he could focus on subjects he enjoyed studying the most.

"I HAVE AN INTEREST in, and aptitude for, the hard sciences," Duncan explains. "So I liked the challenge offered by higher-level, undergraduate Physics and Maths courses as well as the breadth of topics available."

Since he graduated in 2015, Duncan has forged a career in the public service, employed first as a policy analyst with the New Zealand Treasury, and now as senior analyst with the Ministry of Justice, where his work involves providing advice to Ministers in his areas of expertise: Treaty policy, Budget process, and public financial management.

For many of us, the intricacies of the political environment, and the day-to-day operations of government Offices and Ministries are a mystery. For Duncan, they're a relished opportunity to work closely with senior politicians, and be involved (and influential) in decisions that affect New Zealand.

THE MCGUINNESS INSTITUTE

Your career so far has seen you move from the New Zealand Treasury to the Ministry of Justice. Why did you choose to make the move from finance?

As a public servant, you have the opportunity to either become a generalist (with a broad skill set in policy-making and government), or to specialise in a particular policy area. I was looking for opportunities that would allow me to use the skills and knowledge I had built-up at the Treasury in a different environment. In reality, the majority of my work at Treasury wasn't finance specific, but related to the mechanisms of government, and the policy process, which are easily transferable to other policy roles in agencies.

Tell us a bit about your current role as part of the Māori Crown Relations Unit. Can you explain what your role involves?

My unit looks at how the Crown can better engage with, partner with, and support Māori people and organisations, to fulfil the relationship envisaged in the Treaty. We do this in a number of ways, like helping build agencies' capabilities in engaging with Māori on policy, and through developing policy on the application of the Treaty to policy.

The application of your Physics and Mathematics training to your work in the Treasury seems a straightforward one, but how do you transfer your science knowledge to your current role, which seems more diverse?

Good policy analysis requires a number of skills. Logical thinking, concise writing, and clear communication are all critically important, and they're all skills that you develop through the course of any science degree.

Mathematics trained me to think logically and rigorously about complex issues. You have to set out your reasoning in arriving at a solution. This is very applicable to policy advice, as it is crucial to demonstrate how you have arrived at your proposal. A rigorous thought process helps cut through complex policy issues.

Physics taught me to write and communicate clearly and concisely, which is a valuable skill in the policy world, as decision makers need to be able to quickly absorb the information and key decisions you are outlining in your advice. Florid language, while pleasant to read, can inhibit the clear communication of ideas.

As your career progresses, each step will be more and more influenced by your work experience and less by your education. In this instance my work on Treaty negotiations at the Treasury allowed me to take a promotion and work full-time on similar work at Justice.

Can you tell us about a recent project that you've worked on?

My last project at the Treasury was helping with the implementation of the 'wellbeing approach'. This approach guides the Government to take a broader view of what success means, by measuring and reporting on the breadth of factors which contribute to people's wellbeing – and not just restricting government reporting to financial measures.

What has been the highlight of your career so far?

Getting exposure to a wide range of Ministers and their working styles has been valuable for me in understanding how decision-making works at the top level of Government.

Working on the delivery of the annual Budgets has been a particular highlight, as it's one time of the year that the work of the Treasury and the decision-making of the Government is presented and considered by the wider public. Advising the Ministers of Finance over those Budgets was a valuable experience and taught me a lot about the value of high-quality advice that serves its purpose well.

What kind of impact do you hope your work will have?

My focus in providing advice is that it serves Ministers well. Accurate information is crucial for Ministers to make good decisions but they are incredibly busy. Concise, well-framed advice is often more effective than thorough, information-heavy reports.

I hope that I can bring a pragmatism and clarity to complex issues, and use my experience of how the system of Government works to improve how we work to improve the lives of New Zealanders.

Where do you see your career heading? What else would you like to achieve?

I'd like to work in management in the public sector. I enjoy helping people develop their skills, and I enjoy shaping and positioning advice at a high-level rather than being bogged down in the details.

I'd also like to be an advisor to the Prime Minister at some point!

What drives you?

I'm driven by doing the best job I can at whatever I'm doing. Being able to influence how New Zealand is governed for the better is something I am passionate about, and it drives my career ambitions and aspirations.

Finally, tell us something about yourself that we can't learn by Googling you!

I used to fly planes quite regularly back when I was a member of the Air Training Corps.

SUFFRAGE 125 Whakatū Wāhine

From struggle to celebration

Women in Science

Two thousand and eighteen: 125 years since the New Zealand Electoral Act declared that for the purpose of voting the word 'person' would include women – 19 September marks the anniversary of Women's Suffrage in New Zealand. As we acknowledge the significance of Suffrage 125, we reflect that 2018 has been a remarkable year for our women in science, with so much to celebrate.

IN MAY, DISTINGUISHED Professor Margaret Brimble, from the School of Chemical Sciences, was elected as a Fellow of the Royal Society of London – the first New Zealand-born woman to have received this honour.

In June, Professor Charmian O'Connor, also from the School of Chemical Sciences, was made Dame Companion of the Order of New Zealand for her services to education and chemistry. And, in July, Professor Juliet Gerrard from the School of Biological Sciences was appointed Prime Minister's Chief Science Advisor – the first woman in the role.

But we didn't stop there. Not content with celebrating the achievements of our current women scientists, we began an ambitious project to encourage more women to study science by raising the profile of all our women scientists and their contributions to scientific learning.

In September, to commemorate 125 years of Women's Suffrage in New Zealand, we obtained permission from University Council to temporarily rename our schools, departments and the faculty itself to honour alumnae of note, who have been pivotal to the history of science in New Zealand and beyond. During that same week we launched our landmark Women in Science Campaign (see inset box page 14).

In November, in an act symbolic in its intent and permanence, we formally named the atrium of our flagship Science building after one of our most distinguished alumnae – Dr Kathleen Curtis. The names of buildings and places play a prominent, visible role in our University, and the Kathleen Curtis Atrium is an enduring reminder of the pioneering contributions women have made to the history of science, and to our University. ➤

"Higher female participation in teams can help to overcome biases, ensure more equal participation and broaden viewpoints"

– HON DR MEGAN WOODS

Left: The Hon Dr Megan Woods, declares the Kathleen Curtis Atrium officially open.

Above: The Royal Society Te Apārangi generously gifted this portrait of Dr Kathleen Curtis to display in the Atrium.

"A girl needs all the qualifications she can get, because you never know what life will hand out."

— VIVIENNE CASSIE COOPER

"No one else had been through the social science training that I had been through. In terms of the science, the study of the science, I was a loner."

– DAME MIRA SZÁSZY

Dame Mira Szászy's son Philip (holding Dame Mira's graduation portrait) and his wife Annette.

"Women should be encouraged to tackle anything that men can do. It is good for society to have as many women as possible conversant with the mindset and knowledge of the hard sciences."

– JANICE EMENS MCADAM

PhD in Biological Sciences graduate Dr Leilani Walker, granddaughter of the reknowned Dr Ranginui Walker, addresses guests at the Kathleen Curtis Atrium naming ceremony. Leilani's full speech is available on her website www.leilani-walker.com

Read the full biographies of these trailblazing women scientists on our dedicated Suffrage 125 Science website

www.suffrage125science.auckland.ac.nz

During her keynote address at the Kathleen Curtis Atrium naming ceremony, the Hon Dr Megan Woods, Minister for Research, Science and Innovation, referred to the growing body of evidence showing that diversity leads to greater creativity, innovation and productivity, and has the potential to improve the quality of research and the relevance of outcomes for society.

The University publishes an annual report on its progress in the equity space, and Dr Woods acknowledged the University's commitment to transparency. However, while the Faculty of Science community is more diverse than ever before – 51 percent of our 8,000 equivalent full-time students identify as female – more progress is needed, particularly in the equal representation of women in senior science positions.

"Higher female participation in teams can help to overcome biases, ensure more equal participation and broaden viewpoints which can, in turn, spark new discoveries", says Dr Woods.

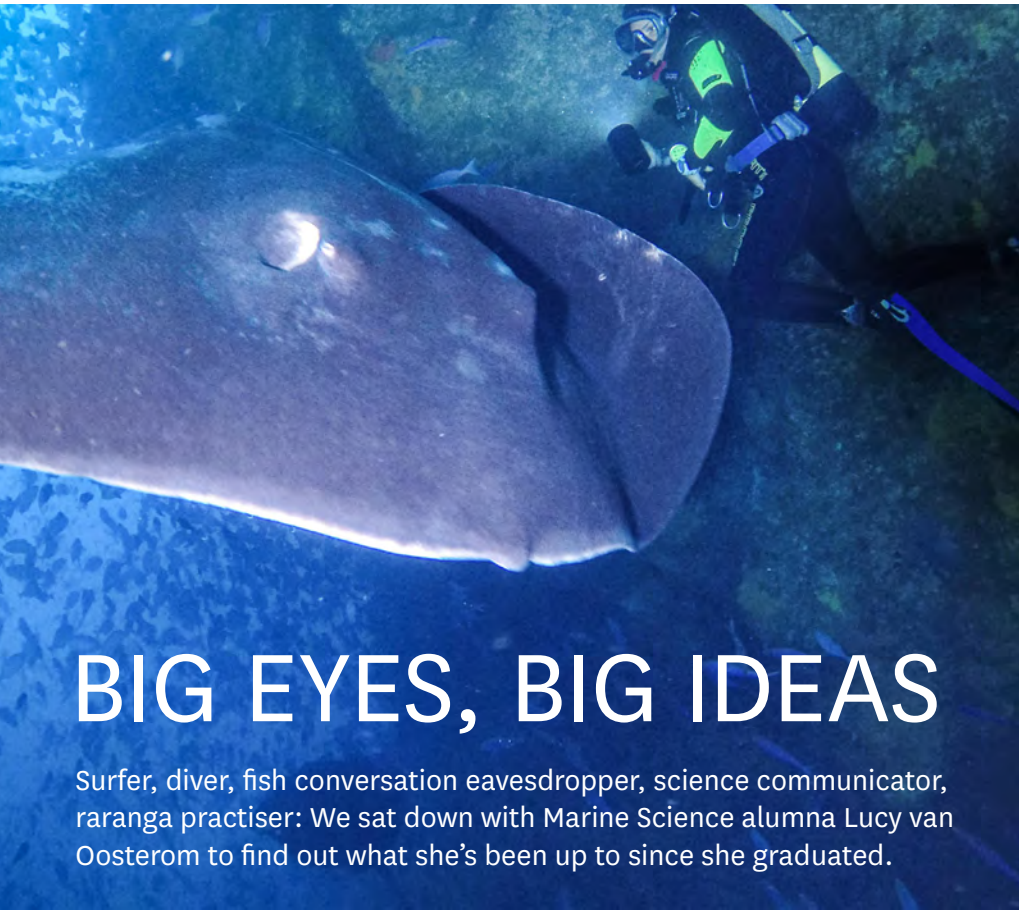
"A representative scientific workforce is more likely to pursue solutions that put the long-term wellbeing of the New Zealand people and our environment at its centre."

Faculty of Science Associate Dean Equity, Professor Virginia Braun, says that while momentum has been building in recent years, there is still the need to proactively support the diversification of science.

"We cannot simply wait for this change to happen. We need to look at ways to act, and to do things differently."

These actions are our steps towards doing things differently – towards doing the science that New Zealand will need in the future.

Read the Hon Dr Megan Woods' full speech from the Kathleen Curtis Atrium naming ceremony at www.beehive.govt.nz/speech/opening-kathleen-curtis-atrium



BIG EYES, BIG IDEAS

Surfer, diver, fish conversation eavesdropper, science communicator, raranga practiser: We sat down with Marine Science alumna Lucy van Oosterom to find out what she's been up to since she graduated.

GROWING UP IN the Bay of Islands, Lucy van Oosterom had a lot of in-the-sea experiences from a young age, and, after an especially memorable dolphin encounter at Seaworld, she knew she wanted to become a marine biologist. A keen surfer and diver, Lucy studied Marine Science at the University of Auckland, and her masters research on the acoustic behaviour of big eyes, a species of New Zealand fish, was published in *Scientific Reports*, an open-access journal from *Nature Research*. Since graduating, Lucy has worked as a technician for the School of Biological Sciences and recently, she has been working on a project for *New Zealand Geographic* using 360 virtual reality filming.

Lucy, fish vocalisation is a very unusual topic! Why did you choose to work with the species big eyes, and what did you learn about their acoustic behaviour?

My supervisor, Craig Radford, had already done some work with big eyes, and we wanted to explore how they use sound under water. It's basically their main sense. Big eyes are nocturnal, so they come out at night to feed, and they live in caves under little outcrops during the day. When they're out at night they're too far away to see each other clearly in the dark, but they still remain in these loose groups and they all go back to the same cave.

We think they're using the sound to stay together as a group, to know where they are and stay in contact, just like us saying "Hey, I'm over here!" It must be for safety, because the sound they make is really loud – predators would obviously be able to detect it as well, so it has to have some big advantage.

Can you tell us a bit more about the NZ-VR project that you're working on? It sounds really exciting.

We're using 360 virtual reality (VR) filming to tell stories about our environment. We have 20 targeted sites that we want to film around New Zealand. So far we've done the Hauraki Gulf, Poor Knights and Leigh Marine Reserve, and we've been up to Parengarenga Harbour, the Three Kings Islands, and Niue.

We're using this technology to get people to engage more with the environment. A lot of people will see a photo or a traditional video and think it's really beautiful, but they won't really relate to it. Virtual reality has been dubbed 'the empathy machine' because when people watch a video with a headset on they really engage with it – it's super immersive. We're working with the Sir Peter Blake Trust, who are taking the videos to schools. Around 20,000 students from Auckland all the way north will watch the videos and learn about the related environmental issues.

What kind of impact do you hope NZ-VR will have?

The Hauraki Gulf is a hot topic at the moment. There's Sea Change – Tai Timu Tai Pari and the Hauraki Gulf Marine Park, and the Gulf is in trouble in lots of ways, with environmental degradation and damage. The Gulf's mauri is being affected, and our goal is to get more people to really care about these issues. I hope that the project stimulates more conversation so that changes happen at a higher level – politicians and environmental groups need to see and feel the accumulation of lots of people caring about these issues.

Left: Lucy films an aggregation of short-tailed stingrays in Northern Arch, Poor Knights Marine Reserve.

You're clearly a passionate science communicator. Why is it important for scientists to be able to communicate about their work?

A lot of scientists struggle to communicate their work, not necessarily in a simplified way, but in a way that their very specific topic becomes relatable to a wider audience. One of the key things is being able to articulate it in a way that is exciting and accessible, and make it fun. Otherwise most people just won't come across the science. The visual media is ideal for this, because you can easily tell the story for different age groups and different interests.

When you took the job at *New Zealand Geographic*, did you have these visual media skills?

No, I had to pick them up on the fly! They needed someone who was able to do both the fieldwork (the diving and the filming) and work well with the team, as well as the in-the-office work, stitching together videos and editing them, which was all really new to me. I'd never done video editing before so I had to learn a whole lot by trial and error.

That sounds like quite the challenge! Would you say challenge is something that drives you?

Yes, definitely. I'm really competitive, particularly with myself. I get a bit bored if I'm not mentally or physically challenged, or if I don't have goals to work towards. I also need a lot of variety. I think that's why I love what I'm doing because every day can be quite different.

You've achieved a huge amount already: publishing ground-breaking research, producing and telling important New Zealand conservation stories. Where do you see your career heading?

I've been so lucky to be in this amazing job, going out and filming these incredible things, and then coming back and doing science communication: it's basically my dream job!

I still would really like to do my PhD because I love being involved with research. I loved doing my masters; I got to do a lot of diving and I worked with an incredible field team. I also really enjoyed the write-up stage of my masters. People usually find that stressful, but having work that was publishable was a real stand-out moment for me. But I'm still not sure whether to pursue a career in academia.

Tell us something about yourself that we can't learn by Googling you!

When I'm not in the water I love to do raranga, which is Māori flax weaving. Raranga is meditative. I learnt alongside a lot of Māori culture and practice, so you feel like you're creating something that has a lot of respect behind it. I've made lots of baskets and bags; I like to make things that people are going to use and cherish.

Learn more about the NZ-VR project www.nzgeo.com/vr

Bringing education to life

The current preoccupation with all things digital has amply demonstrated that many of today's youth would rather engage with devices than with humans, so the use of Artificial Intelligence as an educational tool would appear to be a no-brainer.

KIWI STUDENTS BECAME the first in the world to experience a digital teacher in their classroom when Vector launched an avatar called 'Will' – created by AI developer Soul Machines – to teach primary school students about renewable energy as part of its 'Be Sustainable with Energy' schools programme.

Microsoft Solutions Specialist Professional Sam McNeill believes that AI will empower schools and teachers and "provides the key to a step change for the industry". However a conversation with University of Auckland computer scientists provides an important reality check on the digital future.

Let's start with the avatars. There's no doubting that Vector's 'Will' captured the attention of children and encouraged engagement, but predictions that digital teachers could somehow replace humans would appear to be somewhat premature.

Department of Computer Science Associate Professor Andrew Luxton-Reilly says that predicting the future is always fraught. Back in the 1950s they were saying that because a computer could play chess there would be intelligent machines within 20 years, but 60 years later he says "we really haven't made much progress in that direction" because machines struggle to replicate the subtlety of human behaviour.

Nevertheless, Andrew says that AI can still play an important role in general education in much the same way that the Google search engine provides basic information about a topic. "We might see some big gains in this area relatively soon without needing a machine to genuinely understand and model the knowledge that you have in the way that a human being would do it."

> ***"The power it [virtual reality] has for showing the three or four dimensional structure or working of a scientific problem is immense"***

As the Director of the Centre for eResearch, Professor Mark Gahegan believes that AI will lead to some radical changes in the education sector – over time. University research using artificial intelligence has been helpful in a variety of projects, such as modelling the erosion of beaches, due to its ability to sift and analyse complex data. "We've been building AI tools that perform extremely well against human based predictions made using mathematical models based on theory."

However, a project to help hard of hearing students by translating a lecture in real time had limited success because the translation tools being used need to be re-trained for specific accents. What's more, he says the vocabularies they draw from will need enlarging to include the technical vocabulary used in the classroom for different subjects. "Real time translation, real time mark up in lectures doesn't work well yet, but it will. It's just a few years away."

One of the more tangible benefits of AI for University research is the ability to use deep learning to analyse data in real time that would have previously been prohibitive to gather and process. "We'll learn things that we never expected to see," says Mark. "We can analyse your every breath and heart beat and we can look for patterns in all of that, and we're only just beginning to see how that has a really dramatic effect on what we know about ourselves. What we know about the world."

The Centre for eResearch features a Visualisation Suite where virtual and augmented reality is being used to bring previously complex and little understood scientific issues to life. Wearing a pair of 3D glasses, it is possible to watch the Kaikoura earthquake unfold as the energy dissipated and hit Wellington within a matter of seconds. The ability to rapidly interpret complex mathematics makes it possible to diagnose a large earthquake in less than a minute, which Mark says "could leave time to get some people to safety in the wider affected area – if we had a national warning system."

Other innovations include the use of virtual reality to teleport students into a bunch of human protein molecules where they can nudge them around and change the pH levels to see how they assemble into larger structures. "The power it has for showing the three or four-dimensional structure or working of a scientific problem is immense," says Mark. "It can turn what is a dull textbook idea

Images captured in the Centre for eResearch Visualisation Suite

of what a protein looks like into something that's living that you can interact with and play with which I think engages your imagination and learning and creativity far more. That's really where we would like to be."

Rather than simply being told about things in a university lecture, Mark believes that the technology will also allow students to discover how things work for themselves. "The part about education that is fun and engaging is discovery and that's how we should be teaching – creating the environment where students can discover things for themselves."

Before that can happen though, Mark says there needs to be a greater commitment to invest in immersive and augmented reality technology – like video walls, 3D projectors and sophisticated headsets – at every level of the education system. "We should be doing better in the classroom using this kind of technology."

Like artificial intelligence, data mining and learning analytics are also likely to play an increasing role in education, especially in identifying the 'outliers' who might under or over perform in a classroom. "At the moment there's not a lot of that happening," says Andrew, "but I think we will see a lot more of that because the data science, the analysis of big data, is just exploding everywhere."

Given the increased use in schools of digital tools such as mathematics websites, game-based activities and computerised testing, Andrew says that intelligent systems could be used to recognise patterns which determine that a person is deviating from a standard pattern and moving in a way that is known to lead to poor outcomes. "So let's take that student and provide them with some sort of intervention that steers them back onto the right path."

Similarly, Intelligent Tutoring Systems – which have been around since the 1980s – have had a positive impact in areas like computer programming. But, like AI, they have limitations when it comes to arts subjects which require more subjective judgements and Andrew says they are still "a long way away" from being able to achieve the so-called '2 sigma' gold standard of being able to replicate a one-on-one tutor experience.

While he acknowledges that AI has a place in the classroom, as the father of two primary school children Andrew says that the majority of their classroom experiences are built around "old fashioned" collaboration in group settings which involve talking to each other. "That's really hard to enhance in any kind of way with any kind of artificial intelligence," he says.

Furthermore, while digital tools might help with specific tasks there is the potential for children to lose their ability to communicate and work socially in groups or teams, which would be contrary to primary school curriculums. AI might be ideal for personalised or customised education for high or low achievers, but as far as any step change goes Andrew says "I'm less convinced that we'll see it sweeping in and changing the way our education happens."

Find out more about the work of the Centre for eResearch www.eresearch.auckland.ac.nz

Cooperation in early childhood

Being stranded on a desert island with Dr Annette Henderson would almost certainly guarantee that any available food would be evenly shared. In fact, she laughs, "I would probably starve myself", given her tendency to put others first.

IT'S THAT ETHOS that also drives her longitudinal research into the development of cooperation in early childhood. Whether it be sharing a meal or driving a vehicle – cooperative behaviour is considered to be fundamental to the success of human societies. But why are some people more likely to cooperate than others, and why is cooperation difficult to sustain?

By looking at cooperative motivations, Annette says the study is trying to tease apart our behavioural ability and competence from our actual motivation and tendencies to cooperate – as well as trying to understand how to enhance people working together.

"We want to try to figure out how we can help our children grow into healthy adults. If you're seen as being helpful and kind and caring you typically have better outcomes, so it's important to look at those things."

Having moved to Auckland in 2009 from the University of Maryland, Annette faced an initial challenge to establish a dedicated testing space for developmental research for children. What was a temporary space has now become the Early Learning Lab, Auckland (ELLA) – a unique facility in the new Science building where over 3,000 families have participated in a range of studies on social, language and cognitive development in childhood.

In keeping with her studies, Annette's lab is truly cooperative. "Everybody has to help each other, and so when I interview new students I say that it's a team environment and if you're not going to be OK with this then this is not the place for you."

Initially backed with University of Auckland seed funding, Annette ran a pilot study into early cooperative behaviour which became longitudinal in 2013 with a Marsden Fast Start grant, and which supported her research into cooperation development across the first three years of life.

Annette says the project snowballed into a sample that numbers 255 children and a Rutherford Discovery Fellowship in 2015 has given her another five years to be able to ask and answer more questions. "That's the nice thing about funding around here," she says. "If there's a novel thing that you really need to do – and should do to drive the field forward – you can do that."

The research is being conducted within two distinct projects, the first being to look at cross-cultural differences in young children's cooperation understanding, ability and motivation. Because babies develop really quickly in the first year, testing began at nine months with simple tasks like passing a ball back and forth with parents to understand 'turn-taking'. "We are testing whether infants who are good at passing the ball back and forth will become better co-operators later in life," says Annette.

Jaxson, Annette's son, performs a cooperation task with research fellow Dr Siobhan Kennedy-Costantini.

"Some people would say that children don't cooperate until they're three or four. I would argue that that's not the case"

What followed at 12, 13, 22, 36 and 48 months was a series of more complex tasks that combined skill and co-ordination to measure early behavioural markers of cooperation with parents and peers.

A novel twist to the research has been the development of 'looking time' measures, which involves the use of an infra-red eye tracker to capture a visual reflection on the cornea. "Through their eye gaze we can get a window into what they're thinking," says Annette, adding that no one has previously compared these really early measures with later behaviour to see if they're related or not.

"Some people would say that children don't cooperate until they're three or four. I would argue that that's not the case, so our research is trying to see what things are related to each other early on and how those develop across time."

The cross-cultural element of the research involves a similar study of up to 100 children in Vanuatu that aims to address a perceived gap created by the fact that most cooperative studies have focused on so-called western, educated, industrialised, rich and democratic (WEIRD) populations.

Describing it as an opportunity to expand her skill set, Annette says the Pacific Islands work has presented challenges including the variability of education across the sample. It has also validated her 'other oriented' tendencies. On a field trip to Vanuatu where everyone was hungry, she says she was "so anxious" about taking the last passionfruit.

A variety of factors such as biological and genetic makeup, education and important events in a child's life – like an earthquake or parental separation – all have to be taken into account. Among the many challenges is the simple fact that Annette's expertise is being stretched as children age so she's having to learn about new ways to capture what children do that's appropriate for their age group in order to ask "the next big questions" about pro-social behaviour.

William performs the robot task, another assessment of cooperation.

One of the most important factors in shaping the earliest cooperative behaviours are parent/infant interactions, which are the focus of the second project being conducted in collaboration with Associate Professor Mark Sagar at the Auckland Bioengineering Institute.

"We have to understand how early parent/infant cooperative interactions unfold in developmental time to be able to make models of those interactions," says Annette, "so that we can learn more about parent interactions with babies, but also learn how to create artificial intelligence that can also engage in cooperative interactions."

Given the fact that communication is a cooperative act – and that babies influence parental behaviour – high speed multi-angled video cameras are being used to capture eye and body movements between parent and child. The research also involves a 'baby swap paradigm' in which parents interact with another child to capture different reactions and help build hypotheses about what happens in a 'good cooperation'.

However the process of coding video interactions frame-by-frame – recorded at fifty frames a second – in order to create a virtual baby is incredibly time-consuming and Annette concedes that they are a long way from that goal.

Nevertheless, progress is being made. Preliminary analysis is showing that what is being done in the lab really matters and Annette is excited by the fact that they can encourage cooperation development in some of the children by giving them specialised experiences. "Maybe we should engage in positive acts with our children early on so that we can encourage them to be better cooperators later on."

While she is keeping an open mind as to whether "what happens early on doesn't matter later on", she says that parents should play simple games like peek-a-boo and passing a ball with babies even if they don't think a child understands it.

"That's the remarkable thing about babies, they understand a lot more than we think they do early on. So interacting with your babies in fun games that show this cooperative nature of interactions might actually be a nice way of enhancing their development. And it's fun for parents!"

Given the recent trend in psychology to focus more on the positives than the deficits, Annette also believes that if she can understand why children are more likely to work with others then maybe that could be applied to adults "so that we can be kinder individuals and work together to solve problems that are harming our environment."

Find out more about the work of the Early Learning Lab www.earlylearning.ac.nz

Supporting our Science students

Established in 2010, the Faculty of Science Student Support Awards are made possible by the Science Student Support Fund.

Left: Psychology student Donny Morar and her son Jayden.

Right: Forensic Science student Kent Onesemo.

"Working as a child and adolescent psychologist seems to be the best way to try to break some of the unhealthy cycles that we see so often at CYF – I want to make a real difference to children's lives"

THE MAIN PURPOSE of the Awards is to ensure a greater number of talented and deserving students who are experiencing financial hardship have the opportunity to fulfil their academic goals of undergraduate or postgraduate study. In 2017 the awards were updated to allow a greater number of students to benefit from this support.

Donny Morar was one of the students who received an award from the Science Student Support Fund this year.

Donny has just completed her Bachelor of Science majoring in Psychology, and she has applied to the 2019 Psychology honours programme. When she completes her honours degree, she hopes to be accepted onto the Doctorate in Clinical Psychology, with a view to becoming a registered child and adolescent psychologist.

In her pre-student life, Donny worked full-time at Child Youth and Family [now Oranga Tamariki]. She wanted to do more to help children but felt that by remaining in full-time work, the only pathway available to her was to become a social worker, which she didn't want to do. So she decided to leave her job and enrol in Psychology at University.

"Working as a child and adolescent psychologist seems to be the best way to try to break some of the unhealthy cycles that we see so often at CYF – I want to make a real difference to children's lives."

As a solo mum, Donny was delighted to learn that she was eligible to apply to the Science Student Support Fund. Winning an award means she can continue her studies without worrying about how she is going to afford the costs associated with postgraduate study.

"I've been able to purchase a new laptop to help me with my studies and future research projects, and I'll be able to afford the textbooks needed for my honours year. The award means that I can get a few repairs done on my car so I'm able to transport my son to his after-school activities."

Donny was also able to get a food parcel from AUSA (Auckland University Students' Association) when she was really struggling last year. She has this advice to give other students who may be facing hardship:

"Don't give up, and don't let anxiety take over. There is help available, and even if you're too shy to ask for help, there is information online. Focusing on the big picture also helps, as hard times are usually only temporary.

"Think positive, and look after yourself so you can do the best you can in your studies."

KENT ONESEMO also received an award from the Fund. Kent has been working for the Forensic division of the Samoan Police since 2012, and last year received a scholarship from the New Zealand Agency for International Development (NZAID) to study for his masters in Forensic Science.

He chose to come to the University of Auckland because he can study in conjunction with the Institute of Environmental Science and Research (ESR), the organisation responsible for the forensic work of the New Zealand Police.

"Back home in Samoa I'm mainly a field officer, but studying for my masters here in New Zealand allows me to observe and experience first-hand how forensic analysis is completed in the laboratory setting."

Kent says that one of the best things about his programme is learning the different techniques that can be applied to yield the best results from his samples of CBD (a compound with medicinal value found in cannabis plants). "Part of my thesis is looking at ways of determining the origin of cultivated cannabis plants using elemental profiles and stable carbon and nitrogen isotopes."

"Part of my thesis is looking at ways of determining the origin of cultivated cannabis plants using elemental profiles and stable carbon and nitrogen isotopes"

Ultimately, Kent hopes to increase the use and reliability of forensic evidence in Samoan court rooms. He also wants to teach forensics to inspire young people to pursue it as a career. "In Samoa there is a misconception that being a doctor is the only career outcome if you take science subjects like biology and chemistry. I'd love to change that conception."

The award Kent received from the Science Student Support Fund has really helped him with the financial struggles he has experienced as a result of living in Auckland.

"The award means I've been able to afford my living costs, as well as being able to support my family back home in Samoa. There have also been other costs associated with my thesis, such as printing and binding, which the award will greatly help me with when it is time for submission."

As an international student, Kent is quick to point out the variety of assistance and support groups who are dedicated to helping students achieve their academic goals. "There are some difficulties for international students, such as language barriers and culture shock, which can really affect your ability to stay focused. The best advice I can give is to always ask for help."

Solutions to a sustainable future

What do you get when you combine bright minds with a focus on the future, a well communicated piece of research, coupled with strong mentorship, and help toward living costs?

From left: Associate Dean Sustainability Dr Niki Harré, Faculty of Science Sustainability Research Award recipients Polly Holland, Mallory Sea and India Merrick.

WITH THE SUPPORT of the Faculty of Science Sustainability Research Award, four young scientists are forging their own path by creating research that focuses on sustainability initiatives relating to each of their disciplines.

Eleanor Kearns, India Merrick, Mallory Sea and Polly Holland are recipients of the award, which aims to encourage student projects on issues related to human wellbeing and ecological flourishing within the University and the wider community.

While science isn't always synonymous with sustainable practice, it is becoming more so. Certainly, the next generation of scientists have a very strong motivation to ensure their science is in fact sustainable, transparent and inclusive.

Polly Holland, who is studying for a Master of Science in Environmental Science, is very aware that her worldview of sustainability has changed significantly since progressing into postgraduate study.

"My undergraduate studies were in biology and chemistry and we learnt a lot about the prospects of technology, such as genetic engineering and chemical innovations, to combat societal issues," she says. "Technological innovation is amazing, but I suspect that over-reliance on technical solutions gives us a false sense of security that we don't have to change our behaviour."

It is a sentiment shared by her fellow awardees. Eleanor Kearns, who is in the final stages of completing her Bachelor of Science (Honours) in Chemistry, is amazed at how little she knew before studying courses in green chemistry as an undergraduate student.

"I had no idea how unsustainable chemistry could be, or any of the interesting ways people are combatting it by focusing their chemistry on sustainable practices that address worldwide sustainability issues," says Eleanor, who is researching how the synthesis of novel donor materials can help improve the efficiency of solar conversion technologies and thus reduce their cost.

Marine Science masters students, India Merrick and Mallory Sea, have focused their attention on the marine environment.

India's research looks at establishing marine reserves, a vital tool used to preserve and protect our biodiversity. She has created a species presence database and multivariate statistical analysis can be used to provide graphs that allow these large datasets to be easily viewed, and used as a supplementary tool in future marine reserve establishment processes to increase the sustainability of our fisheries.

Mallory Sea, who comes from the landlocked state of Iowa in America, discovered the ocean while on a student exchange programme in coastal Panama. And yes, her name is really Mallory Sea – a variant surname courtesy of her Swedish ancestors. Mallory is about to begin her research into New Zealand's endemic green-lipped mussels and one of their major predators, the eleven-armed sea star. She aims to show how different spatial arrangements of mussels in their mussel beds will effect predation rates.

It is fascinating to see how everyone's research differs. Environmental scientist Polly is tackling the complex issues of social, institutional and political barriers that inhibit change toward a sustainable model with her topic, 'Pipe Dreams and Dirty Streams'.

"With respect to water quality, a lot of environmental degradation is a result of the infrastructure built into our cities," she says. "For example, our traditional storm water networks that protect us from flooding, infrastructure damage and protect our health and safety, also lead to a myriad issues such as altered stream morphology, sedimentation, and pollution in the runoff – all impacting the aquatic life in the receiving waterways."

Consequently, Polly is using a case study of Auckland's proposed Central Interceptor project to understand how large-scale, centralised infrastructure is legitimised in an age with increasing calls for sustainability and environmental awareness.

Heady stuff! And Dr Anna Santure, from the School of Biological Sciences, who, along with colleague Dr Bruce Burns, assessed the Sustainability Award applications, is not surprised.

"I have a feeling that the applications we've received so far have been from students who are already fairly well versed in living sustainable lives," she says with a smile. "We hope to raise the profile of sustainability at the University through these awards, and send a signal to our students about the value and importance of sustainability research as they begin to plan their postgraduate projects."

The Faculty of Science Sustainability Network, which runs the awards, is now in its fourth year. There are over 100 staff in the wider network with Dr Niki Harré, Associate Dean Sustainability, instrumental in galvanising the working group to formalise such initiatives as the reduction of waste management at the Science Centre, composting throughout the faculty, and the development of interdisciplinary teaching collaborations, such as a new three-course sustainability module available to undergraduate students.

While the University establishes itself as a national leader in sustainability research and teaching, the Faculty of Science Sustainability Research Award is creating an interdisciplinary network of new researchers armed with the skills, experience – and the science – to create positive, progressive and sustainable change.

Find out more about the faculty's commitment to sustainability www.science.ac.nz/sustainability-awards

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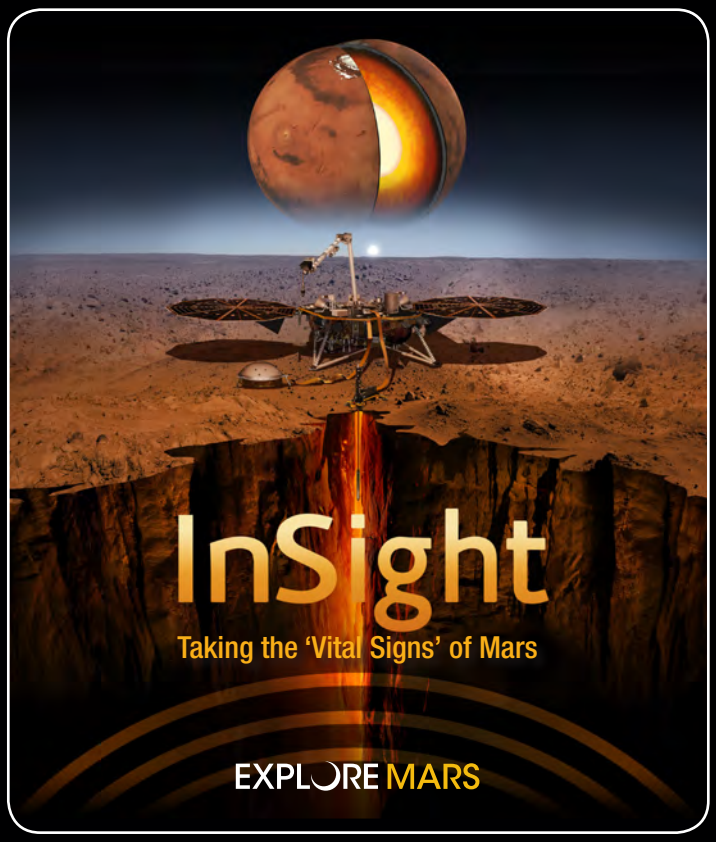

"Like many people around the world, scientists at the University of Auckland held their breath as NASA's InSight probe landed safely on Mars, at the same time inSCight *was finalised for print. In pleasant synergy InSight shares its name with this magazine, but in this case it is short for Interior Exploration using Seismic Investigations, Geodesy and Heat Transport. The probe will drill several metres below the Martian surface, in a major first for planetary exploration. It carries seismographs and instruments that will unravel the internal structure of Mars, shedding light on the processes responsible for the formation of the "rocky planets" in our solar system, and elsewhere in the universe."*

– **Professor Richard Easther, head of the Department of Physics, and executive member of Te Ao Mārama Centre for Fundamental Inquiry**

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