A photograph of three people standing on a dark, rocky beach at night. They are silhouetted against a vibrant orange and yellow glow from a sunset or fire in the background. The sky above is filled with numerous stars.

# Explore, discover, share

HIGHLIGHTS 2016

ROYAL  
SOCIETY  
TE APĀRANGI

EXPLORE | DISCOVER | SHARE



# **Supporting New Zealanders to explore, discover and share knowledge**

---

**Exploring our world,  
discovering knowledge and  
sharing that knowledge are  
central to the role of the  
Royal Society Te Apārangi.  
Discover what we were up  
to in 2016.**

**Find out more detail about  
all of these issues on  
[royalsociety.org.nz](http://royalsociety.org.nz).**

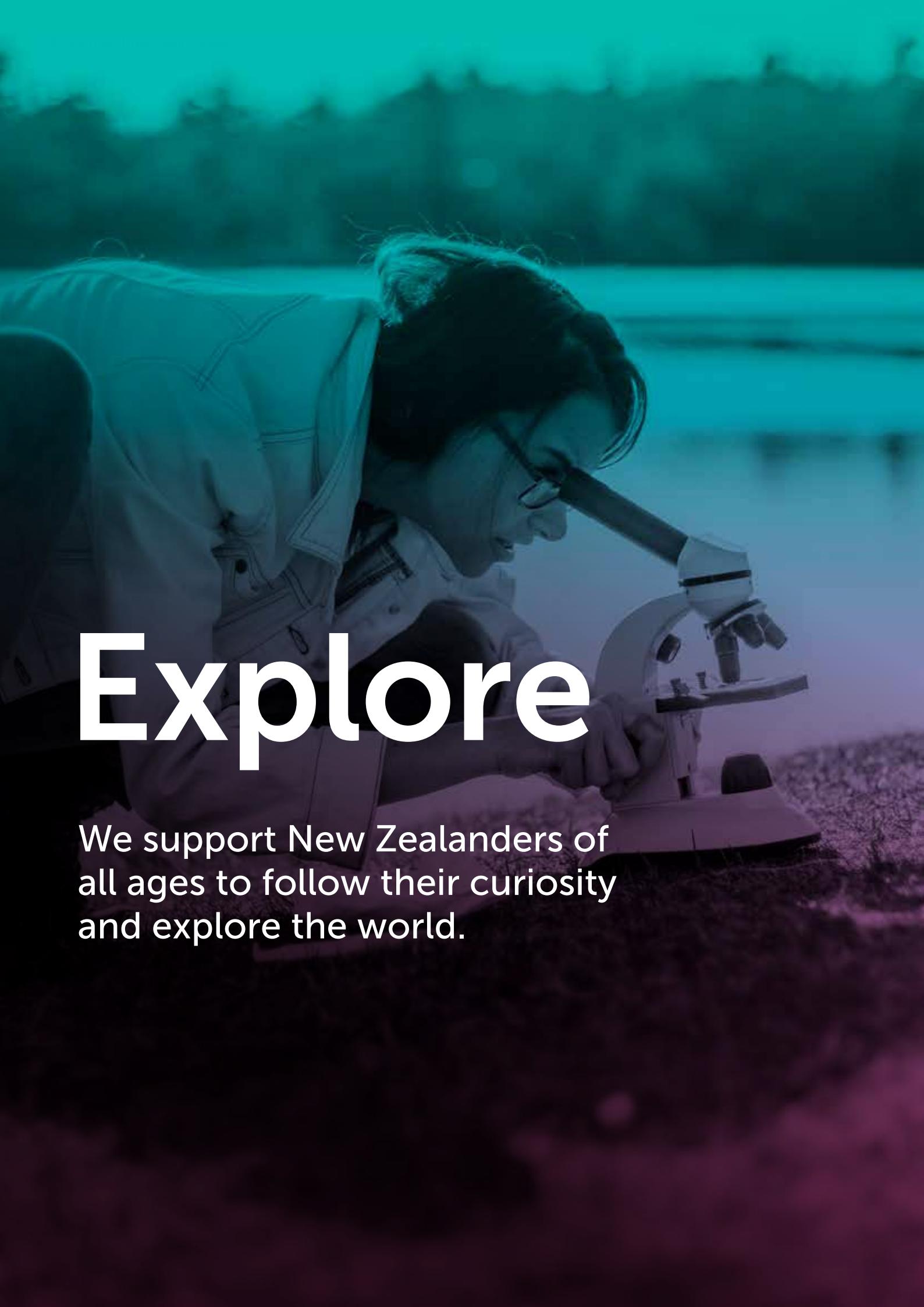
---

Our Māori name, Te Apārangi, means a 'group of experts'. At the core of the Royal Society Te Apārangi are our Fellows, women and men at the top of their fields, who along with other experts help us provide evidence-based advice to government and the public. In a world full of information of variable quality, we hope you can look to us for reliable, interesting guidance on issues of public concern.

During 2016 we provided advice on issues of both global and national concern. Our focus on climate change resulted in two major reports supported by public talks, information for public, teachers and students, daily social media updates and discussions with government experts. We also provided public information on sugar and gene editing, and we made expert submissions to government on issues including the Health Research Strategy and the Environmental Roadmap.

Our experts help us make decisions on who should receive New Zealand's Research Honours and where government research funding, like the Marsden Fund, should be allocated. We also manage educational programmes, and public outreach projects, supported by government funding.

We support the pursuit of knowledge and foster a culture that encourages New Zealanders to explore, discover and share that knowledge.

A photograph of a person wearing a hard hat and safety glasses, looking through a microscope. The person is outdoors, with a blurred background of trees and a body of water.

# Explore

We support New Zealanders of all ages to follow their curiosity and explore the world.

# Students tackling challenging problems by sharing ideas

---

**Forty talented school students from around New Zealand gathered together at Powering Potential in Wellington for three days to tackle 10 major climate change issues.**

---

They worked with experts and mentors to find answers to conundrums such as: how do New Zealand houses impact on climate change? And how do we tackle emissions in the aviation sector when there are no alternative fuel sources at the moment? The results impressed the experts as much as the parents and teachers. The students themselves said the experience was 'life-changing', teaching them about teamwork and motivating them to look at new career options.

Seventy-two students from Dunedin to Auckland took on the New Zealand Institute of Food Science and Technology NZIFST / CREST Student Product Development challenge in 2016. They worked with scientists, technologists and engineers to develop everything from dehydrated breakfasts to protein-enriched yogurt and spicy dried fish.



Students who participated in Powering Potential 2016.

# Connecting industry and teachers provides insights for future learning

---

**Many employers are looking to employ students from their local schools but find that their skills and education don't add up to a suitable employee.**

---

Our Teachers in Industry programme connects local businesses, teachers, and career advice providers in the Franklin and Papakura region. Teachers visit local industries to see what it is they do, and use the experience to consider how they might adapt their curriculum to include more practical skills or relevant skills for the workplace. Both teachers and businesses say they greatly value the programme. In 2016 there were 61 schools, 119 teachers, 29 businesses and 24 service agencies involved. This programme is funded by government.

One of the most exciting visits was a day trip to Air New Zealand's Aviation Institute to look at how they operate their flight training, engineering and digital technologies operations and discuss what skills they are looking for in employees. Air New Zealand is interested in employing local school students once they've finished their education.



Teachers in Industry visit to Air New Zealand.

# Helping our school students explore and learn with science leadership in schools

---

There's a great school in Stokes Valley, Lower Hutt, called Koraunui. The students there are really enjoying learning about science; it's a hands-on experience there.

---

They've been exploring through installing beehives, making natural balms and creams, building a shed to store garden tools, and establishing a school taro patch among other things.

The Prime Minister awarded one of their teachers, Dianne Christenson, the 2016 Prime Minister's Science Teacher prize recently for the great work she's doing leading the school in how to teach science. Dianne had previously spent two terms getting hands-on science experiences herself as part of our Science Teaching Leadership Programme. She's now working with her school to implement the practical science and leadership skills she's picked up, to the delight of Koraunui teachers and students.

The Science Teaching Leadership Programme is funded by government. We had two intakes in 2016. In phase —placement with a science organisation and leadership training—we had 16 teachers in the first intake and 21 in the second; and for phase 2, implementation back at school, 57 and 55 teachers respectively.



Dianne Christenson (Photo by Mark Tantrum).

# Increased Marsden funding allows support for more research and more early-career researchers

Marsden funding was increased to \$66 million over four years in the 2016 Budget. This meant that 117 new research projects could be supported

At December 2016, we were managing 367 live research contracts, each over three years.

That includes another 49 **Fast Start** grants for early career researchers, 20 more than in 2015. We also updated the eligibility criteria to allow for time taken off for child-care and similar commitments.

Through these grants we are supporting researchers at an early stage in their careers to explore topics including climate change, nitrogen run off, immigration, and understanding New Zealand's native plants and animals.

Slow-moving landslides, ancient Māori social networks, and how melanin acts as a sunscreen are some of the intriguing topics being explored with support from the **standard grants**.

## Determining the potential of the corneal transition zone for corneal transplants



### Dr Jie Zhang, University of Auckland

*Disease, damage or loss of the innermost layer of the cornea (the corneal endothelium) can result in blindness. Current methods to repair the affected cornea involve transplants but there aren't enough donors. Dr Jie Zhang has a Marsden Fast-Start grant, and aims to increase the number of patients who can be treated from a single donor.*

## Counting our tūpuna in Aotearoa New Zealand



### Associate Professor Tahu Kukutai, University of Waikato

*Demographic survival is the bedrock of peoplehood. For many indigenous peoples, colonisation threatened their survival. Scholars agree that the size and health of most indigenous populations declined after European contact. But the timing, magnitude, and causes of decline are topics of ongoing debate, and a newly funded Marsden project.*

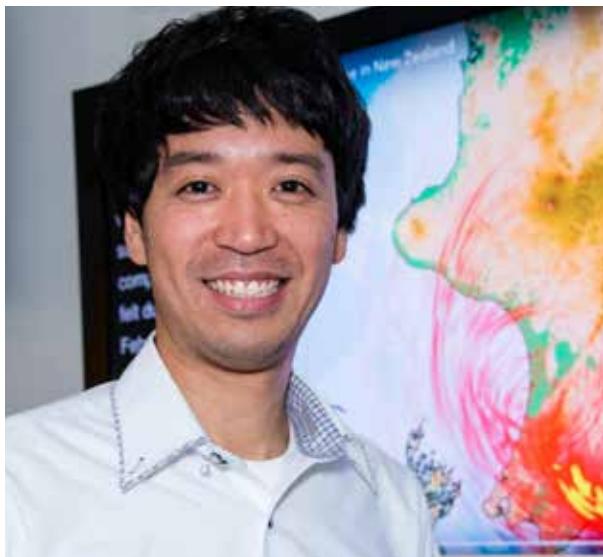
# Supporting early career researchers to become leaders and develop their careers

---

Earthquakes, nanotechnology and the search for new antibiotics featured in our 2016 Rutherford Discovery Fellowships.

---

We awarded 10 to support early career researchers, and five postdoctoral fellowships and three PhD scholarships for emerging researchers through our Rutherford Foundation Trust. This is supported by government.



*Rutherford Discovery Fellow Dr Yoshihiro Kaneko, a seismologist at GNS Science, will use state-of-the-art seismological techniques to image and model the Hikurangi subduction plate boundary, which will help New Zealand be better prepared for the next megathrust earthquake.*

PHOTO CREDIT: Margaret Low, GNS Science

# Supporting established researchers to explore their area of expertise

---

Topics supported this year include new migraine medicine, predicting sea level rise, and speeding up data transfer.

---

Funded by government, James Cook Research fellowships allow established researchers to explore their own research interests full time for two years. We awarded three fellowships in 2016:

**Professor Debbie Hay** is exploring the safety and efficiency of a new type of migraine medicine.

**Professor Tim Naish FRSNZ** is working to improve sea level rise predictions and to better understand how the Antarctic ice sheet will respond to warming temperatures.

**Professor Peter Smith** is investigating how to improve the rate of data transfer in 5G (fifth generation wireless systems).

We are also helping our researchers to collaborate internationally by managing three Catalyst Fund programmes funded by government:

- Catalyst: Seeding focused on small and medium pre-research partnerships.
- Catalyst: Influence focused on participation in and membership of international science forums.
- Catalyst: Leaders to support international fellowships for exceptional researchers.

A photograph of two people, a woman on the left and a man on the right, wearing lab coats and safety glasses. They are both smiling and looking down at something in their hands, possibly a small object or a piece of equipment. The background is blurred.

# Discover

We recognise the discoveries that New Zealanders make through their research, from school children through to researchers at the top of their field.

# Keep it shut, then flush it out

---

**That's how you minimise your exposure to pollution in indoor carparks, according to research by Michelle Schneideman and Susie Kwon from Epsom Girls Grammar School.**

---

This discovery helped them achieve Team Gold CREST awards in 2016. Their research looked at driver behaviour, ventilation settings, carpark infrastructure and carbon monoxide levels. Susie said they constantly asked themselves questions, were creative, changed and refined their methods and tested ideas to reach their conclusions. Discovery at work.



Team Gold CREST: Michelle Schneideman and Susie Kwon.

# Celebrating our discoveries

---

**A highlight of our year is to recognise the outstanding discoveries and achievements of researchers at the New Zealand Research Honours awards.**

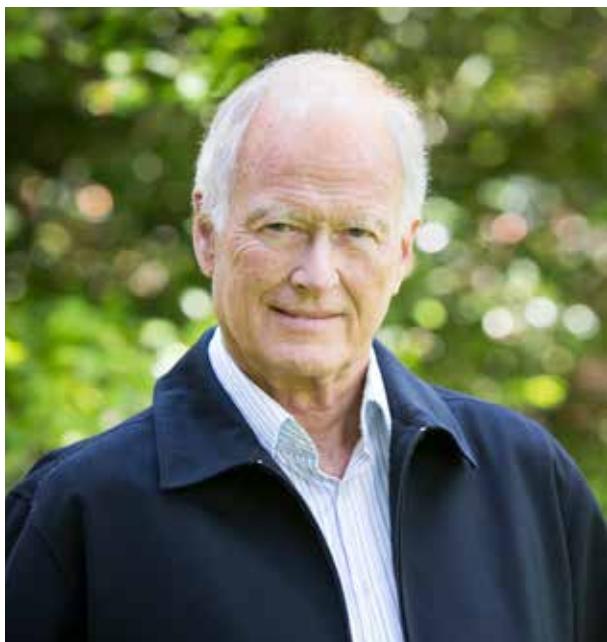
---

These researchers and scholars help us better understand the world we live in and contribute to the richness of our community.

The medal-winners' research in 2016 covered some intriguing problems. How did human language evolve? How can school leaders best enable students to learn successfully, or teach literacy? How does light move in fibre optic cables? Can we mimic muscle movement using polymers? Is it possible to model a respiratory system? What impact have colonial ways of thinking had?

The Rutherford Medal, the Society's premier award, was received by Emeritus Professor Michael Corballis ONZM FRSNZ of the University of Auckland for his research into the human mind. His work includes understanding the differences in the two hemispheres of the brain, the evolution of language and the human capacity for 'mental time travel' where we can think about both the past and future.

Full lists of medal winners are available on [royalsociety.org.nz](http://royalsociety.org.nz) and in our Annual Review 2016.



Professor Michael Corballis.

# Prime Minister's Science Prizes

---

**The Prime Minister awards five prizes to recognise the impact of science on New Zealanders' lives, to celebrate the achievements of current scientists, teachers and science communicators and encourage those of the future. The Society manages the process for the Prime Minister.**

---

The Prime Minister's 2016 Science Prize was awarded to the team of University of Otago researchers, led by Professor Richie Poulton, behind the Dunedin Multidisciplinary Health and Development Study, which is credited with providing the most detailed data on human development ever amassed.

The study, based on researching the lives of about 1,000 children born in Dunedin in 1972 and 1973, has enabled evidence-based health and social policy-making and changed the way policy makers, clinicians and practitioners think and act, both in New Zealand and overseas. It has led to many changes in policy, helped with identifying antisocial behaviour stemming from childhood, and increased our understanding of the later-life effects of adolescent cannabis use, among many other things.

The Prime Minister's Science Prizes also covered worldwide research into the effects of ground shaking caused by earthquakes; a primary school teacher leading science in her school; experimental semiconductor physics; and great science communication. All winners are listed on the website: [pmscienceprizes.org.nz](http://pmscienceprizes.org.nz).



Richie and his team at the Dunedin Multidisciplinary Health and Development Research Unit.



# Diverse range of researchers and scholars elected as Fellows

Nineteen researchers and scholars were elected as Fellows of our Academy in 2016.

The new Fellows included a majority of females (ten out of nineteen); two Fellows from Crown Research Institutes; one Fellow from a private research organisation; two Fellows with Māori ethnicity; and one with Asian ethnicity. The first female mathematician was also elected. Find more information on [royalsociety.org.nz](http://royalsociety.org.nz).

## THE NEW FELLOWS ARE:

### **Professor Jacinta Ruru**

*University of Otago  
Co-Director of  
Ngā Pae o te Māramatanga.*



Her work considers how the legal systems of former colonies ought to recognise Indigenous peoples' interests in land and water.

### **Dr Judi Hewitt**

*Principal Scientist at NIWA  
whose interdisciplinary contributions have advanced fundamental knowledge of marine biology and advanced environmental science.*

### **Professor Tony Merriman**

*University of Otago  
has made major contributions to the science of autoimmune diseases and gout, particularly among Māori and Pacific people.*

### **Professor Donna Rose Addis**

*University of Auckland  
has studied how the brain stores and retrieves memories, including in those suffering from amnesia, clinical depression, and dementia.*

### **Professor Rod Dunbar**

*University of Auckland  
studies how T cell responses can be stimulated in cancer therapy, and is helping accelerate the advent of cancer immunotherapy.*

### **Professor Hinke Osinga**

*University of Auckland  
is a specialist in dynamical systems theory, the mathematical analysis and prediction of behaviour that changes with time.*

### **Professor Hinke Osinga**

*Our first female maths fellow is from the University of Auckland. She is a specialist in dynamical systems theory, the mathematical analysis and prediction of behaviour that changes with time. She is developing numerical methods for computing invariant manifolds or 'tipping points'. Her work has made a significant contribution to manifold theory, and her publications, illustrations, animations and outreach activities have made her famous worldwide in the mathematics and arts communities.*



**Professor Hong Di***Lincoln University*

has led pioneering research into nitrate leaching and nitrous oxide emissions from intensive dairying systems, leading to mitigation technologies.

**Professor David Craw***University of Otago*

has advanced knowledge of the relationship between plate tectonics, mineral deposits and latterly New Zealand fauna such as freshwater fish.

**Professor Rosalind Hursthouse***University of Auckland*

has had a profound impact on ethics in philosophy. She is a leading figure in the development of 'virtue ethics'.

**Professor Lynnette Ferguson***University of Auckland*

is a world leader in nutritional genomics with an international reputation in mutagenesis and issues of chronic disease.

**Professor Stephen May***University of Auckland*

is a world authority on language rights and an international expert in indigenous language, immersion education and multilingualism.

**Professor Peter Shepherd***University of Auckland*

who has made important contributions to understanding how defects in a cell signalling pathway contribute to cancer and diabetes.

**Professor Cris Shore***University of Auckland*

developed approaches and methods for analysing policy, power and organisations. He worked on the EU and university reform.

**Dr Skelte Anema***Fonterra Research and Development Centre*

is an expert on interactions between milk proteins under different conditions. He has six patents for innovative dairy technologies.

**Dr Jenny Juengel***AgResearch scientist*

is researching how genetic mutations in sheep influenced reproductive outcomes. She identified a cell responsible for advancing or inhibiting fertility.

**Professor Linda Tuhiwai Smith***University of Waikato*

studied 'decolonising' research methodologies and has reshaped inquiry across many domains.

**Professor Parry Guilford***University of Otago*

studied cancer biology and genetics, identified the first known gene for inherited gastric cancer and developed a test for bladder cancer.

**Professor Annie Goldson***University of Auckland*

is an acclaimed documentary film maker contributing to humanities and film culture, forging a dialogue between these two domains.

**Professor Kathleen Campbell***University of Auckland*

is unearthing evidence for past life in 'extreme' environments, contributing to the search for bio-signatures on other planets.

The Society also announced the election of two Honorary Fellows, aimed at encouraging strong ties with leading international scientists and scholars and New Zealand's research community.

**Professor Grant Montgomery***University of Queensland*

pioneered methods for trait identification in farm animals and contributed to genome mapping for complex diseases.

**Professor Chris Simon***University of Connecticut*

uses molecular biology to answer questions related to the origin, spread and conservation of biological diversity, using cicadas.



# Share

Knowledge is for sharing. We need it to make decisions on important issues, and to enjoy life to its fullest.

# Focus on climate change

## What will climate change mean for New Zealand and what can be done to reduce the risks?

Providing the public with answers to these questions was a strong focus of the Society in 2016 with an all-year campaign to share information, the publication of two major reports, and a number of public events and educational activities and materials. The reports were unique in pulling together information from a wide range of fields for a New Zealand context.

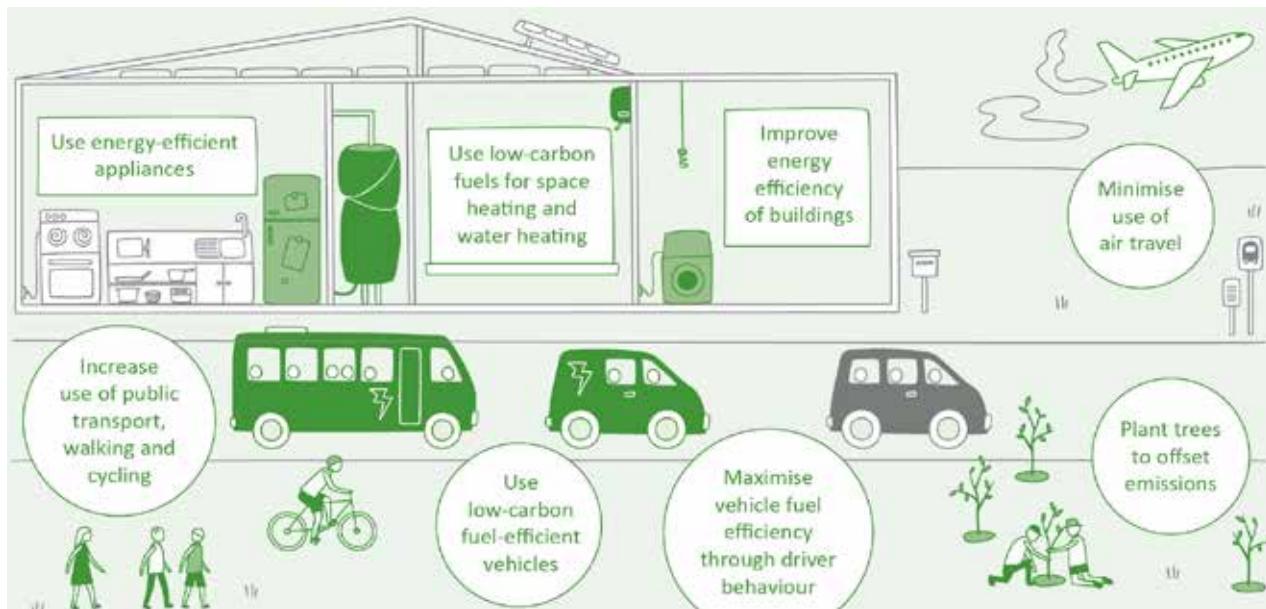
The first report, Climate Change Implications for New Zealand, identified six key risk areas:

- coastal margins
- flooding from rivers
- availability of and competition for freshwater
- changes to our surrounding oceans
- threats to our unique ecosystems
- flow on effects from climate change impacts and responses overseas.

The report Transition to a Low-Carbon Economy for New Zealand found there were good opportunities to mitigate climate change in all sectors, including:

- reducing fossil fuel use
- increasing renewable electricity
- using low carbon transport, such as electric cars, buses and rail
- managing energy use in buildings
- improving energy efficiency
- considering trade-offs in agriculture
- planting forests (may only be an interim solution)
- supporting low-carbon choices.

The second report also considered the interactions between technology, policy and behaviour and the factors that either limit or provide opportunities for change, and gaps in our knowledge.



# Cutting-edge research for MPs

The Speakers Science Forum presents the latest research to MPs to inform the issues being addressed in Parliament.

We work with Science New Zealand, Universities New Zealand, and the Independent Research Association of New Zealand to bring experts to Parliament. In 2016 we covered issues of healthcare costs, nanotechnology, climate change, and primary sector issues.

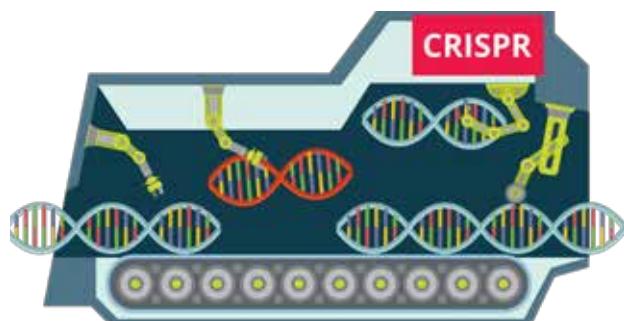
# Revolution in gene editing

New gene-editing techniques are revolutionising the ease and accuracy of making changes to genetic material.

They have huge potential benefits in many sectors including healthcare, agriculture and conservation, but are not without risks.

To help us all understand the advances occurring in gene editing, we prepared a fact sheet, infographics and an animation in simple language, explaining current gene-editing technologies and what they are already being used for around the world.

More information will be provided in 2017 including a discussion about the ethics of gene editing, and the risks and opportunities of it.



# What we know about sugar and health

The media is full of confusing information about sugar and health. We set out to remove some of the confusion by providing the latest research on sugar and health in an easy-to-understand animation and fact sheets published in English, Te Reo, Tongan and Samoan.

Excessive consumption of sugar is harmful for health and hard for consumers to avoid because it is difficult to work out how much added sugar is in food and drink. Current World Health Organisation guidelines say we should keep added sugar intake below 12 teaspoons of added sugar per day for most people.



The concentrated sugar in one glass of orange juice



is equivalent to:



It is recommended to have no more than 12 teaspoons of added sugars each day



How many teaspoons of sugar are found in some common food and drinks?



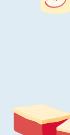
A bottle of energy drink



A bottle of sports drink



A bottle of fruit smoothie



A slice of red velvet cake

# Sharing ideas with New Zealanders face to face

---

**Our public events programme ranged across issues of climate change, culture in education and terrorism in history, to treating bone disease and reading great books.**

---

Some highlights included:

**Professor Konai Helu Thaman** talking about the importance of culture in teaching and learning, which made us consider new perspectives on how we teach and learn, how we do our research and the assumptions we need to be aware we are making.

**Dr Dava Newman**, NASA's Deputy Administrator, on the research underway to get humans to Mars and back. Her talk covered psychology to ethics, physics and engineering.

**Roxanne El-Hady** 18, UK Young Scientist of the Year 2016, shared her enthusiasm and experiences in science and work on climate change with young female students.

**Bill Oddie**, comedian, author, conservationist and BBC wildlife presenter, entertained us with his tales of birding.



Professor Konai Helu Thaman.



Dr Dava Newman plays an anti-gravity game with children who attended her public talk.

# Special issues of journals: from grounding of the MV Rena to arachnids

---

To help researchers share their discoveries, we publish eight peer-reviewed journals.

---

In 2016, we also published numerous special issues, on subjects including:

- the life and work of Tony Whitaker, a prominent New Zealand herpetologist
- advances in geodesy and active tectonic deformation
- in honour of Professor Robert Jackson, a prominent New Zealand arachnologist, marking his retirement
- the MV Rena: cross disciplinary investigations into the effects of oil, contaminants and debris
- the ecology and biogeography of south-temperate forests
- social movements, resistance and social change in Aotearoa New Zealand.



# Help us ensure New Zealanders can keep exploring, discovering and sharing knowledge

In our fast-paced world, it's important to have a source of trustworthy information on the big issues we face.

With your help we can provide more quality, reliable, expert information on issues you care about, and issues that could affect you in the future.

Your support will allow us to continue and expand our work to support New Zealanders to explore, discover and share knowledge.

Visit our website today to donate, become a funding partner, friend or member.

[www.royalsociety.org.nz](http://www.royalsociety.org.nz)

---

## Connect with us

Here are some ways we can get together:

 @royalsocietynz

 RoyalSocietyNZ

 royalsociety.org.nz

## Royal Society Te Apārangi

11 Turnbull Street, Thorndon, Wellington 6011  
PO Box 598, Wellington 6140, New Zealand  
T +64 4 472 7421

ROYALSOCIETY.ORG.NZ

ISSN 2537-9283 (Print)  
ISSN 2537-9291 (Online)

Published 2017