HIGHLIGHTS
TE TAU 2019

Royal Society
Te Apārangi

TŪHURA TOROHĒ TOHATOHA

ROYAL
SOCIETY
TE APĀRANGI

HIGHLIGHTS 2019

Photo: Neil Ross / NZ Gardener

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HIGHLIGHTS

2019

AROTAKENGA OUR YEAR IN REVIEW

TĒNĀ KOUTOU KATOA. HE MIHI TĒNEI KI TE WHĀNAU WHĀNUI. OUR ROLE IS TO SUPPORT NEW ZEALANDERS TO TŪHURA EXPLORE, TOROHĒ DISCOVER AND TOHATOHA SHARE KNOWLEDGE.

TŪHURA EXPLORE

We support New Zealanders to follow their curiosity and explore the world through the many rangahau research funds and development opportunities we offer. Best known is the Marsden Fund which celebrated its 25th anniversary in 2019. We also administer a number of other opportunities, including some for talented taiohi young people.

TOROHĒ DISCOVER

We recognise the discoveries that New Zealanders make through their research, from school children through to researchers at the top of their field who we elect as Fellows of our academy. We celebrate excellence by presenting medals and awards and we synthesise expert knowledge on topics of importance to Aotearoa.

TOHATOHA SHARE

Knowledge is for sharing. We need it to make decisions on important issues and to enjoy life to its fullest. We share information on key topics and facilitate the sharing of the latest research discoveries through our public events and expert advice programme, journals and the Science Media Centre.

This publication shares what we were up to in 2019.

Read on to discover more about our mahi during the seasons of te tau 2019, marked by the rising of four major stars identified by iwi Māori to divide the year: Rēhua, Poutūterangi, Takurua and Whitikaupeka. Each of these stars rise in the morning before the sun during different times of the year, marking the beginning of a certain period of time.

KO RĒHUA TE WHETŪ

KO POUTŪTERANGI TE WHETŪ

KO TAKURUA TE WHETŪ

KO WHITIKAUPEKA TE WHETŪ

KO RĒHUA TE WHETŪ

The star associated with summer and warm weather.

KO POUTŪTERANGI TE WHETŪ

The star of the 10th month of the Māori year appears around autumn.

KO TAKURUA TE WHETŪ

The biggest star in the sky and marks the winter. Takurua itself is another name for winter.

KO WHITIKAUPEKA TE WHETŪ

This star's name means the changing of the season and it is associated with spring.

RĒHUA

The star associated with summer and warm weather.

TOHATOHA

SHARE

ACADEMY CENTENARY EVENTS PROVIDE FOOD-FOR-THOUGHT

KO TE KAI A TE RANGATIRA HE KŌRERO
THE FOOD OF CHIEFS IS ORATORY

On 14 and 15 February 2019, Royal Society Te Apārangi celebrated kotahi rau tau 100 years since the first Fellows were admitted into the Academy. The first Fellows were inducted in 1919, following a review of science in New Zealand by Allan Thomson that recommended a body of Fellows be established, selected on the basis of research distinction. Fittingly, centenarian Dr Eddie Robertson OBE CBE FRSNZ, who turned 100 in January 2019, agreed to cut the cake at the celebratory dinner. A geophysicist, Eddie was Director General of the Department of Scientific and Industrial Research (DSIR) in the last 10 years before his retirement. A special guest at the dinner was Professor Dame Anne Glover FRSE, Royal Society of Edinburgh President, who spoke on the challenges of ensuring research academies are relevant to society. A symposium was held the following day with the theme of 'inclusive excellence'. It explored the topic of how to better measure te hiranga excellence across multiple disciplines. There was much discussion and many wero challenges laid down in each of the four sessions.

"I was honoured to cut the cake and I enjoyed conversing with other Fellows and guests."

EDDIE ROBERTSON

VIEW SUMMARY OF INSIGHTS FROM SYMPOSIUM

THINKING LOGICALLY

Professor Rod Downey FRSNZ gave the 2019 Rutherford Lecture in five centres on the mathematical and philosophical background to our digital age. Winner of the 2018 Rutherford Medal, Rod was recognised for his revolutionary research into computability and the algorithmic study of randomness. In his kōrero, he outlined the advances in mathematics and technology that have led to today's algorithms and computers, including the history of 'logical thought' going back to the time of Aristotle.

"Computers were born from logic, which is the part of mathematics that takes language seriously and is the 'calculus' of computing. My work has given some new approaches to understanding how to cope when certain problems seem too hard to solve exactly in any reasonable time."

ROD DOWNEY

LISTEN TO RNZ INTERVIEW: THE COMPUTER SAYS YES – LOGIC, ALGORITHMS AND SOCIETY

TOHATOHA

SHARE

GENERATOR DESIGN A WINNER AT TAIWAN SCIENCE FAIR

Former John Paul College student, Cian Hinton won the environmental engineering category of the Taiwan International Science Fair with his design for an electrical generator for a hydropower station. He had aimed to design a cheap source of electricity that could be adapted to any environment or situation. Mentored by his science teacher, Tim Bell, the design process had taken five years and 300 prototypes. The model he showcased in Taiwan could generate power from water and was fully functional. Cian travelled to Taiwan with a Talented School Students Travel Award, funded by the Ministry of Business, Innovation and Employment and managed by Royal Society Te Apārangi. Cian is now studying engineering and mechatronics at the University of Canterbury.

"This is a completely new [design] concept that has not been explored yet and, as an aspiring engineer, this is exactly the sort of thing that I wish to explore. I would love to see it provide universal access to electricity in third world countries for use in medical care and communication."

CIAN HINTON

READ MORE ON CIAN'S INVENTION

TŪHURA
EXPLORE

Photo: Stephen Parker, NZME

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MARSDEN FUND CELEBRATES 25 YEARS

EHARA TAKU TOA I TE TOA TAKITAHI, ENGARI TAKU TOA, TAKITINI E

SUCCESS IS NOT BY THE WORK OF ONE, BUT BY THE WORK OF MANY

Marsden Fund Te Pūtea Rangahau a Marsden was established by the New Zealand government in 1994. Since then, it has driven world-class research in Aotearoa by supporting and incentivising excellent researchers to work on their best and boldest ideas and to connect internationally. The research supported by the fund is leading to new knowledge and skills with the potential for significant future impact for Aotearoa. On March 25, a celebratory event was held at Te Puia Thermal Reserve in Rotorua, acknowledging the achievements of excellent researchers and affirming ngā matawhānui the vision for the future of the fund.

The evening started with manuhiri guests being formally invited into Te Puia with a pōwhiri by Te Arawa. Past Chair of the Marsden Fund Professor Juliet Gerrard FRSNZ, Prime Minister's Chief Science Advisor, acknowledged Simon Upton FRSNZ for starting the fund and successive Ministers of Research, Science and Innovation for their continued support. She also noted the inclusive nature of the fund that sees women and Māori applicants do at least as well as other applicants. Current Chair Professor David Bilkey thanked all those who help the fund operate, especially the assessment panellists who face the daunting task of selecting projects to recommend for funding from a large number of truly excellent proposals. He said that they were required to predict the future in making their recommendations – no easy task! During the evening, a number of recipients of the Marsden Fund shared stories of what receiving a Marsden Fund grant had meant to them.

"Knowledge can grow in the most hostile environment but it thrives when it is nourished. The Marsden Fund nourished me many years ago when I had an idea."

PROFESSOR LINDA TUHIWAI SMITH FRSNZ

READ MORE ABOUT THE MARSDEN 25 EVENT

HOPE FOR THE FUTURE

Five New Zealand early-career researchers were selected by Royal Society Te Apārangi and supported by Catalyst: Leaders to attend the 11th HOPE Meeting in Japan in March 2019, run by the Japan Society for the Promotion of Sciences. These wānanga are held annually for graduate students from selected countries in the Asia-Pacific region to form collegial interdisciplinary networks and to gain an appreciation of the global diversity in science. Participants also get the opportunity to learn from Nobel laureates about how to be successful in their research careers.

"I am sincerely grateful for being given the pleasure of participating in the 11th HOPE Meeting. This meeting brought together over 100 young researchers from around Africa and the Asia-Pacific region. I believe that, thanks to this opportunity, I will be able to further develop and promote my research in lung health, and it is my hope that I will be able to positively affect the health and welfare of peoples around the world."

SARAH HOWE, 11TH HOPE MEETING PARTICIPANT

TOHATOHA

SHARE

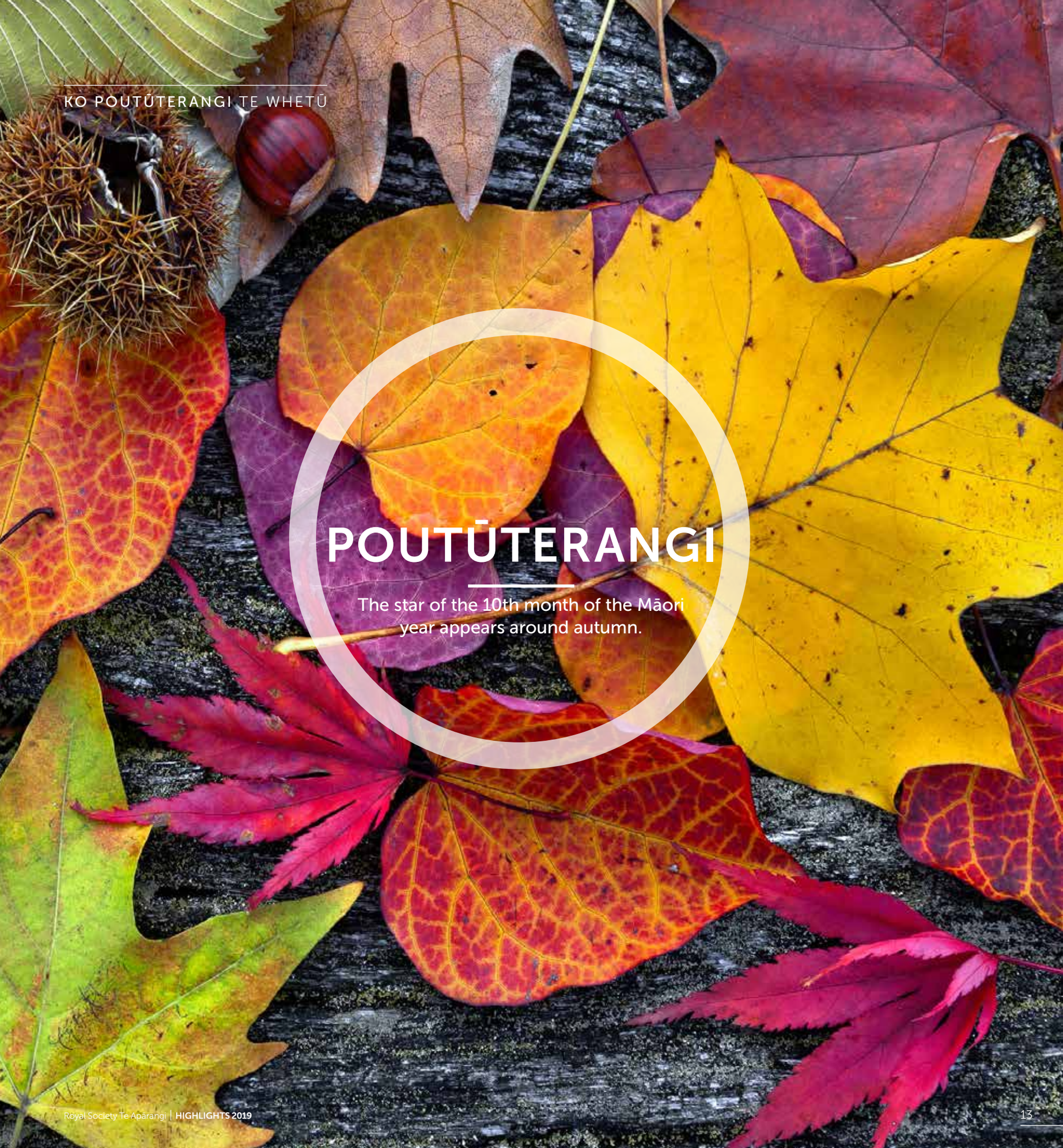
COLLABORATING ON KAIMOANA

Thanks to an International Leader Fellowship funded by Catalyst: Leaders, Cawthron Institute and the New Zealand oyster industry have been able to develop closer research links with Dr Pierre Boudry – a world leading shellfish genetics and physiology expert from L'Institut Français de Recherche pour l'Exploitation de la Mer (Ifremer, the French Marine Science Research Institute).

During Dr Boudry's first of three fellowship-funded visits to New Zealand, he regularly met with Cawthron's shellfish scientists and industry partners, and visited Pacific oyster farms as well as the Cawthron Institute's shellfish facilities. He also participated in a Pacific oyster workshop organised by the Cawthron Institute and with additional participation from Australia's national science research agency (CSIRO), Moana, SPATnz, University of Sydney, and Auckland University of Technology.

"The research collaboration between Cawthron and Dr Boudry and Ifremer is providing valuable insights for New Zealand's shellfish breeding programmes, with the aim of reviewing and enhancing the methodologies and strategies used for family-based shellfish selective breeding in New Zealand."

DR JANE SYMONDS, CAWTHRON INSTITUTE



POUTŪTERANGI

The star of the 10th month of the Māori year appears around autumn.

KO MATARIKI E ĀRAU ANA THE GATHERING OF MATARIKI SERIES OF TALKS

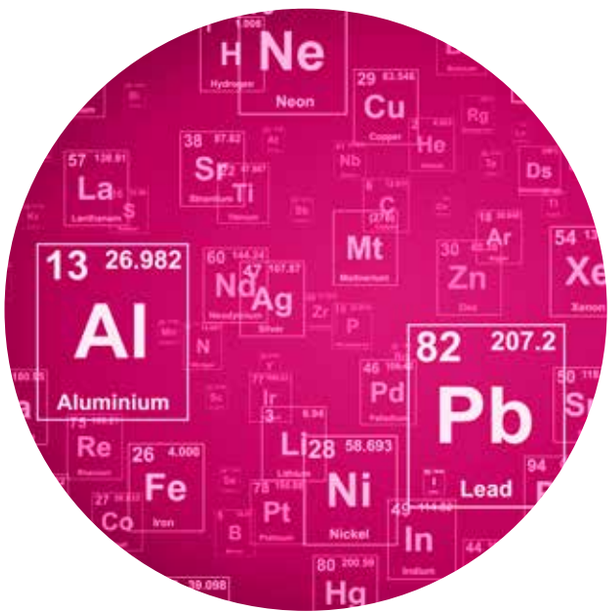
Professor Rangi Matamua (Tūhoe) shared his detailed knowledge about Matariki and highlighted connections between cultural knowledge and science in a 20-talk series in New Zealand and Australia during 2019. Rangi is passionate about Māori astronomy and is the author of the best-selling book Matariki: The Star of the Year. As Associate Dean Postgraduate within the Faculty of Māori and Indigenous Studies at the University of Waikato, Rangi is heavily involved in researching how Māori studied and applied their knowledge of the celestial bodies. Rangi and his whānau have an astronomical connection with Royal Society Te Apārangi that stretches back to the late 1800s. His ancestor, Te Kōkau Himiona Te Pikikōtuku, was a tohunga and friend of Society member Elsdon Best. Their relationship set in course the collection and recording of Māori astronomical knowledge by Te Kōkau. This lecture series revived the relationship between Rangi's whānau and Royal Society Te Apārangi, and helped celebrate and disseminate Māori knowledge of the cosmos to a new generation.

"In association with Royal Society Te Apārangi, I took my whānau, my sisters, on tour with me and we were able to disseminate information on Māori astronomy, particularly pertaining to Matariki, to near on 8,000 people, which is fantastic. We're getting great coverage and that's helping to normalise a traditional cultural practice of our ancestors in a modern context."

RANGI MATAMUA

WATCH INTERVIEW WITH RANGI ON MĀORI TELEVISION'S MARAE PROGRAMME

TOHATOHA
SHARE



PERIODIC TABLE TURNS 150

In May the Society celebrated the 150th anniversary of the ripanga pūmotu periodic table, following its discovery by Dmitri Mendeleev in 1869. By organising elements by atomic number, the columms group elements likely to react in similar ways. We videoed teachers and researchers speaking about how they use the peroidic table in their everyday lives and we asked tauira students around the country to design a periodic table-inspired t-shirt.

"Our knowledge about atoms and molecules doesn't start that long ago. Human kind had been on the planet for a very long time without this knowledge and our society has moved on dramatically from not knowing what things are made of. The peroidic table is an integral part of explaining what all the elements are and how they relate to each other. The guy who thought it up, he got it bang on right first time!"

PROFESSOR RICHARD FURNEAUX FRSNZ

VIEW VIDEOS AND WINNING T-SHIRT DESIGNS

THINKING LIKE A PLANT

How do plants make decisions about how to grow when they don't have a brain? British plant developmental biologist Professor Dame Ottoline Leyser DBE FRS travelled to Aotearoa in May to give the 2019 Rutherford Memorial Lecture to share her discoveries of how plants use hormones to control branching and growth. She is particularly interested in the roles and mechanisms of action of plant hormones such as auxin. One of her discoveries – the auxin receptor – has helped to explain how hormone signals shape the response of a plant to its taiao environment. Dame Ottoline is the director of the Sainsbury Laboratory at the University of Cambridge and was awarded a CBE in 2009 in recognition of her pioneering work in plant science.

"Plants have got to make decisions about how to grow and when to grow and when to flower and so on with no central processing and so instead they use this very elegant distributed processing system. It's substantially based on small molecules, plant hormones, that move about from the shoot to the root and the root to the shoot. Their interactions and their sensitivity to the environment, in combination, allow plants to make decisions about how many branches to make, which places to put these branches and whether to invest in shoots or roots. These are the decisions they are making all the time through this very elegant interaction."

DAME OTTOLINE LEYSER

LISTEN TO RNZ INTERVIEW: HOW TO THINK LIKE A PLANT

LATEST SCIENCE AND TECHNOLOGY INFORMATION FOR MPS

TOHATOHA

SHARE

In collaboration with the Speaker of the New Zealand Parliament, Science New Zealand, Universities New Zealand and the Independent Research Association of New Zealand, we ran our annual Speaker's Science Forum so that Members of Parliament had the opportunity to hear kōrero presentations on topical rangahau research areas.

In 2019, the topics presented were:

- **Mātauranga Māori – Matariki and Ngā Tipu:** How Mātauranga Māori and western science have shaped our understanding of the world – and ourselves.
- **Artificial intelligence and autonomous systems:** How these technologies can be developed responsibly to enhance hauora wellbeing.
- **Addressing hauora hinengaro mental health and wellbeing:** What research tells us about the causes and possible solutions to youth suicide and self harm in New Zealand.
- **Addressing environmental plastic pollution in New Zealand:** How the circular economy and research will help address environmental plastic pollution in Aotearoa.
- **Changing climate: managing growing coastal erosion and flooding threats:** How to adapt and protect our communities and taioa environment from increasingly severe flooding and storms.
- **Medical advances: safety, effectiveness and patient access:** Case studies on latest asthma study and medical devices to treat brain disorders.
- **Carnage on our roads: what can be done to improve road safety:** How research in New Zealand is helping reduce the road toll, both by road safety engineering and social engineering, and the impact of autonomous vehicles.
- **Food for thought:** How we can farm the kai food we need to eat and export without degrading our whenua land. Many new horticulture and aquaculture opportunities exist to achieve this.

"An integrated circular economy focusses on six guiding principles – refuse, re-use, reduce, redesign, recycle and renew – rather than disposal. This mitigates the environmental issues and reduces the demand for new plastic production from oil, which could be met through renewable feedstock."

DR FLORIAN GRAICHEN, SCION, WHO PRESENTED AT THE SESSION ON REDUCING PLASTIC POLLUTION.

LEARN MORE ABOUT SPEAKER'S SCIENCE FORUM

MEDIA SAVVY WORKSHOPS FOR MĀORI RESEARCHERS

WHIUA KI TE AO, WHIUA KI TE RANGI, WHIUA KI NGĀ IWI KATOA!

The Science Media Centre, an independent unit of Royal Society Te Apārangi, held a seventh round of fully-funded media training workshops for Māori researchers in June. These sessions feature face-to-face discussions with journalists, a newsroom tour and many practical exercises to build confidence in a wide range of strategic communication skills. The immersive workshop was launched in 2016 in conjunction with Ngā Pae o te Māramatanga and funded by the Ministry of Business, Innovation and Employment, with the aim of building increased media and public awareness of Māori research and expertise.

TOHATOHA

SHARE

"Too often I attend workshops and wānanga and walk away none the wiser except for losing valuable days. The Media SAVVY workshop was extremely valuable for rounding out my media skills and giving me an added insight into the process. I have been interviewed several times since the workshop, and was able to put into practice those skills."

DENNIS NGĀWHARE POUNAMU, TE WĀNANGA O AOTEAROA

VIEW MORE ABOUT MEDIA SAVVY FOR MĀORI RESEARCHERS

VIDEO ON NZ ORCID HUB

ORCID is a global organisation that provides researchers with a unique digital identifier, which they link with their chosen professional activities. The Society is the lead agency of the New Zealand ORCID consortium that supports the adoption of ORCID in Aotearoa. The software project, the New Zealand ORCID Hub, has been actively used by consortium members to write information including successful funding awards, employment and education affiliations, and research outputs to ORCID records. Authentic information in ORCID records can be used to inform reports on activities, or provide information for funding applications and journal submission systems. Utilising information in ORCID records allows organisations and researchers to save significant time and duplication when making applications and submissions online.

In June we published a video explaining the Hub and the opportunities it provides organisations.

"We're relying on the New Zealand ORCID Hub actually – in the first instance to understand about authenticating records, reading and writing to researchers' records, and then using the tools that they've set up to upload information. The reason why we are encouraging our researchers to get ORCID IDs is it really seems like ORCID IDs are becoming a national and international standard. We have noticed a big increase in the number of research platforms asking people to enter their IDs."

PIPPA MCKELVIE-SEBILEAU, RESEARCH MANAGER,
EASTERN INSTITUTE OF TECHNOLOGY

VIEW NZ ORCID HUB VIDEO

OUR FINANCIALS

IN THE YEAR TO 30 JUNE 2019, THE ROYAL SOCIETY OF NEW ZEALAND GROUP, COMBINING ROYAL SOCIETY TE APĀRANGI AND ITS ASSOCIATED ENDOWMENT TRUST FUND, GENERATED A SURPLUS OF $0.547M (EXCLUDING NET GAINS ON LAND AND BUILDINGS). TOTAL REVENUE (EXCLUDING NET GAINS ON LAND AND BUILDINGS) GREW BY 9.8% TO $8.778M.

The total assets of the group increased by around $1.9m during the year to a value of $21.699m at year end. The physical land and buildings on our Turnbull Street site were revalued at year end and increased in value by $0.4m to a net value of $12.1m at 30 June. Our appointed auditors are Grant Thornton.

We remain reliant on our professional services provision to government for about three quarters of our income. Royal Society Te Apārangi managed eight contestable funds on behalf of the Government during the year, with around $96m being paid out in the 12 months to 30 June 2019 – around $10m more than the previous financial year.

VIEW OUR 2019 AUDITED FINANCIAL STATEMENTS

TAKURUA

The biggest star in the sky and marks the winter. Takurua itself is another name for winter.

Photo: Aurora Australis from Otago Peninsula by Dr Ian Griffin CRSNZ

NEW STRUCTURE FOR COUNCIL

IN JULY, ROYAL SOCIETY TE APĀRANGI'S NEW COUNCIL STRUCTURE CAME INTO PLACE. THE CHANGES WERE AIMED AT IMPROVING THE SOCIETY'S RESPONSIVENESS TO THE NEEDS AND PERSPECTIVES OF ALL PARTS OF THE RANGAHAU RESEARCH COMMUNITY.

TŪHURA

EXPLORE

The main changes were:

- Introduction of three new permanent roles (early career and Māori research perspectives), but reduced numbers of other types of role to avoid Council enlarging.
- Replacement of three Vice-Presidents by a Chair and Deputy Chair of the Academy Executive Committee, these roles serving on both the Academy Executive Committee and Council to help ensure cohesive decision making between the two bodies.
- The general membership electoral college was disbanded in favour of more specific electoral colleges.

As of 1 July 2019, the members of the Royal Society Te Apārangi Council were:

- Professor **Wendy Larner** FRSNZ President, Royal Society Te Apārangi 2018-21
- Professor **Richard Blaikie** FRSNZ Chair of Academy Executive Committee 2017-2020
- Dr **Tony Conner** CRSNZ FRSNZ Deputy Chair of the Academy Executive Committee 2018-2021
- Associate Professor **Melinda Webber** MRSNZ Councillor 2018-2020
- Associate Professor **Siouxsie Wiles** MRSNZ Councillor 2018-2021
- Professor **Ken Strongman** FRSNZ Councillor – Branches Representative to June 2020 (*sadly deceased December 2019)
- Dr **Liz Gordon** MRSNZ Constituent Organisation Representative 2017-2020
- Dr **Tom Baker** MRSNZ Councillor – Early Career Researcher Representative 2019-2022
- Dr **Reremoana Theodore** MRSNZ Co-opted Councillor 2019-2020
- Dr **Russell Burton** MRSNZ Co-opted Councillor 2019-2020
- Dr **Dianne Sika-Paotonu** MRSNZ Co-opted Councillor 2019-2020

"By making these changes in the electoral colleges and how Councillors are elected, we ensure that each class of membership plays a role. We hope that the changes will be a positive step to embrace the strategic directions to which the Society has committed to better serve the full breath of New Zealand's research community."

DR ANDREW CLELAND FRSNZ, ROYAL SOCIETY TE APĀRANGI CHIEF EXECUTIVE

VIEW MORE ON COUNCIL RESTRUCTURE

PRESIDENT'S ADDRESS ON REDEFINING RESEARCH EXCELLENCE

In July, Royal Society Te Apārangi President Professor Wendy Larner FRSNZ FAcSS FNZGS gave an address entitled 'Research Excellence in a "Grand Challenge" World', where she discussed why we need to recognise and acknowledge research excellence in its multiple forms, including impact and advancement. She spoke about the shift away from rangahau research done by an individual and measuring impact from quality of publications alone towards research carried out by large multi-disciplinary diverse teams and measuring success by engagement and relevance.

"We need to ask different questions about the nature of research excellence. My view is that the highly individualised and competitive features of the research landscape are both partial and dated. Research colleagues in CRIs, independent research organisations, the private sector and iwi organisations will already be attuned to a much more porous and heterogenous research landscape. We might draw attention to the growth of new research relationships with industry, government and cultural institutions. Women's studies, Indigenous studies and development studies have also long been sites from which calls for new relationships with external partners have emerged and been enacted. We should be particularly aware of this in Aotearoa New Zealand given the importance and influence of kaupapa Māori in shaping knowledge formations and research practices in this country."

WENDY LARNER

VIEW VIDEO AND TRANSCRIPT OF PRESIDENT'S ADDRESS

NEW COMPANIONS

FIVE PEOPLE WERE RECOGNISED FOR THEIR OUTSTANDING HAUTŪTANGA LEADERSHIP OR SUSTAINED CONTRIBUTIONS TO PROMOTING AND ADVANCING PŪTAIAO SCIENCE, HANGARAU TECHNOLOGY AND ARONUI HUMANITIES IN AOTEAROA BY BEING MADE COMPANIONS BY ROYAL SOCIETY TE APĀRANGI IN JUNE.

The honour is reserved for those who have made a contribution to society far above and beyond what might be expected of them from the roles they have held. Companions can use the post-nominal 'CRSNZ' after their name to indicate this honour.

"I am very proud of these new facilities at Otago Museum, which rival the best anywhere in the world in terms of inspiring interest in science, nature, and culture. The companionship was a bit of a shock and a real honour''.

IAN GRIFFIN

VIEW MORE ON THE LATEST COMPANIONS

TOHATOHA

SHARE

Dr Judith Bateup CRSNZ is recognised for her outstanding contributions to the teaching of microbiology by secondary school teachers through developing and implementing extensive outreach programmes.

John Bongard ONZM CRSNZ is recognised for being at the forefront of commercial innovation in New Zealand, including as former Chief Executive and Managing Director of Fisher & Paykel.

Dr Ian Griffin CRSNZ is recognised for his work championing museums as centres of science communication and for transforming Otago Museum's engagement facilities.

Dr Barbara Hayden CRSNZ, NIWA's Chief Scientist for Coasts and Oceans, is recognised for her numerous contributions to marine science.

Dr Rob Whitney CRSNZ FNZIC is recognised for his contribution to energy, both through New Zealand's energy council and as New Zealand's delegate at the World Energy Council, where he was involved in the energy scenarios projects.

PLASTICS: SOMETHING EARTH CANNOT DIGEST

In July 2019 we released an evidence summary and additional resources on plastics in the environment, which is a topic of growing concern. The resources set out how kirihou plastics are made, used and disposed of, how plastics enter the environment and the risks plastics pose to wildlife and humans. They introduced concepts about how we can reduce plastic pollution, such as switching to a circular economy instead of continuing to rely on single use plastics.

New Zealand has a high per-capita use of plastics and, like the rest of the world, we are witnessing large amounts of plastic pollution, even in remote places like Stewart Island's Mason Bay. Most plastic is produced from fossil fuels, consuming 4-8% of global oil production. The amount of plastic produced each year has doubled over the last 20 years and is still growing rapidly, despite growing concerns about plastic pollution and climate change. The report outlines that we have thrown away three-quarters of the volume of plastics ever produced. Less than 20% of the waste plastic generated each year is recycled worldwide. Of the remainder, about 70% goes to landfill and 30% is incinerated. Much of this waste plastic is entering our moana oceans, says environmental chemist Associate Professor Sally Gaw from the University of Canterbury, who contributed to the report. Waste plastic in the environment breaks down into smaller and smaller pieces, known as microplastics, and scientists are concerned about the effects of these entering the food chain.

The Society acknowledges a bequest from Ian Baumgart's estate that made this work possible.

"It has been estimated that the equivalent of a garbage truck-load of plastic waste has been dumped into the ocean every 38 seconds over the past decade. Unless we do something, it is estimated that by 2050 there will be more plastic than fish in the ocean. In addition to entrapping and killing animals, plastic waste in the ocean can provide rafts for invasive species to move around the world and plastic debris has also been associated with decreased health of coral species. However, most of the concern is now focussed on microplastics."

SALLY GAW

SEE MORE ON PLASTICS IN THE ENVIRONMENT: TE AO HURIHURI – THE CHANGING WORLD

SOCIETY JOINS GLOBAL BODY FOR ENGINEERING AND TECHNOLOGY

In late June 2019, the Society was admitted as the 28th member of the Council of Academies of Engineering and Technological Sciences (CAETS). By joining CAETS, the Society is now a member of all three major peak bodies across science, technology and the humanities. CAETS is grounded in both research and the advancement of engineering and technology through world-class intellectual endeavour.

"By sharing practices with such academies, we hope to learn how they draw on their diverse groups of fellows to strengthen activities such as giving expert advice to governments."

DR ANDREW CLELAND FRSNZ, ROYAL SOCIETY TE APĀRANGI CHIEF EXECUTIVE

READ MORE ON SOCIETY JOINING CAETS

THE AGE OF ARTIFICIAL INTELLIGENCE IN AOTEAROA

IN AUGUST 2019 WE PUBLISHED INFORMATION DISCUSSING WHAT THE GROWING USE OF ARTIFICIAL INTELLIGENCE COULD MEAN FOR AOTEAROA AND THE RISKS THAT NEED TO BE MANAGED TO ENSURE ALL CAN BENEFIT.

TŪHURA

EXPLORE

The project outlined a number of sectors where artificial intelligence is already in use. One area where New Zealand is world-leading is in the government sector, with most government agencies using artificial intelligence. AI is also being used to predict vineyard harvests, as a tutor for high school tauira students, and in the banking sector through the introduction of automated assistants. Applications under development include those for better health diagnoses, smarter management of resources such as water and fertiliser on farms and the energy sector, faster identification of biosecurity threats, or tracking endangered species. In our personal lives, we could benefit from driverless cars, digital assistants for travel booking and language translation, and one-on-one tech support or tutoring.

Videos explaining the potential impact of artificial intelligence starred Lia, a digital human created by Soul Machines. Soul Machines is a company led by Dr Mark Sagar FRSNZ, which is seeking to humanise human-machine cooperation by creating a virtual nervous system.

The project highlighted that artificial intelligence does not come without risks, including privacy breeches and discrimination as well as major changes to the job market.

It came out of a review led by the Australian Council of Learned Academies (ACOLA) that the Society contributed to, called The Effective and Ethical Development of Artificial Intelligence: An Opportunity to Improve Our Wellbeing. Professor James Maclaurin, Co-director of the Centre for Artificial Intelligence and Public Policy at the University of Otago, who was an author on the ACOLA report, said there was an urgent need for New Zealanders to reflect on what AI-enabled future the nation wanted. He said we could show international leadership in developing a mix of regulation, education, new business practices and new institutions to ensure artificial intelligence could benefit all New Zealanders, not just a small number of companies or people.

"In reality we don't know and likely cannot usefully predict how many jobs there will be in 20 years' time and what those jobs will look like. It's important that we don't conflate the number of jobs that disappear with the number of people unemployed, because, as with any new technology, many new roles will be created. Some of these new jobs will be high pay, high value and others will be low paid, low value, resulting in under-employment. It's fair to say that few jobs will be unaffected. We will need safety nets and AI-aware labour laws. But there is genuine excitement that human cooperation with intelligent machines may define the next era of our history and could bring many benefits to society."

JAMES MACLAURIN

SEE MORE ON ARTIFICIAL INTELLIGENCE IN AOTEAROA

TŪHURA

EXPLORE

CALLS FOR GENE-TECHNOLOGY REGULATIONS OVERHAUL AND WIDE PUBLIC DISCUSSION

Moe mai rā e te rangatira,
haere ki te huinga o te kahurangi, ki
Hawaiki nui, ki Hawaiki roa,
ki Hawaiki pamamao.
E kore koe e warewaretia.

The Panel acknowledges the contribution of Dr Barry Smith (Te Rarawa, Ngāti Kahu) who served as the Chair of the Gene Editing Panel Māori Reference Group, who sadly died in February.

During 2019 we continued our major expert advice project to explore the ethical, social, legal, regulatory, environmental and economic implications of gene editing for Aotearoa. In previous years, the expert panel had explored the potential use of the technology in three areas:

- healthcare
- environmental pest management
- primary industries.

For each of the three scenario areas, the panel produced summary discussion documents, as well as more-detailed technical descriptions, and ran a number of public discussions and hui around the country to find out what information about gene editing would be helpful to inform communities.

In August 2019 the panel published the findings from an analysis of New Zealand's legal and regulatory framework in the context of the scenarios considered, as well as some reflections from the process, and updated versions of the scenario documents.

The regulatory review identified a number of potential issues, including that the legal framework is becoming increasingly out of date given the global advances in gene-editing technology. Expert panel Co-chair Dr David Penman CRSNZ said that there is a need to move on from a black and white view of 'GM or not GM' – to a much more nuanced view that recognises a wide range of applications of the technology, some of which may be more acceptable to New Zealand communities than others. He said that while there have been a number of international summits on the use of gene editing, it was important that New Zealand develops its own view. Co-chair Professor Barry Scott FRSNZ said that for all three areas – health, pest control and primary industries – they heard views for and against the use of gene editing. Across all scenarios, feedback from Māori participants highlighted the importance of whakapapa and mauri, involving tangata whenua around indigenous species, protection of data, and intellectual property implications of gene editing for taonga species.

"The Panel would like to see a legal and regulatory system in New Zealand that is more future-proofed and 'fit-for-purpose' by being easier to navigate, having clear and consistent definitions, and providing a better basis for assessing the risks and opportunities of particular applications of gene editing rather than focussing on the gene-editing process itself. There is also an urgent need for a wide and well-informed discussion across New Zealand's diverse communities about their preferences for application of gene editing, in order to inform any regulatory change."

BARRY SCOTT

READ GENE EDITING IN AOTEAROA REPORTS

SPECIAL JOURNAL ISSUE ON CONSERVATION

In September, the *Journal of the Royal Society of New Zealand* published a special issue on the state of conservation in New Zealand, guest edited by David Towns and Charles Daugherty ONZM FRSNZ, with an editorial by Daniel Simberloff. This special issue reviewed the state of biodiversity conservation in Aotearoa following the establishment of the Department of Conservation (DOC) in 1987. The papers in this issue outline the successes, failures and key technological shifts in biodiversity conservation in the past 30 years; how visionary people and institutions have instigated conservation at landscape scales and in urban areas; the growing roles of Māori and non-Māori communities; and audacious new goals that reflect continuing attitudinal changes to the conservation of native biodiversity alongside the global and local implications of climate change.

"As an ecologist I am well aware of what has been lost, and why, but also of the inspiring efforts, especially recently, to save what is left and to restore at least some of the landscape to a semblance of its earlier state."

DANIEL SIMBERLOFF

VIEW SPECIAL ISSUE ON CONSERVATION

TŪHURA

EXPLORE

END OF AN ERA FOR FOOD INNOVATION

AFTER 11 EXCITING YEARS, 2019 WAS THE LAST YEAR THAT THE FOOD INNOVATION CHALLENGE WAS OFFERED.

The challenge has been run by the New Zealand Institute of Food Science and Technology and the Society to give senior secondary students the opportunity to experience first hand the innovative work done by scientists, technologists and engineers in New Zealand's food industry, and to raise the profile of a career in the industry. The students worked in teams with mentors to develop food products. The challenge was linked with the Society's Team Silver Challenge CREST award so all participants who achieve the CREST assessment criteria attained the award. The programme also ran development courses for teachers on food technology. Winning and commended products developed in 2019 included 'Whey Tea', 'Flaming Lemons' and 'Spirulina Pasta'. While the formal programme has ended, the Society and NZIFST will continue to support tauira and kaiako interested in food technology learning.

LUFILUFI LENE-ISARA ATTENDS ASIAN SCIENCE CAMP

TŪHURA

EXPLORE

Lufilufi Afaese Lene-Isara, 2019 Head Prefect at Rongotai College in Te Whanganui-a-Tara Wellington, was one of the students supported by a Talented Students Travel Award to attend an international science event. Lufi attended the Asian Science Camp held in China, which seeks to "enlighten science-talented youth through discussion and dialogue with top scholars". Born in Samoa, Lufi shifted to New Zealand in 2002. He recalls that his passion for science ignited when he visited Rongotai College's science department as a Year 8 student during the open day: "I still remember being in a state of awe, looking at microscopic structures, jolting at the sight of an elephant's toothpaste and playing with the electronic circuit sets!" He is very grateful to have been exposed to such a strong and experienced science department and for the support of the dedicated staff at Rongotai College, especially principal Kevin Carter.

"I will continue to be curious about the way everything in the world interacts; from the subatomic level to the astronomical level. I want to step up as a role model for my fellow Pasifika brothers and sisters, interested in science, who face the barriers of stereotypes that I once faced. I want to ensure that all Polynesian students understand that science is a pathway and in particular, I want to show people my faith does not hinder my passion for science but it, in fact, strengthens it."

LUFILUFI LENE-ISARA

VIEW MORE ON LUFILUFI LENE-ISARA

Lufilufi Lene-Isara with his mother Atelaite Isara and father Isara Isara.

LIVESTOCK ‘WORM DETECTIVE’ WINS FALLING WALLS LAB NEW ZEALAND

TOHATOHA
SHARE

Seer Ikurior won Falling Walls Lab New Zealand and the opportunity to pitch his idea at the Falling Walls finals in Berlin for his research on detecting lambs with parasites from observing their resting and grazing behaviour. Worms present a major health issue for sheep farming and all lambs are routinely treated with anti-worm treatment whether they are infected or not. Unfortunately, this is causing an increase in the numbers of worms resistant to treatment, just as the overuse of antibiotics is increasing the numbers of antibiotic-resistant bacteria. Seer’s research is making it possible to identify and treat just those lambs showing ‘wormy behaviour’. Seer was selected from 45 applicants from Aotearoa and the Pacific, 20 of which were chosen to pitch their ideas at the Falling Walls Lab New Zealand event held by Royal Society Te Apārangi, with support from the German Embassy in Wellington. Falling Walls is a global event, dedicated to supporting science and the humanities. In 2018, Seer won a prize for communicating his rangahau research in the 180 Seconds of Discovery video competition, organised by the Society’s Early Career Researcher Forum.

“Like us, worms pass on successful recipes to the next generation, only their recipes are for being resistant to worm treatment!”

SEER IKURIOR

VIEW VIDEO OF SEER PRESENTING IN BERLIN: BREAKING THE WALL OF RESISTANT WORMS

WHITIKAUPEKA

This star's name means the changing of the season and it is associated with spring.

Photo: Neil Ross / NZ Gardener

NGĀ TŪHONOHONO CONTINUED CONNECTIONS

Tuia i runga, tuia i raro
Tuia i roto, tuia i waho
Tuia te here tangata
Ka rongo te pō
Ka rongo te ao
Tui, tui, tui tuia

Unite above, unite below
Unite within, unite without
United as one
Listen to the night
Listen to the world
Now we can unite as one

THE 250TH COMMEMORATION OF JAMES COOK'S LANDING NEAR TŪRANGANUI A KIWA GISBORNE, AOTEAROA PROVIDED A FOCAL POINT FOR FACILITATING THE RECONCILIATION OF PERSPECTIVES FOLLOWING HIS ARRIVAL, AND THE IMPACT OF HIS CONTACT ON IWI MĀORI.

This had two threads to it. Firstly, an iwi perspective of local events surrounding Cook's arrival, how they were affected by that and, more generally, what that arrival has meant for Māori communities since then. Secondly, a New Zealand perspective about how that arrival has shaped this country's development.

The first thread was informed through iwi lead research and relationship building with institutions in the UK that hold relevant information and taonga. The goal was to reconnect with taonga housed in the UK by making connections with institutions such as University of Cambridge, Natural History Museum, London, British Museum, The British Library, Royal Botanic Garden Edinburgh, Kew Gardens, and The National Maritime Museum.

Representatives of the delegation visited The Royal Society London, and enjoyed a warm welcome and very constructive dialogue with their historian and head of information services.

The second thread was informed by authentic iwi knowledge holders and evidence-based story telling of the events of Cook's arrival and the joint history since then.

One example is a documentary about resilience, perseverance and stronger futures. It was a chance for Rongowhakaata to reflect on its recent history and explore what the 'Expression of Regret' really means for its people.

KO WHITIKAUPEKA TE WHETŪ

"The Society was given an exceptional opportunity to contribute to this reconciliation for three very important reasons. Firstly by our very nature, we are an independent evidence-based organisation with access to the best scholars and with a mandate to tell the accurate history of this country. However, even more than that, the Society is working at re-defining itself in a way so that it builds long term relevancy to all our communities and in a way that recognises New Zealand's globally unique cultural history. Finally, as a national organisation that intends to be around for the long term, we are an ideal partner in developing and maintaining necessary long term relationships.

We have shaped an extraordinary relationship with Tūranganui a Kiwa through Rongowhakaata Iwi Trust, Te Aitanga a Māhaki Trust, Ngāti Oneone and Tāmanuhiri Tūtū Poroporo Trust through this mahi, this commemoration experience and by supporting Tūranganui a Kiwa in reconciliation. This included the acknowledgement of wrong and grievance from the British High Commission with an 'expression of regret'; investing in iwi counter narrative accounts of Aotearoa and Pacific perspective; celebrating Polynesian navigation fleet; building and widening the body of knowledge by sharing of information as well as capability and capacity; building strong, lasting relationships with key bodies nationally and internationally; and by using our wide communications networks to communicate an iwi narrative. It has been an astonishing journey."

KAHU HOTERE (NGĀTI MANIAPOTO, TE AUPŌURI, TE RARAWA, NGĀTI WAI)
DIRECTOR – MĀORI, ROYAL SOCIETY TE APĀRANGI

VIEW DOCUMENTARY ON EXPRESSION OF REGRET AND WHAT IT MEANS FOR RONGOWHAKAATA

TŪHURA
EXPLORE

GOLDEN BINAURAL BEATS

Samantha Brown, of Sacred Heart Girls' College (Hamilton), was awarded a Gold CREST for her investigation on binaural beats. Binaural auditory beats are what the listener hears when tones at two different frequencies are presented to the left and right ear. The listener hears a single tone, which equals the frequency difference between the two tones. Anecdotal reports suggest that binaural beats can relieve stress and improve sleep by influencing brainwave patterns. In her CREST project, Samantha had students at her school listen to binaural recordings nightly for four weeks. Using electroencephalogram (EEG) measurements to look for changes in brainwaves, she did not observe any evidence of relaxation.

CREST is a Royal Society Te Apārangi programme with different levels to encourage students to be innovative, creative and to problem solve in science, technology and environmental studies.

"The results suggest that after 15 minutes of continuous listening to the binaural beat, there is a decrease in alpha power, and this trend does not change with daily exposure. The anecdotal reports which claim binaural beats have an increased alpha power in the brain are not supported by this study."

SAMANTHA BROWN

SPECIAL IPCC REPORT ON OCEAN AND CRYOSPHERE

TOHATOHA

SHARE

New Zealand researchers were involved in a special report 'Ocean and Cryosphere in a Changing Climate' approved and accepted by the Intergovernmental Panel on Climate Change in September 2019. The report highlights the urgency of prioritising timely, ambitious and coordinated action to address unprecedented and enduring changes in the moana ocean and cryosphere in order to preserve ecosystems and livelihoods that depend on them. New Zealand SCAR (Scientific Committee on Antarctic Research) researchers have played an important part in the report writing. They are contributing to the research that aims to understand the role that Antarctica is playing, and will continue to play, in future climate change – especially through the acceleration of melting contributing to sea level rise, according to Professor Gary Wilson, who is the Chair of the National Committee in Antarctic Sciences and holds a Vice-President role at SCAR.

"Understanding future and potentially non-linear behaviour in Antarctica's ice sheets and ice shelves is going to be critical to the development of international response plans. New Zealand has recently launched a new programme of research that addresses this and the impact of the melt on Antarctica's changing biodiversity."

GARY WILSON

READ MORE ON THE SPECIAL IPCC REPORT

ACCELERATING RESEARCH CAREERS WITH RUTHERFORD DISCOVERY FELLOWSHIPS

EACH YEAR ON BEHALF OF THE GOVERNMENT WE AWARD RUTHERFORD DISCOVERY FELLOWSHIPS TO LEADING EARLY- TO MID-CAREER RESEARCHERS, SUPPORTING THEM TO ACCELERATE THEIR RESEARCH CAREERS IN NEW ZEALAND.

In 2019 the awarded Fellows' rangahau span a wide variety of interesting topics, including:

- using a lab-on-a-chip approach to understand how plant diseases such as kauri dieback and myrtle rust target and invade their hosts;
- investigating the communication between brain and body to develop better coping mechanisms for those who suffer from anxiety;
- finding out what 'social capital' means within a Māori world view and how this is relevant to other populations; and
- combating loneliness in adolescents and emerging adults by increasing our understanding of social identity.

TŪHURA

EXPLORE

2019 RUTHERFORD DISCOVERY FELLOWS

Dr David Aguirre, Massey University, for research titled: Ecosystems on unstable foundations: examining the potential for coral and macroalgal responses to global change.

Dr Olivia Faull, University of Otago, for research titled: Breathing and anxiety: Understanding the miscommunication between brain and body, and how best to treat it.

Dr Jodie Hunter, Massey University, for research titled: Developing mathematical inquiry communities: Using a strength-based approach to provide equitable opportunities to learn mathematics for diverse learners.

Associate Professor Andrew McDaid, University of Auckland, for research titled: Uncovering new knowledge of neurological and musculoskeletal rehabilitation mechanisms using novel data-driven methods.

Dr Alexander Melnikov, Massey University, for research titled: Applications of modern computability.

Dr Volker Nock, University of Canterbury, for research titled: Electrotaxis and protrusive force generation in fungal and oomycete pathogens – pathways to new biocontrol strategies.

Associate Professor Melanie Ooi, University of Waikato, for research titled: Resilient and efficient light-based plant detection and characterisation for precision agriculture and environmental sustainability.

Dr Matthew Roskruge, Massey University, for research titled: The economics of social capital from a Māori perspective.

Dr Damian Scarf, University of Otago, for research titled: The belonging project.

Dr Jenni Stanley, University of Waikato for research titled: What does protection sound like? A modern approach to understanding New Zealand's underwater soundscapes and acoustic pressures.

Dr Ágnes Szabó, Massey University, for research titled: Growing old in an adopted land: Cross-fertilizing ageing and acculturation research.

VIEW MORE ABOUT THE 2019 RUTHERFORD DISCOVERY FELLOWS

DATABASE THAT CAPTURES GENETIC DATA AND INDIGENOUS RIGHTS

TOHATOHA

SHARE

Dr Libby Liggins from Massey University and Auckland Museum won the 2019 World Data System (WDS) Data Stewardship Award for her role in leading the Ira Moana – Genes of the Sea project that is delivering a searchable 'metadatabase' for New Zealand's genetic and genomic data and also captures Indigenous rights – a world first.

The metadatabase aims to ensure the kaitiakitanga of genetic data resources, linking genetic sequences with information – such as location, date, and mana whenua – creating opportunities for data synthesis, managing data re-use, and to inform future research directions.

The Data Stewardship Award celebrates exceptional contributions of early career researchers to the improvement of scientific data stewardship through their engagement with the community, academic achievements, and innovations. Libby was nominated by the Society, who holds a membership of the World Data System through Catalyst: Influence. The Ira Moana – Genes of the Sea project is being supported by funding from Catalyst: Seeding. Both Catalyst: Influence and Catalyst: Seeding are managed by the Society and funded by the Ministry of Business, Innovation and Employment.

"Ira Moana enables researchers to add a 'Traditional Knowledge Notice' as metadata. This notice signals that there is accompanying Indigenous rights that need further attention for any future use of the data. This implementation of such a notice is the first for a biological resource and for genetic data, setting a new standard in this research community. While it is important to make data accessible, the notice ensures that Indigenous rights associated with genetic resources are maintained in their metadata."

LIBBY LIGGINS

READ MORE: DR LIBBY LIGGINS WINS 2019 DATA STEWARDSHIP AWARD

2019 RESEARCH HONOURS AOTEAROA

THE ACHIEVEMENTS AND CONTRIBUTIONS OF INNOVATORS, KAIRANGAHAU MĀORI, RESEARCHERS AND SCHOLARS THROUGHOUT AOTEAROA NEW ZEALAND WERE CELEBRATED ON 17 OCTOBER AT THE 2019 RESEARCH HONOURS AOTEAROA, HELD AT THE TOWN HALL IN ŌTEPOTI, DUNEDIN.

Mana whenua Ngāi Tahu graciously welcomed us as manuhiri with a spirited pōwhiri and Dunedin City Organist David Burchell gave a stirring performance on Norma, the beloved Dunedin pipe organ in the Town Hall. Alongside many speeches during the evening, the Society awarded 17 medals and awards and the Health Research Council of New Zealand also presented three awards.

"In this context I want to begin by acknowledging you all here this evening. As Aotearoa New Zealand's leading researchers and research organisations with a wide range of networks, communities, whanau and whakapapa, you bring your expert knowledges and outstanding qualities to the debates about our shared futures.

But given my commitment to enhancing equity and diversity in our research communities, to better engaging with Māori researchers, mātauranga Māori and Te Ao Māori, and to understanding and supporting the next generation of researchers – you will also understand why I wish to explicitly acknowledge those who are still under-represented amongst us, and also point out that there are still many who are not in the room with us.

As we look forward to our shared futures we will need new relationships, to really stretch ourselves, be part of new dialogues across disciplines, across organisations, across sectors, and across communities. We will need to learn how to listen to those who are not already in the room, those who are not like us. For this is how we will realise the full potential of Aotearoa, by realising the potential of all not just some."

PROFESSOR WENDY LARNER FRSNZ FAcSS FNZGS,
ROYAL SOCIETY TE APĀRANGI PRESIDENT

VIEW VIDEO OF WENDY LARNER'S RESEARCH HONOURS AOTEAROA SPEECH

2019 RESEARCH HONOURS AOTEAROA AWARDEES

TOP HONOUR

Distinguished Professor **Jane Harding** ONZM FRSNZ was awarded the **Rutherford Medal** for her pre-eminent work determining the causes of newborn conditions and long-term consequences of interventions around the time of birth. Professor Harding is based at the Liggins Institute at the University of Auckland. Her research has led to new therapies and understandings that have improved outcomes for mothers and babies around the world. She pioneered a simple treatment for low blood sugar in babies, has shown that a routine-therapy was actually causing brain damage in premature babies, and has provided some of the first evidence that the health and treatment of a pregnant woman not only influences her baby's growth, but also her baby's disease risk as an adult.

COMMUNICATION AND LEADERSHIP

The **Thomson Medal** was awarded to Dr **Tim Haskell** NZAM, formerly of Callaghan Innovation, for his outstanding contributions to the organisation, support and application of science and technology in New Zealand. Dr Haskell's endeavours range from developing DSIR's first computer network, implementing earthquake-safe building systems, NMR development, manuka honey extraction and large-scale telescope componentry. Furthermore, Dr Haskell led New Zealand's Antarctic sea ice programme for nearly 40 years. Alumni from "Camp Haskell" are now key researchers in critical climate research programmes and in 2009 Antarctica's Haskell Strait was named after him.

Dr **Ocean Mercier** (Ngāti Porou), Victoria University of Wellington, was awarded the **Callaghan Medal** from Royal Society Te Apārangi for her pioneering work engaging audiences in science and mātauranga Māori. Dr Mercier's science communication spans television, public talks, writing, and university teaching. Described as "a bridge between worlds" by her former supervisor and medal namesake Sir Paul Callaghan, Dr Mercier is best known as a TV presenter. She hosted two seasons of Project Mātauranga (2012, 2013), a show which investigates how Māori people, knowledge and methods work with the scientific community to solve a variety of problems, and the third season of Coast New Zealand (2018).

PHYSICAL AND BIOLOGICAL SCIENCES

Professor **Jadranka Travas-Sejdic** FRSNZ from the University of Auckland and the Macdiarmid Institute was awarded the **Hector Medal** by Royal Society Te Apārangi for an outstanding contribution to the field of advanced polymers and nanomaterials. Professor Travas-Sejdic explores the fundamental aspects of materials composed of polymers and applies these findings to create electronic devices for a wide range of biomedical applications. These include hand-held sensors for electrical detection of DNA, such as detecting bacteria in water; stretchable electronics that can be worn or implanted to mimic biological functions; and novel carbon-based 'nanodots' for cell imaging.

Distinguished **Professor Philip Hulme** FRSNZ from the Bio-Protection Research Centre at Lincoln University has been awarded the **Hutton Medal** by Royal Society Te Apārangi for advancing knowledge on how non-native plants become invasive weeds in New Zealand. Aotearoa has more non-native plant cover than almost anywhere else in the world, representing one of the most intractable issues facing New Zealand's environment. Professor Hulme's research has established that many pest plants have come from botanic gardens, ornamental nurseries and the pastoral sector and he calls exotic plants "ticking time-bombs". He has presented clear and practical policy recommendations, which are changing how scientists and policymakers address plant invasions worldwide.

HUMANITIES AND SOCIAL SCIENCES

Professor **Edwina Pio**, Auckland University of Technology, was awarded the **Te Rangi Hiroa Medal** by Royal Society Te Apārangi for her pioneering research into intersectional diversity and its implications for business, government, education and society. Professor Pio studies how the intersection of ethnicity, religion and gender impacts on – and is influenced by – the world of work. Her studies have included entrepreneurship among Indian women in New Zealand, experiences at work for Muslims, and Māori mothers transitioning into higher education. She is making an important contribution to knowledge on how an increasingly diverse New Zealand can build a better workforce and society through respect, dignity and honouring difference.

Associate Professor **Selina Tusitala Marsh** ONZM FRSNZ, University of Auckland, was awarded the **Humanities Aronui Medal** by Royal Society Te Apārangi for her outstanding creative and scholarly work to bring the voices of Pasifika poetry to a broad audience. An acclaimed poet, Associate Professor Marsh has just finished her two-year term as New Zealand's Poet Laureate and was the Commonwealth Poet in 2016. She has published many collections of poetry and her latest book, which is just published, is a graphic memoir. Her writing is included in many anthologies, academic texts and websites. Through her scholarship, Associate Professor Marsh is providing a new framework through which Pacific Literature can be analysed.

Emeritus Professor **Roger Horrocks** MNZM, University of Auckland, was awarded the **Pou Aronui Award** by Royal Society Te Apārangi for his tireless work over five decades to support New Zealand culture in the creative arts. Professor Horrocks pioneered teaching Film, Television, and Media Studies in universities, just as a new film industry was emerging in New Zealand in the 1970s. He also helped establish many cultural organisations, including the Auckland International Film Festival and NZ On Screen. His research and writing on New Zealand-born artist and filmmaker Len Lye catalysed the re-discovery of this artist in New Zealand and the establishment of New Plymouth's Len Lye Centre.

CO-CREATED RESEARCH

Royal Society Te Apārangi presented a new award that recognises excellent, innovative co-created research, conducted by Māori, that has made a distinctive contribution to community wellbeing and development in Aotearoa. The inaugural **Te Rangaunua Hiranga Māori Award** was presented to **Ngā Pae o te Māramatanga**, New Zealand's Māori Centre of Research Excellence, for successful fostering and leadership that has carved out a space for community-led mātauranga Māori, te reo and tikanga Māori science research in Aotearoa. Without the infrastructure that long established disciplines have, Ngā Pae o te Māramatanga has developed and implemented new processes and structures to support Indigenous community co-created research in a tertiary environment. It has supported over 160 community-partnered research projects and has become a national and global exemplar for Indigenous research, featuring excellent, innovative co-created research for and by Māori.

TECHNOLOGY AND APPLIED SCIENCE

Professor **Keith Gordon** FRSNZ, University of Otago, was awarded the **MacDiarmid Medal** by Royal Society Te Apārangi for his innovative use of light to understand the molecular structure of a wide range of materials from solar cells, fish oils, to plastics in the environment. He uses interactions between light and matter – known as spectroscopy – to achieve this. His research has optimised solar cells, and he has developed methods to identify the different crystalline forms of pharmaceuticals, even at the nano-scale. He has also developed methods to assess the quality and composition of foodstuffs, including dairy, fish and horticultural products.

Professor **Cather Simpson** FRSNZ, University of Auckland, received the **Pickering Medal** from Royal Society Te Apārangi for her pioneering research and commercialisation of innovative photonic technologies, which are addressing challenges with a New Zealand focus and global impact. Professor Simpson's research uses ultrafast laser pulses to probe molecules in the millions of billionths of seconds after absorbing light. She has developed this technique for micromachining and microfabrication and she has also spun out the technology to solve problems in New Zealand's agricultural sector. These include being able to sort sperm by sex and assess the composition of milk for every cow at every milking.

Professor **Don Cleland**, Massey University, was awarded the **Scott Medal** by Royal Society Te Apārangi for making advances in the field of food refrigeration and heat pump technology. Professor Cleland has provided a suite of tools that allow accurate predictions for how a food will respond during processing, cool storage and transport. He has made advances in understanding how product shape affects rates of freezing, thawing, cooling and heating and the movement of water in and out of a food product during refrigeration. By prioritising sharing his findings, Professor Cleland's research is leading to improved performance, energy efficiency and sustainability of food processing and refrigeration systems worldwide.

EARLY CAREER RESEARCHERS

Dr **Lee Streeter**, University of Waikato, received the **Cooper Award** for making key advances in the theory and practice of time-of-flight imaging, a technique used in many industries to produce rapid 3D images of moving objects. Dr Streeter has developed numerous methods to reduce errors in this imaging technique and has even been able to use motion blur to determine both how far and how fast objects are moving, greatly extending the usefulness of this technique for industry.

Dr **Lisa Te Morenga** (Ngāpuhi, Ngāti Whātua Ōrākei, Te Uri o Hau, Te Rarawa), Victoria University of Wellington, was awarded the **Hamilton Award** for providing irrefutable evidence that sugar in the diet contributes to weight gain. Dr Te Morenga's breakthrough meta-analysis study, published in the *British Medical Journal*, clearly demonstrated a link between free sugars in the diet and the risk of excessive weight gain. The study found sugar increased weight by promoting excess energy consumption, not through metabolic effects. Based on this research, the World Health Organisation has updated its guidelines to limit free sugar in the diet and many countries have introduced new policies to reduce sugar consumption.

Dr **Bronwyn Wood**, Victoria University of Wellington, received the **Early Career Research Excellence Award for Social Sciences** for her research on how today's young people engage as citizens – especially in the school context. Dr Wood led a team that evaluated a NCEA initiative for personal social action within the social studies curriculum. This research showed that teachers could foster meaningful democratic engagement in their students through a hearts and minds approach. She has also researched youth citizenship in multicultural neighbourhoods, and advocates for lowering the voting age to 16 in New Zealand, alongside enhanced civics education in schools.

Christian Offen, a PhD candidate at Massey University, was the winner of the **Hatherton Award** for his paper that outlines the development of a new framework to study a class of non-linear differential equations that have values at which the number of solutions changes. These equations can be used to model physical systems with tipping points or where effects lag behind causes. By using advanced geometry to describe these equations, followed by analysis with what is known as 'catastrophe theory', his framework has proven useful for the general situation and has allowed him to discover new features of this type of equation.

Dr **Anne-Marie Jackson** (Ngāti Whātua, Ngāpuhi, Ngāti Wai, Ngāti Kahu o Whangaroa, Te Roroa), University of Otago, received the **Te Kōpūnui Māori Research Award** for forging new knowledge at the interface of mātauranga Māori and the physical sciences. Dr Jackson studies how traditional connections with water and ocean can bring flourishing health. She is part of a team creating a water safety programme for Māori that seeks to strengthen whānau connections to water and reduce drownings. She is Co-founder of Te Koronga – a Māori postgraduate research excellence group focussed on ancestral scholarship and excellence, leadership and community connectedness – which is building a strong platform for Indigenous research at her university.

VIEW MORE ON THE 2019 RESEARCH HONOURS AOTEAROA WINNERS

TOROHĒ

DISCOVER

TOHATOHA

SHARE

TĀ TIPENE O'REGAN MADE A COMPANION

Sir Tā Tipene O'Regan (Ngāi Tahu) was made a Companion of Royal Society Te Apārangi in a special presentation at this year's Research Honours Aotearoa in Ōtepoti Dunedin, Te Waipounamu. He was recognised for his exceptional mana, outstanding leadership and eminent contributions to promoting and advancing science, technology or the humanities in New Zealand. Unable to attend the ceremony due to ill health, his daughter Dr Hana O'Regan attended and spoke on his behalf. She said the distinction was incredibly important to him, "for his love for what has been achieved, and what is being continued to be done in the name of research, the pursuit of knowledge by the Royal Society, and the researchers in every corner of this land".

"It is my great joy that given its foundations in the New Zealand Institute, the Royal Society's re-inclusion of Māori culture, research and scholarship in recent years, provides us with a wonderful example of wā kāinga syndrome, that of returning to its roots."

SIR TĀ TIPENE O'REGAN

VIEW MORE ON TĀ TIPENE O'REGAN BECOMING A COMPANION

TŪHURA

EXPLORE

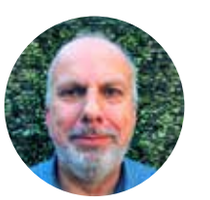
RESEARCH FELLOWSHIPS ON SKELETAL STORYTELLING, HEART CELLS, EVOLUTIONARY ANALYSIS AND PRETERM BIRTHS

WE AWARDED FOUR ESTABLISHED RESEARCHERS PRESTIGIOUS JAMES COOK RESEARCH FELLOWSHIPS IN 2019, WHICH PROVIDE GOVERNMENT FUNDING TO UNDERTAKE STUDY OR RESEARCH IN THEIR FIELD OF ENDEAVOUR FOR TWO YEARS.

Professor Hallie Buckley MRSNZ, University of Otago, will analyse human skeletal remains from archaeological sites in early colonial mining and pastoral settlements in Otago. She will construct osteobiographies, which are someone's personal life history as told by their skeleton, to tell the stories of everyday people who built the foundations of New Zealand's colonial society.

Professor Alexei Drummond FRSNZ, University of Auckland, will work to develop the next paradigm for scientific computing for complex biological problems through a radical upgrade and modification of the underlying algorithms and programming languages underpinning his software 'BEAST'. His research will result in a major advance in computational methods and tools for evolutionary analysis.

Associate Professor Andrew Taberner, University of Auckland, will develop a cutting-edge device to study how living heart muscle cells carry out their function. This will include 3D bioprinting of isolated cells in a format that allows rapid testing of their properties. His aim is to develop a technology that could provide opportunities to develop new treatments for diseases affecting the heart.



Professor Mark Vickers, University of Auckland, aims to develop an effective non-invasive clinical blood test to predict preterm birth using microRNAs, which are small non-protein coding RNAs that play a multitude of roles in gene regulation, and may indicate future complications in pregnant women. Early identification of mothers at risk of preterm birth allows for timely intervention strategies with benefits to both mother and child.

VIEW MORE ON THE 2019 JAMES COOK RESEARCH FELLOWS

EARLY CAREER RESEARCHERS AWARDED FELLOWSHIPS AND SCHOLARSHIPS

Our Rutherford Foundation awarded ten postdoctoral fellowships and a PhD scholarship with funding from Government in 2019. The researchers will be exploring a diverse range of research topics, including:

- metamaterials that could potentially turn every glass window into a transparent solar panel;
- pathogen-resistant kiwifruit that do not require metal-based pesticides;
- improved earthquake hazard resilience in Aotearoa;
- new methods for producing personalised cancer therapies that enable the patient's own immune system to search for and destroy cancerous cells.

TWO-YEAR NEW ZEALAND POSTDOCTORAL FELLOWSHIPS:

Dr Maedeh Amirpour, University of Auckland, for research titled: Toward tailored 3D printed bio-based human interfaces – rational design by predictive modelling.

Dr Nick Brettell, Victoria University of Wellington, for research titled: Matroids representable over all fields of size at least four.

Dr Emma Davison, University of Auckland, for research titled: Automated flow technology for the synthesis of personalised cancer vaccines.

Dr Anna Gosling, University of Otago, for research titled: Understanding the genetic origins of gout and metabolic disease in Pacific populations: an evolutionary approach.

Dr Lisa Hamm, University of Auckland, for research titled: Learning to see: identifying visual processing challenges through innovative assessment tools.

Dr Azadeh Hashemi, University of Canterbury, for research titled: Developing a simple and effective method for directing the differentiation of stem cells in the lab.

Dr Jay Jayaraman, Plant & Food Research, for research titled: A strategy towards durable kiwifruit immunity to Pseudomonas syringae pv. actinidiae (Psa).

Dr Rodrigo Martinez Gazoni, University of Canterbury, for research titled: Novel and easily-scalable metamaterials for energy and environmental applications.

Dr Lisa Pilkington, University of Auckland, for research titled: Data science QSAR strategies and tools for medicinal chemists.

Dr Brook Tozer, GNS Science, for research titled: Improving New Zealand's hazard resilience through seismic imaging of Earth's most dangerous faults.

THREE-YEAR CAMBRIDGE RUTHERFORD MEMORIAL PHD SCHOLARSHIP:

Benson Chen, Emory University, for research titled: Deep phenotyping and genotyping in inherited optic neuropathies.

VIEW MORE ON RUTHERFORD FOUNDATION 2019 AWARDEES

REGIONAL WORKSHOPS ALLOW SHARING IDEAS ON SCIENCE LEARNING

TOHATOHA

SHARE

During October and November 2019, the Science Teaching Leadership Programme provided opportunities for participant schools to reconnect at regional three-day workshops. Ninety kaiako teachers across Aotearoa got together in five locations to discuss their science learning programmes, have a field experience with a local science organisation and explore ways to extend programmes into their local communities. This was the first time these regional hui had been held and the feedback showed the participants valued the experience.

"The most valuable aspect of attending this workshop for me was time! The time to think, listen, reflect and learn from others on the journey. The time to plan and share with others on your team. The time to think! Also, it was a reminder that improving science learning is a journey and all schools and teachers take their own path that suits them. Networking is great to gather ideas, but simply copying won't work because every school is individual."

KERRI SATHERLEY, RUSSELL STREET SCHOOL, PALMERSTON NORTH

VIEW MORE ON THE SCIENCE TEACHING LEADERSHIP PROGRAMME

25

WORLD CLASS RESEARCH SUPPORTED BY MARSDEN FUND

Te Pūtea Rangahau a Marsden, the Marsden Fund, allocated $83.671 million (excluding GST) to 125 research projects across Aotearoa in 2019. These grants support excellent New Zealand research in the areas of science, engineering, maths, social sciences and the humanities. The grants are distributed over three years and are fully costed, paying for salaries, students and postdoctoral positions, institutional overheads and research consumables. Established researchers were awarded 74 Marsden Fund standard grants and there were 49 recipients of Fast-Start grants to support early career researchers. This year two large interdisciplinary projects received inaugural Marsden Fund Council Awards worth $3 million (excluding GST) each. One project will contribute to knowledge about predicting the behaviour of biological systems and their response to shifting temperatures, as might occur with climate change. The other is investigating genetic markers associated with metabolic diseases (like diabetes and gout) in Pasifika populations and how these diseases might have evolved.

"International peer reviewers described some of this year's research as the best they had ever seen. Te Pūtea Rangahau a Marsden supports our leading and up-and-coming researchers to carry out cutting-edge studies that advance knowledge in a wide variety of disciplines. The outcomes of their mahi work should have great scholarly impact and benefit Aotearoa in areas such as te taiao the environment, health care, and education."

PROFESSOR DAVID BILKEY, MARSDEN FUND COUNCIL CHAIR

IS MALARIA TO BLAME FOR DIABETES IN PASIFIKA PEOPLE?

A research team receiving a Marsden Fund Council grant will investigate whether ancient malaria led to a genetic predisposition to metabolic diseases such as heart disease, diabetes and gout in Pacific populations. The team will test the idea that the genetic variant that can lead to metabolic disease today evolved in Pacific ancestors as a protection against malaria. The research team includes Professor Tony Merriman FRSNZ, Professor Lisa Matisoo-Smith FRSNZ, Dr Anna Gosling of the University of Otago, Associate Professor Frank Camacho of University of Guam and Dr Paul Pumuye of the University of Papua New Guinea. Collecting new biochemical, health and genome data from a range of Pacific populations, they seek to provide new insight into the prevalence of metabolic disease in Pacific populations.

"This project has the potential to change the erroneous and stigma-producing perspective that modern metabolic disease is purely caused by a modern lifestyle."

DR ANNA GOSLING

VIEW MORE ON THE MALARIA PREDISPOSITION PROJECT

SAVING KĀKĀPŌ WITH FERTILITY BOOSTING RIMU FRUIT

Dr Janet Pitman and Dr Simon Hinkley, both from Victoria University of Wellington, received a Te Pūtea Rangahau a Marsden Fund Standard Grant to investigate whether rimu fruit is a 'super-food' that triggers breeding in kākāpō. Although a trigger for kākāpō breeding seems to exist in rimu fruit, the exact nature of this is unknown. Previously they have found that hormone-like compounds similar to oestrogen are present in rimu fruit. Janet and Simon hypothesise that when kākāpō eat rimu fruit, the compounds in them may trigger breeding by raising circulating oestrogen levels and promoting egg yolk protein and sperm production. Using a multidisciplinary approach, they will explore this possibility through a diverse range of experiments. These experiments will isolate the plant hormone in rimu fruit, measure its response in kākāpō, and identify the genes responsible for poor breeding in kākāpō. Their work could have implications for conservation efforts attempting to boost the reproductive success of this critically-endangered native parrot.

"Kākāpō only get one chance to breed every two to five years, during the mast years, so the fertility of kākāpō during that time is vital."

DR JANET PITMAN

READ MORE ON THE RIMU FRUIT AND KĀKĀPŌ FERTILITY PROJECT

HOW RIVER SCIENCE IS VALUED BY ENVIRONMENTAL DECISION-MAKERS

Over the past decade, agricultural intensification and urbanisation have taken their toll on the water quality of many rivers in Aotearoa. Human activities are pushing ecosystems, including awa, to the brink of collapse and scientists have conducted much research to help understand the degradation of rivers. However, not all scientific knowledge is considered, valued, and used equally, according to Dr Marc Tadaki, a postdoctoral researcher at the Cawthron Institute. He has been awarded a Te Pūtea Rangahau a Marsden Fast-Start Grant to examine how river science is valued in the courts, in regional planning, and in freshwater monitoring. By identifying which knowledges are dominant and which are marginal, Dr Tadaki will consider the consequences of these arrangements for ecosystems and communities.

"I'm interested in how different systems of knowledge, including mātauranga Māori and various fields of western science such as ecology, chemistry, or geomorphology, are considered in decision-making contexts, and whether we as a society might wish to value knowledge differently."

DR MARC TADAKI

READ MORE ON THE RIVER SCIENCE PROJECT

RESEARCHERS AND SCHOLARS ELECTED AS FELLOWS

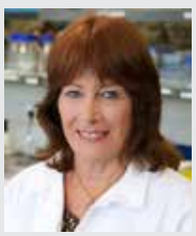
NINETEEN NEW NGĀ AHUREI A TE APĀRANGI FELLOWS AND A NGĀ AHUREI HONORE A TE APĀRANGI HONORARY FELLOW WERE ELECTED IN 2019. FELLOWS ARE ELECTED INTO THE ROYAL SOCIETY TE APĀRANGI'S ACADEMY FOR OUTSTANDING DISTINCTION IN RESEARCH AND SCHOLARSHIP OR CONTRIBUTION TO ADVANCING PŪTAIAO SCIENCE, HANGARAU TECHNOLOGY AND ARONUI HUMANITIES.

NGĀ AHUREI A TE APĀRANGI FELLOWS

Dr **Philip Barnes** FRSNZ, NIWA, is an internationally-recognised marine scientist who uses geophysical and geological methods to unlock the secrets of the earth beneath the seabed. Over the past three decades, his expansive research into New Zealand's undersea environment has revolutionised our perspective of the fault lines and active tectonic processes that shape Aotearoa and its surrounding seafloor.

Dr **Kelvin Berryman** FRSNZ, GNS Science, is a foremost pioneer and international expert on active tectonics and seismic hazard assessment. Kelvin's work seeks to quantify natural hazards (particularly earthquake and tsunami), and landscape change as a product of geological processes and climate variation over periods of many thousands of years, and to then communicate this knowledge in terms of the risk to lives and livelihoods to policy makers and the public.

Professor **Anne-Marie Brady** FRSNZ, University of Canterbury, is a specialist of Chinese politics (domestic politics and foreign policy), polar politics, Pacific politics, and New Zealand foreign policy. Her ground-breaking research into the Chinese Communist Party's political interference activities demonstrates the important role of the academic as 'critic and conscience' in a modern democracy.



Professor **Jillian Cornish** FRSNZ, University of Auckland, is an international leader and educator in bone biology and its application to orthopaedic research. She has identified key bone regulatory molecules and pathways in normal bone biology and has identified potential bone growth factors to be used to treat disease. One candidate is lactoferrin (a multifunctional milk protein) which can build new bone and is antimicrobial. It is currently being investigated to prevent biofilm implant-related infection in orthopaedic injuries.

Professor **James Crampton** FRSNZ, GNS Science and Victoria University of Wellington, studies life before the last great extinction. Using innovative methodology and analytical techniques, he seeks to reconcile evolutionary and ecological processes observed in the living biota of today, with long-term patterns and processes of past life on Earth, inferred from the remarkable fossil record.

KO WHITIKAUPEKA TE WHETŪ

Professor **Caroline Crowther** FRSNZ, University of Auckland, is a maternal fetal medicine subspecialist. Her work has changed care for wahine before preterm birth and for diabetes in pregnancy. Her research on preventing cerebral palsy in preterm infants with the use of antenatal magnesium sulphate treatment is proving to be one of the few interventions to prevent this severe motor disability.

Professor **Nicola Dalbeth** FRSNZ, University of Auckland, is a rheumatologist and professor of medicine who leads a research programme in gout, an arthritis of major relevance to Aotearoa New Zealand. Her work has identified novel mechanisms of disease and defined treatment approaches for gout. Her research in both pharmacological and non-pharmacological treatments has been incorporated into international gout management guidelines.

Professor **Valery Feigin** FRSNZ, Auckland University of Technology, has changed our understanding of stroke and traumatic brain injury prevention and epidemiology. His research has had significant implications for health care services, research planning and priority setting. His novel approach to primary stroke prevention through motivational population-wide intervention (Stroke Riskometer app) has received worldwide recognition.

Professor **Ronald Fischer** FRSNZ, Victoria University of Wellington, is a leading cross-cultural psychologist. His research focuses on documenting and exploring the origins and consequences of human cultural diversity. This quest raises fascinating problems, including what is 'culture', and how cultural activities both facilitate and undermine our health and wellbeing.

Professor **Merryn Gott** FRSNZ, University of Auckland, is recognised for the social science lens she brings to the significant public health challenge of reducing suffering at the end of life. She directs the Te Ārai Palliative Care Research Group. The group uses creative research methods to make visible the role of social factors such as cultural identity, gender and age in determining the end of life experiences of people with life-limiting illness and that of their whānau.

Professor **Brendan Hokowhitu** FRSNZ (Ngāti Pūkenga), University of Waikato, is a pioneering Māori scholar who has helped define the globally nascent field of Indigenous Studies. By re-centring Indigenous knowledge generally, Brendan's work on masculinities, sport sociology, critical theory, and film and media studies has challenged many dominant and limiting truths about Māori and Indigenous peoples.

Professor **Astrid an Huef** FRSNZ, Victoria University of Wellington, is a highly regarded pure mathematician working in functional analysis. Astrid studies dynamical systems, mathematical objects intended to model the way things change, and their abstract generalisations. They can be studied in a variety of ways, and Astrid uses the techniques of infinite-dimensional algebra and analysis which arose in the study of algebras of physical observables in quantum mechanics.

Associate Professor **Selina Tusitala Marsh** FRSNZ, University of Auckland, is a poet and scholar renowned for her outstanding creative and scholarly contribution to Pacific literature and Pacific Literary Studies. Through her critical and creative work, Selina cuts paths through un-poetic environs, enacting the Samoan concept of 'Va' to nurture and adorn people, spaces and places through the transformative power of poetry.

Professor **Tim Mulgan** FRSNZ, University of Auckland, is a significant international scholar in moral philosophy and philosophy of religion. His work develops a new understanding of our place in the universe, and explores its implications for our obligations to future people. He argues that, while humanity is incidental to the purpose of the universe, safeguarding the human future is our only hope of achieving anything of cosmic significance.

KO WHITIKAUPEKA TE WHETŪ

Professor **Rewi Newnham** FRSNZ, Victoria University of Wellington, is an outstanding researcher and educator who studies past and present environmental change, mainly through pollen analysis (palynology). His research includes reconstructing New Zealand's past climates and their controls and links to global climate change, determining human and volcanic impacts on the environment, tracing sea level and lake history and contemporary effects of pollen on human health.

Professor **Elaine Reese** FRSNZ, University of Otago, is a world-leading expert on autobiographical memory. She began her career with the ground-breaking discovery that the way in which mothers and young children talk about the past has long-lasting effects on a child's memory development. Her research has expanded to include studies with older children and adolescents and Māori families and continues to show that maternal reminiscing is reflected in a child's emerging life story.

Associate Professor **Mark Sagar** FRSNZ, Soul Machines and University of Auckland, is a pioneer in the computational modelling of the face. He studies and attempts to replicate digitally how the face appears and moves, how muscles create form and how the nervous system creates expressive behaviour in face-to-face interaction and social learning. His company Soul Machines aims to humanise AI, re-imagining how we collaborate with technology.

Professor **Philip Seddon** FRSNZ, University of Otago, is a reintroduction biologist concerned with the science and practice of conservation translocations: releasing organisms to establish new populations. He explores the risks of new forms of translocation, including moving species outside their historical ranges in response to climate change, but also the application of new technologies for de-extinction and synthetic biodiversity conservation.

NGĀ AHUREI HONORE A TE APĀRANGI HONORARY FELLOWS

Distinguished Professor John Dudley Hon FRSNZ, University of Bourgogne-Franche Comté, has made sustained and exceptional contributions to science through pioneering research in optical physics and global science advocacy. He studies unusual kinds of nonlinear waves, such as stable waves in lasers and optical fibres, looking to develop practical light sources for industry. He also studies unstable waves, such as destructive rogue waves on the ocean's surface.

VIEW MORE ON THE 2019 NGĀ AHUREI A TE APĀRANGI FELLOWS

TOROHĒ

DISCOVER

SUPPORTING FREEDOM AND RESPONSIBILITY IN SCIENCE

TOHATOHA

SHARE

The Society is the national member of the International Science Council (ISC) and provides executive secretarial and advisory support for the ISC's Committee on Freedom and Responsibility in Science (CFRS). The committee promotes the rights of researchers to engage in scientific activities and their corresponding duty to practice science responsibly and share knowledge in a public space. The committee's first meeting was held in Paris from 18 to 19 November. Representatives from the Society also represented the ISC and CFRS at the World Science Forum in Budapest, which had the theme of ethics and responsibility in science. The International Science Council formed in July 2018 as the merger between the International Council for Science and the International Social Science Council.

"The science we bring to the UN must have rigour, relevance and responsibility – this is what it takes to advance science as a global public good."

HEIDE HACKMANN,CEO, INTERNATIONAL SCIENCE COUNCIL

Photo: Adrian Heke, Education Gazette

STUDENTS PETITION GOVERNMENT TO PROTECT NATIVE FISH

TŪHURA

EXPLORE

A group of students from Hikurangi School, a small rural Northland kura, took a petition to parliament in November calling for the government to protect the habitat of the native black mudfish outside of conservation reserves. Led by their teacher Helen Moore, who began as a participant teacher of the Science Teaching Leadership Programme in 2018, the girls researched and developed an online petition and accompanying video on the remarkable fish, which they learned can live out of water for several months. Helen became concerned about the plight of native freshwater fish when she was doing a placement at Northland Regional Council at the beginning of the Science Teaching Leadership Programme. This inspired her to take the topic of fresh water fish conservation back into her classroom and she has learned how to get students to think like scientists though making observations, finding the evidence and drawing conclusions. The petition with 650 signatures was well received at parliament and the students may be requested to make an oral submission to the Environmental Select Committee in 2020.

"The girls have researched and spoken to experts and, in doing so, have found out more about the taonga that is the mudfish, which was so important to their iwi in the past. We have found there are people out there willing to help – experts are always willing to help – and they get excited when kids want to know things."

HELEN MOORE

VIEW MORE ON STUDENT PETITION

POWERING POTENTIAL: 8 QUESTIONS: 8 TEAMS: 8 MENTORS

"I've been inspired to go to university this year! I've been wrestling with it for a while but being able to work with like-minded people and hear their stories has really empowered me to want to go on and study science".

2019 POWERING POTENTIAL PARTICIPANT

VIEW MORE ABOUT POWERING POTENTIAL

The fifth Powering Potential event took place in Hakihea December with forty students from across New Zealand travelling to Wellington to work in teams to tackle some 'big problems' posed by scientists and technologists, who mentored the students. The students had 48 hours to research an issue before presenting potential solutions to a public audience. This programme, supported by Freemasons New Zealand, seeks to give students valuable skills and experiences, and demonstrate to them the benefits of following a career in science and technology. Team 'Sleeping Beauties' looked at why sleep is so important and how to improve sleep for adolescents. 'Play it by Air' tackled the issue of air pollution in cities. 'Dark Vaders' brainstormed how to lift awareness of the dangers of light pollution for moths. 'Botany Buds' considered what plants would both mitigate greenhouse gas emissions and improve New Zealand's natural ecology. 'De Fault' looked at the issue of housing in areas at high risk from natural disasters. 'The Which Doctors' looked at how we can use genome sequencing for personalised medicine. 'Bad Beaches' addressed the challenges of monitoring marine reserves and 'Fellow Humans' looked at how to make robots more human, especially through manipulating their 'voice'.

STUDENTS DESIGN APP TO NAVIGATE SCHOOL

TŪHURA
EXPLORE

Palmerston North Girls' High School is an EnviroSchool and students Caitlin Naylor, Jordan Daubney and Rachel Greenwood developed an app called PNGHS Navigational to make the school's navigation more sustainable. The students' technology project was developed to assist tauira, teachers, whānau, guests plus anyone new to Palmerston North Girls' High School (PNGHS), with navigating in and around the school through using a digitised map, photographs, and written information. At the start of each school year, the school had been printing out hundreds of paper maps for Y9 students. The three students determined that the majority of these maps were lost or crumpled by the end of the first week and their surveys showed that new people to the school had difficulties making sense of the paper-based navigation system. The app was developed through the Tahi Rua Toru Tech programme and received a Team Silver Challenge CREST award. It is available through Google Play for Android devices and the Apple app store.

"As long as there are new people, there are lost people."

CAITLIN NAYLOR, JORDAN DAUBNEY AND RACHEL GREENWOOD

VIEW MORE ON PNGHS NAVIGATIONAL

SUPPORTING THE MEDIA TO COVER THE WHAKAARI WHITE ISLAND ERUPTION

TOHATOHA

SHARE

The tragic eruption of Whakaari on 9 December will be remembered as one of our most severe volcanic tragedies. As when any major news story breaks in Aotearoa, the Science Media Centre sought to assist journalists to report on the scientific aspects of the story. In addition to providing an 'Expert Reaction' on the eruption, which gathers a collection of quotes from experts that can be used in news stories, the Science Media Centre also sent out lists of available experts to media and redistributed the latest information coming out of GNS Science and GeoNet. The Science Media Centre responded to dozens of media enquiries and shared information from volcanologists who explained that the eruption happened suddenly with little warning due to the type of volcano Whakaari is.

"Sudden, unheralded eruptions from volcanoes such as White Island can be expected at any time. Magma is close to the surface, and the heat and gases from this heat the surface and ground waters to form vigorous hydrothermal systems. We know hydrothermal and so-called 'phreatic' eruptions can occur suddenly and with little or no warning because they are driven by the expansion of super-heated water into steam. This expansion is supersonic in speed, and the liquid can expand to 1,700 times its original volume. This produces catastrophic impacts."

PROFESSOR SHANE CRONIN, UNIVERSITY OF AUCKLAND

VIEW WHAKAARI ERUPTION EXPERT REACTION

TOROHĒ

DISCOVER

HEALTH IMPACTS OF CANNABIS UNDER THE SPOTLIGHT

In December we released a report that summarised what is known about the potential risks and benefits to health from the use of recreational and medicinal cannabis.

It found evidence that cannabis-based medicines have some therapeutic effect in specific clinical situations such as treating chronic pain, nausea from chemotherapy, muscle spasms due to multiple sclerosis and in rare forms of epilepsy. However, we don't have good evidence that they work better than existing medicines available to treat these conditions.

For recreational use, some harms are seen including mental illness, particularly in youth, drug use disorders, respiratory illness, impaired cognition, increased road accidents and lower birthweights in babies born to women exposed to cannabis. The report also highlighted the dangers of synthetic cannabinoid products, which are linked to deaths and daily life-threatening cases presenting at New Zealand emergency departments.

For both recreational cannabis and cannabis-based medicines, the report found large knowledge gaps in understanding the health effects, particularly in specific groups of the population, and this lack of knowledge poses a public health risk. The population groups thought to be at most risk from cannabis use are those under 18 years, pregnant and breastfeeding women, people over 50 years and heavy cannabis users.

The report draws heavily on the 2017 publication by the US National Academies of Sciences, Engineering and Medicine as well as additional literature of relevance to Aotearoa.

"With changes to New Zealand's legislation on prescribing cannabis and the upcoming referendum on whether New Zealand should legalise recreational cannabis, Royal Society Te Apārangi has prepared this report to assist people considering the opportunities and risks to health associated with cannabis use."

PROFESSOR WENDY LARNER FRSNZ FAcSS FNZGS,
ROYAL SOCIETY TE APĀRANGI PRESIDENT

VIEW MORE ON HEALTH IMPACTS OF CANNABIS

NGĀ AHUA O TE AO HURIHURI – RETHINKING OUR SHARED FUTURES JOURNAL ISSUE

In December a special issue was published in the *Journal of the Royal Society of New Zealand* on rethinking our shared futures in Aotearoa.

Royal Society Te Apārangi asked a number of experts to contribute papers. The papers covered a range of topics including business, hauora, culture, society, environment, history and even reflections on research practice itself. The special issue was timely, as 2019 marked 250 years from the first encounters in 1769 between mana whenua and Captain Cook. Throughout the year Māori highlighted the fraught nature of commemorating these encounters and the numerous atrocities that followed for iwi Māori through colonisation.

In the preface, Royal Society Te Apārangi Councillors Dr Reremoana Theodore MRSNZ, Associate Professor Melinda Webber MRSNZ, Professor Richard Blaikie FRSNZ and Professor Wendy Larner FRSNZ wrote that the papers "have been presented here to encourage reflection and discussion, and to help us broaden our shared understandings of the purpose, process and impact of research for everyone in Aotearoa".

All papers are open access and the journal cover features art work from Darryn George (Ngāpuhi, Ngāti Wai) entitled Waru – a space of comtemplation that would encourage us to look beyond ourselves to new beginnings and new life.

"The series of 10 articles that make up this supplement are a contribution to discussions around a candid appraisal of our past. They include a number of deeply honest reflections about our history, and stark identification of issues yet to be resolved, with a mix of past, present and future focused approaches. All attempt to look towards the future from a more honest appraisal of our past (ka mua, ka muri). It is also clear that a holistic system-level approach is more important than tinkering with individual policy or practice."

REREMOANA THEODORE, MELINDA WEBBER, RICHARD BLAIKIE AND WENDY LARNER

VIEW MORE ON NGĀ AHUA O TE AO HURIHURI

Art work: Waru by Darryn George (Ngāpuhi, Ngāti Wai)


BARBARA

PROFESSOR WENDY LARNER

NO TE HURIHURINGA ON REFLECTION

IT IS MY PRIVILEGE AND PLEASURE TO CONTRIBUTE SOME BRIEF COMMENTS TO THE ANNUAL REVIEW FOR 2019.

I am writing this on the day that our Prime Minister announced that community transmission of COVID-19 in Aotearoa was expected to occur in the next two weeks. When you read this you will know how the country responded to the threat of the disease and what it has meant for our whānau, friends and country. My sincere hope is that the valiant efforts of our scientists, government officials and health professionals, together with the care and support of our communities, means that you are now settling into a 'new normal'. Te ao hurihuri a changing world.

Royal Society Te Apārangi had its own sorrows in 2019. We were deeply saddened by the passing of Councillor Professor Ken Strongman FRSNZ on 29 December. Ken was a stalwart of Royal Society Te Apārangi and a central figure in New Zealand's research landscape. It was Ken's foresight and careful negotiations that saw the Humanities Council merge with Royal Society Te Apārangi, following the example of the Royal Society of Edinburgh, which also encompasses all of the disciplines. The recent announcement that our highest award, the Rutherford Medal, will now include humanities scholarship in its fields of recognition is both a fitting legacy, and the final step in the full integration of the humanities into Royal Society Te Apārangi.

2019 was a year of great change and further achievement for Royal Society Te Apārangi. In particular, we significantly strengthened engagements with Te Ao Māori, playing our part in Tuia 250 and the rethinking of shared futures. We were proud to work with Tūranga-a-Kiwa in Tairāwhiti Gisborne, and be part of the process for the formal Expression of Regret from the British High Commissioner Laura Clarke. He Wahine Toa. We also sponsored Professor Rangi Matamua's Matariki national series, reviving the relationship between his whānau and Royal Society Te Apārangi, and taking his knowledge of the stars to communities across both Aotearoa and Australia. The recognition of Tā Tipene O'Regan as a Companion of the Society was further evidence of our deep commitment to re-engaging Māori culture, research and scholarship in Royal Society Te Apārangi's activities. This work with Te Ao Māori could not have happened without the leadership of Director – Māori, Kahu Hotere and Director – Communications and Outreach, Tarah Nikora and I tautoko mihi maioha their mahi.

We have also cemented our relationship with the International Council of Academies of Engineering and Technological Sciences (CAETS). While CAETS now spans 30 countries distributed across six continents of the world, Royal Society Te Apārangi is the first multidisciplinary academy to be accepted for full membership. This success delivers on a long held aspiration of Chief Executive Dr Andrew Cleland, and I am delighted that aspiration has now been realised. More generally, the Council and Academy Executive Committee have been restructured so that we are better able to respond to the needs and perspectives of all parts of the research community, including Māori and Pasifika researchers, early career researchers, and the full range of academic domains and research organisations. The result is a relevant and engaged Council membership, who have brought knowledge from their research networks and communities to our deliberations, and an Academy Executive Committee that reflects the full disciplinary span of our activities.

I want to formally acknowledge the contributions of the Council members, the Academy, Council sub-committees, Constituent Organisations and the dedicated Branches who make up the structure of Royal Society Te Apārangi. I applaud the kaimahi staff for the exceptional work they do. I also remain immensely proud of all those who contribute to the many and diverse work programmes of Royal Society Te Apārangi. In addition to the commitments of my fellow Council members and the wonderful staff, we have identified and sought out the best people in Aotearoa to support us in our engagements with partners, panels, expert advice, committees, schools, ministries and our publics. Given my commitment to enhancing equity and diversity in our research communities, I am heartened by the continued support we receive from those who have long engaged with the Society, as well as the new dialogues we are having across disciplines, organisations, sectors and communities. This year has seen enormous change and, while there is still much to do, I am deeply honoured to be on this journey with this rōpū. Tēnā rawa atu koutou many thanks to you all.

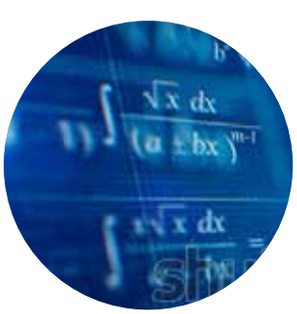
Kia kaha tātou ki te tiaki i a tātou anō.

Let us be vigilant and take care of ourselves and others.

Heoi anō, kia ora be well.

Professor Wendy Larner FRSNZ FAcSS FNZGS

ROYAL SOCIETY TE APĀRANGI PRESIDENT, APRIL 2020



KUPUTAKA | GLOSSARY

aronui	humanities
arotakenga	evaluation, review
awa	river
hangarau	technology
hauora	health, wellbeing
hui	meeting
kai	food
kaiako	teacher
kaimahi	staff
kaimoana	seafood, shellfish
kairangahau	researcher
kaupapa Māori	way of doing things, a Māori approach
kirihou	plastics
kōrero	talk, discussion
kotahi rau	one hundred
kura	school
mahi	work
manuhiri	visitors
mātauranga	knowledge, understanding, vision, wisdom
mauri	life force
moana	ocean
pūtaiao	science
rangahau	research
rōpū	group
taiao	environment, ecosystem
taiohi	youth
tangata whenua	local people, hosts
taonga	treasure
tau	year
tauira	student
tautoko	support
te ao Māori	the Māori world
te hiranga	excellence
tohatoha	share
tono	demand, command
torohē	advice
tūhura	discover
wai	water
wānanga	learning seminar, discussion gathering
wero	challenge
whakapapa	ancestry
whānau	family
whenua	land

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