InSCight

September 2011 | **Faculty of Science Alumni Magazine** Issue 05

Origins of language
An experimental invasion
Stroke rehabilitation
Auckland volcanoes

THE UNIVERSITY OF AUCKLAND
FACULTY OF SCIENCE

InSCight

The University of Auckland Faculty of Science alumni magazine 2011

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If you are a Faculty of Science graduate and have a story to tell about your experiences or achievements, or would simply like to re-establish contact, please get in touch.

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

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

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On the cover: View from the Goldwater estate on Waiheke Island, now part of the University's wine science programme.
- Photographer, Godfrey Boehnke.

A word from the Dean

The past year has seen several major developments for the faculty as well as ongoing change in the science sector.

Professor Grant Guilford, Dean of Science

Nationally there is growing awareness of the link between science and sustainable economic growth, and the need to invest in science and innovation. There is also a very welcome movement toward greater collaboration across academic disciplines and institutions, and stronger links between academia and industry.

The faculty is playing an active role in these changes at a range of levels from individual staff to major multidisciplinary research programmes, such as the thematic research initiatives described in last year's magazine and the new Food and Health Programme.

Across the science sector, we have built closer links with Crown Research Institutes through Joint Graduate Schools and university scientists are leading establishment of the New Zealand eScience Infrastructure to benefit researchers around the country.

We are continuing to build our relationships with industry through these initiatives as well as through many industry-focused research centres, such as the Institute for Innovation in Biotechnology (IIB) opened by the Prime Minister this year.

While we are heavily involved in applied science and innovation, the faculty also has an enviable reputation for curiosity-driven research. As the country becomes more aware of the value of science and innovation, it is important that fundamental science is not overlooked and that creativity in science blossoms.

Basic research not only has inherent value but the potential to be used in unexpected ways. For instance, the language evolution work featured in this issue not only answers fundamental questions about human origins, but also provides a model for studying the evolution of social systems.

Overall, the breadth and depth of our expertise means that faculty is well positioned to assist with many of the key challenges facing the world today, from climate change to food security and loss of biodiversity, and green growth to optimising health and well-being.

We aim to share this expertise with the wider public, and new developments such as the launch of the Interpretive Centre at Leigh, the first Virtual Incredible Science day, and improvements to our website, are helping us to achieve this.

We also aim to continue building our reputation for excellence in teaching and research. The faculty's world-class standing was reinforced this year with excellent results in the QS World University Subject Rankings. We're also delighted by the success of our staff in university and national teaching awards.

Faculty teaching and research, and our links with the wider community, will also benefit from several major building projects. The Leigh Marine Laboratory redevelopment and Thomas Building extension were completed this year, refurbishment of the mathematics, statistics, and physics building is underway, and plans are well advanced for a major redevelopment and expansion of the chemical sciences and geology building.

It has been an extremely busy and successful year and I'm delighted with all that the faculty has achieved.

PROFESSOR GRANT GUILFORD
Dean of Science
The University of Auckland

Leading creativity and innovation in the sciences

Around the Faculty

Underwater world

In June 2011, the South Pacific Centre for Marine Science was made accessible to the public for the first time with the launch of the University's new Marine Interpretive Centre at Leigh. The centre is a key part of a $10 million redevelopment of the University's Leigh Marine Laboratory and campus, and offers visitors insight into research undertaken at the Leigh Marine Laboratory and the abundant marine life at the Goat Island Marine Reserve and surrounding coast. Seven themed pavilions cover the diversity of marine science, from the history and science of the world's first marine reserve to the source of marine food webs and the sounds of the sea.

Unlike other education centres around the world, Leigh is the only one attached to a marine reserve. "We're hoping many of the visitors to the reserve - about 350,000 each year including 600 school children - will go snorkelling down at the reserve and then come and make sense of what they've seen in our centre," says John Montgomery, the director of the laboratory and Professor of Marine Science. "We see the centre as a wonderful opportunity to create a shop-front for marine science, and science in general."

More information:
www.leighmarine.auckland.ac.nz

The new Marine Interpretive Centre at Leigh. - Photographer, Godfrey Boehnke.

Major gift to Wine Science

Pioneering Waiheke winemakers Kim and Jeanette Goldwater have made a $4 million gift to The University of Auckland as part of a development that will see their iconic vineyard and winemaking operation become a new centre for the faculty's Wine Science Programme. The gift will allow students and researchers to be immersed in a world-class commercial winemaking environment.

The University has acquired the Waiheke property, partly through a commercial transaction, and partly through the $4m philanthropic gift.

The 14-hectare vineyard and winery will operate two parallel streams. An established team will continue to produce wines commercially under the premium Goldie brand and more accessibly-priced Island label. Wine science students will keep producing their own wines for teaching purposes under the University's Ingenio label, work as interns in the commercial operation, and have access to the fruit and data for research.

"The new arrangement means that we will be hardwired into the industry and able to fine-tune our teaching to industry needs," says Wine Science Director Randy Weaver. Teaching for the first half of the year-long Postgraduate Diploma in Wine Science will be onsite at the Waiheke estate and students will continue to work there several days a week for the remainder of their studies. "We are expanding the curriculum for the Postgraduate Diploma in Wine Science and anticipate that the number of students will double to around 30.

Prime Minister The Rt Hon John Key officially opens the Institute for Innovation in Biotechnology, with Professor Joerg Kistler and Vice-Chancellor Professor Stuart McCutcheon

IIB officially opened

State-of-the art facilities housing New Zealand's first biotechnology incubator, the Institute for Innovation in Biotechnology (IIB), were opened by Prime Minister, the Rt Hon John Key, in April 2011. The Institute, hosted by the School of Biological Sciences, brings academics and industry together in a single location to share infrastructure, facilities, and expertise.

"The Institute is at the cutting edge of an international trend toward academia and industry working more closely together, to increase opportunities for innovation and accelerate scientific discovery to market," says Director Professor Joerg Kistler. "By providing businesses with access to the research infrastructure, high-tech equipment, and scientific expertise available within academia, we are lowering the barriers to business-led innovation."

As well as providing facilities for industry the Institute creates opportunities for graduate research and employment, and bioscience enterprise training through new postgraduate degrees.

The opening of the Institute, which has been operating from temporary facilities since 2006, marked the completion of a purpose-designed building that provides a permanent home and increases its research space to more than 10,000m^2. Nine biotechnology companies are currently co-located in the Institute, and six organisations with an interest in science and innovation are involved as partners.

More information: www.biotech.co.nz

NeSI leaders (left to right): Professor Tim David (Canterbury), Professor Mark Gahegan (Auckland), Mr Nick Jones (Director, NeSI) , Mr Rick Christie (Chair of the Board, NeSI), and Dr Murray Poulter (NIWA).

High ranking for sciences

The Faculty of Science scored exceptionally well across all its disciplines ranked in the QS World University Rankings®. QS ranks universities worldwide based on academic reputation, employer reputation and research citations, with weightings tailored to each subject.

In the QS rankings by subject, released in May 2011, The University of Auckland was placed 27th in the world in psychology, 30th in both mathematics and geography and area studies, 34th equal in environmental science, 39th in biological sciences, 40th in computer science and information systems, and 43rd equal in chemistry. It was ranked in the 51-100 range in earth and marine sciences, and physics and astronomy.

Dean of Science Professor Grant Guilford says that the rankings are a useful benchmarking tool for the faculty. "It is very pleasing to see an across-the-board improvement in the faculty's rankings from last year and the esteemed international universities with which we stand. It is a testament to the quality of our staff."

More information: www.topuniversities.com

New supercomputer network launched

A national supercomputer network to boost research on many fronts, from climate change to drug discovery, from nanoparticles to models of the human heart, was launched in June 2011 at host institution The University of Auckland. The New Zealand e-Science Infrastructure (NeSI) is designed to keep New Zealand at the cutting-edge of science by providing researchers with the high-performance computers, data storage capacity, and technical expertise that they require.

"NeSI represents the most significant infrastructure investment for New Zealand's science system in the last twenty years," says Professor Mark Gahegan of the Faculty of Science's Centre for e-Research, which led the successful bid to establish the network. "It provides not only the hardware to handle massive computational loads but also the skilled support team to create custom solutions for specific research problems."

NeSI brings together new and existing supercomputer hubs at The University of Auckland, Canterbury University, the University of Otago, NIWA and Landcare Research, and is open to researchers around the country.

More information: www.nesi.org.nz

Left to right: Professor Stuart Bradley (Physics), Professor Grant Guilford (Dean of Science), Professor Chris Triggs (Statistics), Professor Gillian Dobbie (Computer Science), Linda Thompson (Faculty Manager) and Professor James Sneyd (Mathematics).

Chemistry is now Chemical Sciences

To better reflect its size and multi-disciplinary nature, the Department of Chemistry was renamed as School of Chemical Sciences in May 2011. With activities ranging from micro-scale manufacturing to wine aroma analysis, crime scene research, and the synthesis of new drugs, the Department of Chemistry had outgrown its old name.

Many of the school's researchers work across academic disciplines, for instance, collaborating with biologists and medical scientists to investigate new treatments for human disease, with physicists to harness the power of lasers in research and manufacturing, and with engineers to develop new methods of processing food and producing materials.

"The new name better expresses the diverse range of activities which make up modern chemistry, and we have become engaged in most of them," says Professor Jim Metson who was re-appointed for another term as Head of the School of Chemical Sciences.

Building 303 Revamp

The refurbishment of Building 303, commonly known as the Maths/Physics Building, is progressing rapidly. Most of the staff members in the Departments of Physics, Mathematics and Statistics have now been decanted across the city campus. It is anticipated that the Department of Physics will move back into levels 6, 7 and 8 towards the end of September with the remaining departments being re-housed into the building during semester one, 2012.

The building, which was completed in the late 1960s as part of the Science Centre, was some 15,824m^2 in area. In recent years the undergraduate physics laboratories, electrical engineering spaces and four lecture theatres were refurbished, and the current work is addressing the remainder of the building including plant, infrastructure and a structural upgrade. The refurbishment will bring the remainder of the building (over 7,000m^2) up to a level that meets the University's objective of providing high quality infrastructure to support teaching, learning, research and community engagement of an international standard.

Outcomes will include better utilisation of space and the development of spaces that will encourage interdisciplinary activities in a modern and pleasant environment. Space allocations reflect current rather than historical boundaries and space will be generic wherever possible to allow future redistribution. Specialist laboratories will be relocated from the tower to free up space for offices and postgraduate use, and teaching spaces will be centralised on the lower floors. A new break-out space and enlarged shared common room will encourage interaction between staff and students from across the disciplines.

There will be major environmental improvements, with more natural light on some levels and a night-purge system to improve air quality and reduce energy use by lowering temperatures during warmer months.

Student life will be enhanced by the development of informal spaces with wireless networks, and support spaces for Māori and Pacific Island students in a prime position.

The refurbishment is part of the ongoing programme of campus development.

Connecting with Crown Research Institutes

A major new initiative, championed by Dean of Science Professor Grant Guilford, has seen the University establish Joint Graduate Schools with three Crown Research Institutes (CRIs).

The first agreement, creating the Joint Graduate School in Plant and Food Science, was signed with Plant & Food Research in November 2010. It was followed soon after by the formation of the Joint Graduate School in Biodiversity and Biosecurity with Landcare Research and the Joint Graduate School in Coastal and Marine Science with the National Institute of Water and Atmospheric Research (NIWA).

The schools, the first of their kind in New Zealand, focus on educating postgraduate students. They strengthen and formalise links with the CRIs, building on a long history of collaboration between individual scientists, and are expected to have significant benefits for both students and researchers.

The new arrangements make the most of the complementary research activities and facilities at the partner institutions.

They provide students with a greater number and range of potential research projects, as well as access to additional scientific expertise, research infrastructure and industry links. One of the aims is to increase the number of students and scholarship opportunities in fields considered critical to the country's future.

"The Joint Graduate Schools have been a very important initiative for the University," says Vice-Chancellor Professor Stuart McCutcheon. "Not only do they bring the University and CRIs closer together, they increase the number of students participating in joint supervisory arrangements and are therefore win-win situations for those of us who value graduate students working in our organisations."

"The schools will increase the pool of top young scientists with New Zealand-relevant education in plant and food science, biodiversity and biosecurity, and coastal and marine science," adds Grant.

"They will increase the number of graduates available for employment in both industry and academia, and will also enhance the employment-readiness of students by facilitating the inclusion of industry training needs in their education."

Vice Chancellor Stuart McCutcheon and NIWA CEO John Morgan sign the agreement for the Joint Graduate School in Coastal and Marine Science.

"As well as the many benefits for students, the closer relationships will promote research collaborations between the University and CRIs by creating enduring connections between scientists, including initiatives such as the co-appointment of staff."

Under the new arrangement, CRI staff who supervise a group of postgraduate students may also be co-appointed to University academic positions.

Plant and Food Science

"Plant-based industries are a major contributor to New Zealand's economic success, with food industries contributing around half of the country's export earnings including more than $3 billion directly from horticulture," says Dr Ian Ferguson, Chief Scientist at Plant & Food Research.

"By widening access to research expertise, and increasing the number of experienced researchers in this area, we can contribute more effectively to this critical part of the economy and ensure that we have the right science and the right people for the future."

Biodiversity and Biosecurity

Landcare Research General Manager Biological Systems Dave Choquenot says New Zealand is a small nation with significant biodiversity challenges. "It's important that the biodiversity expertise in this country is applied effectively to address those challenges, and that Landcare Research can recruit enough skilled staff to meet our capability development needs."

The Joint Graduate School is an extension of the collaborative research centre created by the two organisations six-years ago, and will focus on postgraduate supervision around Landcare Research biodiversity projects.

"The school will have the flexibility to support both organisations' goals. More than one-third of our science staff are recruited from abroad so initiatives like this are important for fostering capability here in New Zealand."

Coastal and Marine Science

"Worldwide we are not producing enough scientists and we need to grow the talent at home," says John Morgan, Chief Executive Officer of NIWA. "Our local talent, particularly in the area of marine sciences and freshwater sciences, is internationally recognised and often world-leading, and that speaks volumes for our education system. As an employer of marine science staff, the establishment of the Joint Graduate School in Coastal and Marine Science is a very exciting development."

"It is also an opportunity, at a time when there's a lot of pressure on resources, to say that coastal and marine science is an area that counts. The marine environment is a resource that we know relatively little about, and investing in capability now is going to ensure that in future we have the skills and knowledge to make the most of this country's prospects for economic growth."

www.science.auckland.ac.nz/joint-graduate-schools

New appointments

To support postgraduate research at the Joint Graduate Schools the Faculty of Science has co-appointed four new professors, four new associate professors and two senior lecturers; **Professor Margot Skinner, Associate Professors Louise Malone** and **Matt Templeton** and **Drs Robin MacDiarmid** and **Robert Schaffer** from Plant and Food Research and **Professors Dave Choquenot, William Lee** and **Roger Pech**, and **Associate Professors Dianne Gleeson** and **Thomas Buckley** from Landcare Research. Years of industry experience willensure that the new staff members can offer students research opportunities with direct relevance to New Zealand's primary production and food industries, and to pressing issues of measuring, managing and protecting New Zealand's terrestrial ecosystems and biodiversity.

Staff news

New professors

Professor Winston Byblow (Department of Sport and Exercise Science) has achieved scholarly eminence as a neuroscientist. He investigates how the brain controls movement, and the brain's capacity for recovery after disease or injury that impairs movement. He is optimistic that his research will improve motor rehabilitation for stroke sufferers by providing clinicians and therapists with better tools. Professor Byblow is an investigator within the University's Centre for Brain Research and Director of the Movement Neuroscience Laboratory.

Professor Rod Dunbar (School of Biological Sciences) is Director of the Maurice Wilkins Centre for Molecular Biodiscovery, a national network of scientists and doctors developing new therapies, vaccines and diagnostics. His primary research field is human cellular immunology, especially developing therapies for cancer that exploit the immune system. His lab is also working with other human cells that have therapeutic potential, such as stem cells.

Professor Ian Kirk (Department of Psychology) is co-director of the Research Centre for Cognitive Neuroscience, and investigates the neural systems involved in mnemonic and attentional processes. He also has interests in neurogenetics, in cerebral asymmetries, in music perception and production, as well as in cognitive disorders such as Alzheimer's, Parkinson's, schizophrenia and Asperger's Syndrome. His work has been supported by grants from the NZ Royal Society (Marsden), the Health Research Council, and the US National Institutes of Health.

Professor Gillian Lewis, Newly appointed Director of the School of Biological Sciences, is an expert in freshwater Microbiology. She studies natural and contaminating microorganisms in water, such as human viruses that find their way into water and shellfish; how certain microorganisms can be used as indicators of the human health risk of water sources; and how microbes can be used to reduce contamination in the natural environment.

Professor Suzanne Purdy (Department of Psychology) is Head of Speech Science, which she established as a discipline at the University in 2003. Speech Science's Master of Speech Language Therapy Practice, a first for New Zealand, was accredited in 2005. Her research on hearing loss, cochlear implants, auditory electrophysiology, treatment of auditory processing disorder, language disorders in children, brain injury, stuttering, and noise in the workplace spans many aspects of speech science and communication disorders and appears in leading journals. Her research on identification and management of hearing and auditory processing in children has had considerable international and national impact on clinical practice.

Professor John Read (Department of Psychology) worked for 20 years as a clinical psychologist and manager of mental health services before joining the University. His main research interests are: the psycho-social causes of psychosis, primary prevention, attitudes towards "mental illness", and the role of the pharmaceutical industry in clinical research and practice. He is editor of the international peer-reviewed journal *Psychosis: Psychological, Social and Integrative Approaches*.

Teaching awards

Academic staff from the Faculty of Science received awards for teaching excellence at the 2010 University of Auckland Teaching Excellence Awards and 2011 National Tertiary Teaching Excellence Awards (TTEA)

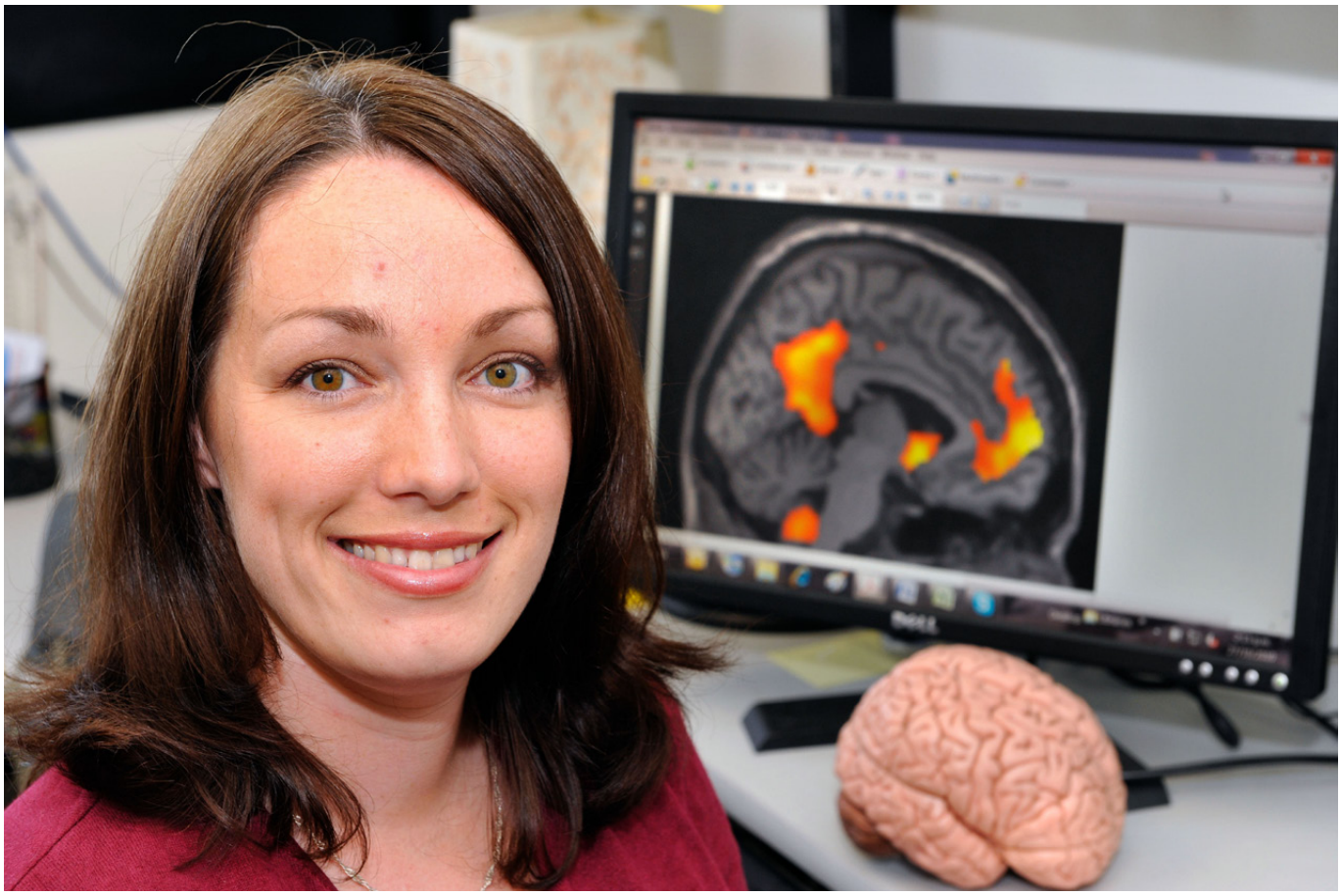
Professor Michael Walker (Biological Sciences) was honoured as the country's top tertiary teacher, receiving the Prime Minister's Supreme Award as well as an award for sustained excellence in teaching in a kaupapa Māori context, at the TTEA ceremony this August. He was honoured for his pioneering work to reverse patterns of under-achievement among Māori and Pacific Island students. Michael established the Tuākana Programme more than 20 years ago to improve retention rates for Māori and Pacific science students, particularly in their first academic year. The innovative programme has been so successful that it has been rolled out across all University faculties. He is described as a rare breed that easily bridges the cultural divide. A colleague attests: "He has led a quiet revolution – teaching Māori about science and scientists about Māori – bringing Māori worldviews and perspectives, tikanga, and te reo, into his research and teaching. He helps his non-Māori learners connect with the world of Māori and assists all learners in linking course content to their future lives and the wider society."

Professor Robin Kearns (School of Environment) was one of 12 recipients of a 2011 National Tertiary Teaching Excellence Award and earlier received a 2010 University of Auckland Sustained Excellence in Teaching Award. Robin is an internationally recognised teacher who first joined the University as a lecturer in 1990. A socio-cultural geographer, he studies the effects of policies and political practices on the cultural dynamics of places,

Professor Michael Walker with Prime Minister The Rt Hon John Key, after receiving the Prime Minister's Supreme Award.

and the influence of those places on human wellbeing. At the national ceremony Robin was honoured as a dedicated and energetic teacher at every level, covering a very wide range of subjects across human geography, the environment and public health. Robin describes himself as an enthusiast who believes in "either giving 110 percent to a task or declining to take it on." "Dialogue is central to learning in whatever context," he says," and the key in the classroom is to invite questions, and, most of all, conversations during the ongoing course of study."

Dr Nicholas Gant was honoured with a 2010 University of Auckland Early Career Excellence in Teaching Award. Nicholas has been teaching at the Department of Sport and Exercise Science as a Senior Lecturer since 2007. He is director of the Exercise Nutrition and Metabolism Laboratory which studies nutritional and pharmaceutical interventions during exercise, especially the role that nutrients and psychoactive substances play in the central control of fatigue and body temperature. According to his students, Nicholas possesses the skill and patience to create a well-supported, self-directed learning environment by giving just the right amount of guidance to challenge students to discover knowledge on their own terms.



Dr Donna Rose Addis received the 2010 Prime Minister's MacDiarmid Emerging Scientist Prize for her world-leading research on memory and imagination

Early career research excellence

Cognitive neuroscientist **Dr Donna Rose Addis** (Department of Psychology and Centre for Brain Research) received the 2010 Prime Minister's MacDiarmid Emerging Scientist Prize for her world-leading research on memory and imagination. The award which comes with prize money of $200,000 recognizes her research into the psychology of cognitive processes and their neurological basis that may lead to new therapies for diseases ranging from Alzheimer's to depression.

Donna also received a Rutherford Discovery Fellowship, supporting New Zealand's most talented young researchers. A second fellowship was given to **Associate Professor Alexei Drummond** (Department of Computer Science). The inaugural fellowships provide both researchers with up to $200,000 annually for the next five years to support Donna's research into the constructive nature of memory and give Alexei the chance to pursue his research which spreads across three broad themes: modelling infectious diseases from a genetic perspective; using genetic information to identify species and the relationships between them; and using evolutionary models to study whole ecosystems.

Dr Gus Grey (Department of Optometry and Vision Science) was one of twelve early-career researchers around the country to receive a prestigious Postdoctoral Fellowship from the Foundation for Research, Science and Technology, for his research on cataracts. The award will support his research into glutathione, an important anti-oxidant in the eye that may help to protect against the development of cataracts. The long-term goal is to develop new therapies to prevent age-related nuclear cataracts.

Dr Augusto Barbosa (School of Biological Sciences) and **Dr Katya Ruggiero** (Department of Statistics) have received Health Research Council of New Zealand (HRC) Emerging Research First Grants. Augusto was awarded a grant worth $145,200 for a three year project on the outcomes of lactobacillus and trichomonas vaginalis interaction, and Katya received a $135,000 grant for a two year project on probing illness with a novel multi-omic time-course statistical platform.

Early Career Research Excellence Awards, recognising and promoting excellence and research leadership potential among emerging researchers, have been given to **Dr Benjamin Thompson** (Department of Optometry and Vision Science) and **Dr Silas Villas-Boas** (School of Biological Sciences). Benjamin received the award for his work on the treatment of amblyopia (lazy eye) in adults,

Dr Silas Villas-Boas (Biological Sciences) received an Early Career Research Excellence Award for his work investigating the biology and metabolism of Epicoccum purpurascens.

and the effects of a novel "at home" treatment using an iPod touch device, and Silas for his work which investigates the biology and metabolism of *Epicoccum purpurascens*, the results of which are expected to assist with future research involving genome sequencing and metabolic engineering. Targeted at those who completed their PhD not more than eight years ago, the prize provides up to $25,000 to support each recipient's research programme.

Distinguished appointment for computer scientist

Professor John Hosking, Professor of Applied Computer Science and Director of the Centre for Software Innovation (CSI), has been appointed Dean of the College of Engineering and Computer Science at the Australian National University (ANU).

"We are very proud to see John appointed to this leadership role at one of the region's top universities," says Dean of Science Professor Grant Guilford. "He is an inspiring individual with a wonderful blend of academic excellence, industry nous, common sense and collegiality. We are looking forward to interacting with John in his new role as we further develop our relationships with ANU."

John has had a distinguished career in software engineering. He has an outstanding academic record and has worked actively with local companies in consultancy and applied research. He was a lead player in the establishment of the CSI – a focal point for engagement between the University and industry – and led the formation of the CSI Academy summer internship scheme and the Extenda research culture building programme. He has also won national and university awards for excellence as a teacher and research supervisor.

Recognition for excellence in research

Three of the new Fellows of the Royal Society of New Zealand (FRSNZ) elected in 2010 are from The University of Auckland and all three are based in the Faculty of Science. **Associate Professor Andre Nies** (Department of Computer Science) was elected in recognition of his world leadership in computability theory and algorithmic information theory. **Professor Mick Clout** (School of Biological Sciences and School of Environment) was honoured as an internationally recognised conservation ecologist, providing scientific leadership in the ecology and conservation of native birds for many years, and in the behaviour and management of invasive mammals. **Professor John Hosking** (Department of Computer Science) was elected as an internationally renowned scientist in the field of software engineering whose work on visual languages, software meta tools and automated software engineering methods has been influential.

Professor James Goodman (Department of Computer Science) has been named a Fellow of the Association for Computing Machinery (ACM) in recognition of his lifetime contributions to parallel processor and memory system design. Professor Goodman, who came to the University in 2003, is a specialist in computer architecture – the interface between hardware and software. He studies high-performance memory systems, particularly for parallel systems which use multiple processors in combination to solve a problem.

Emeritus Professor John Butcher, who taught at the Department of Mathematics and founded the University's Department of Computer Science, received the inaugural Jones Medal for lifetime achievement in mathematical sciences. The award recognises Professor Butcher's exceptional work on numerical methods for the solution of ordinary differential equations and his leadership in the development of New Zealand mathematical sciences.

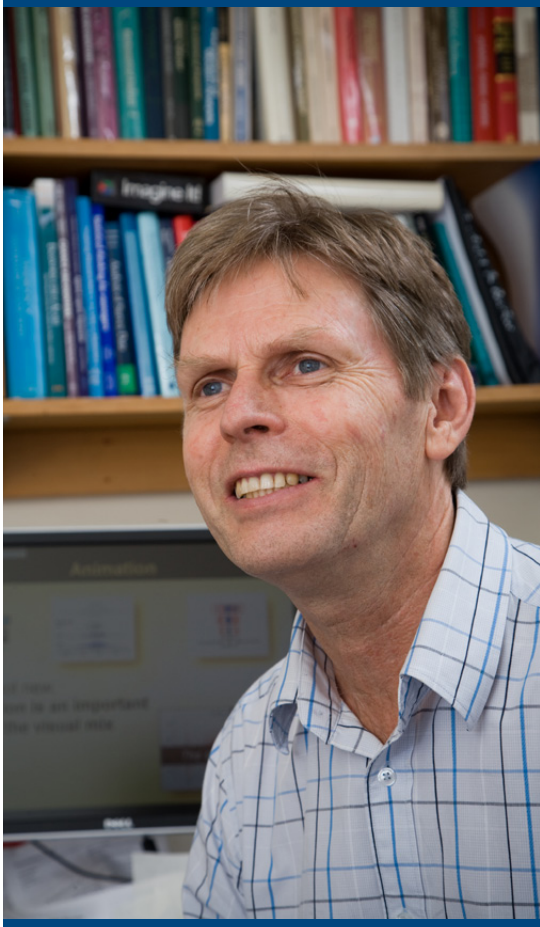
A tribute to Marie Curie

As part of the International Year of Chemistry celebrations, female scientists from the School of Chemical Sciences are contributing to a lecture series in honour of pioneering scientist and Chemistry Nobel Prize winner Marie Curie.

Professor Margaret Brimble opened the ongoing year- long national tour of talks with a lecture on the chemistry of nature and how natural compounds can inspire chemists to create novel anticancer, antibacterial and antiviral drugs. Professor Penny Brothers took the subject of nature as a source of inspiration up again in May and explained how chemists can design new functional molecules based on naturally-occurring pigment molecules, called porphyrins, which give leaves its green and blood its red colour.

In November, Dr Cather Simpson will close the series in Christchurch with her lecture on the usage of light energy. Her talk will explore the challenge of harnessing the sun to generate electricity in a form that we can readily use – electrical energy, mechanical motion, heat and even to treat cancer.

More information about upcoming and past lectures: www.royalsociety.org.nz/marie-curie-lecture-series



Professor Chris Wild (pictured), Dr Maxine Pfannkuch and Matt Regan presented their revolutionary ideas at World Statistics Day in 2010.

Unlocking the lessons inside data

Professor Chris Wild, Dr Maxine Pfannkuch and Matt Regan from the Department of Statistics were invited by the Royal Statistical Society (UK) to give the only talk at the first World Statistics Day in October 2010. They presented their ideas on new methods for teaching critical aspects of statistics, which are considered revolutionary by fellow statisticians.

Professor Neville Davies from the society said that their work is set to transform the international landscape of statistical education. "In my view this read paper was a seminal event in the society's long history. It is ground-breaking in its innovation and should have impact and influence for a long time to come."

The new method relates to teaching statistical inference – the process of drawing conclusions about data that are subject to random variation. It makes extensive use of data imaging software to help young students understand the patterns in data, without getting caught up in complex mathematics. The goal is to introduce and cement statistical concepts first and move on to the underlying mathematics later.

More information about the research: www.censusatschool.org.nz/2009/informal-inference/WPRH/

Student News

Getting the Blues

Three students from the Faculty of Science have been awarded New Zealand Universities Blues Awards for their academic and sporting performances in 2010. **Elizabeth Lamb** and **James Eunson**, both studying for a Bachelor of Science/Bachelor of Commerce Conjoint degree, were honoured for their achievements in Athletics and Badminton. **James Bradshaw**, who graduated in May 2011 with a Bachelor of Science, received his award in recognition for his achievements in Orienteering.

The Blues Awards are considered New Zealand's most prestigious sports awards for university students, recognising an athlete's commitment to and excellence in their sport as well as their studies. The strict eligibility criteria for the awards includes passing national qualifying standards for the relevant sport as well as passing a minimum number of academic classes.

BSc Graduate James Bradshaw received a New Zealand Universities Blues Award in recognition for his achievements in orienteering.

Best Doctoral Theses Award

Dr Cedric Simon from the Leigh Marine Laboratory was awarded the Vice-Chancellor's Prize for Best Doctoral Thesis in 2010. The annual prize honours five students from around the University whose theses are clearly exceptional in terms of the originality, significance and excellence of the research, and were completed in a timely fashion. Cedric examined the shortcomings of conventional formulated diets for spiny lobsters and found that the remedy lies in better designed sea cage culture systems and improving the digestibility of such diets. Cedric's supervisors, Dr Andrew Jeffs and Professor John Montgomery, praised the novel nature of his work and noted that the results of Cedric's thesis 'have had a profound influence on lobster aquaculture and are already being incorporated into the design and operation of new research and commercial lobster aquaculture initiatives around the world'.

Dr Cedric Simon (Leigh Marine Laboratory) received the Vice-Chancellor's prize for Best Doctoral Thesis in 2010.

Science success at 2011 Microsoft Imagine Cup

Competing against more than 100 teams, Team SkyEye - consisting of Science students **Gabriel Hartmann**, **Feixiang Ren**, **Jinsheng Huang**, and **Thomas Power** - secured third place in the New Zealand finals of the 2011 Microsoft Imagine Cup final. The Microsoft Imagine Cup is the world's largest technology competition, challenging students from around the globe to develop technologies that help solve the world's toughest problems, and teams must demonstrate they can turn their ideas into reality. Team SkyEye developed a mobile phone-based driver assistance system designed to prevent car accidents and improve road safety. The project was supported by the wider Environment Perception and Driver Assistance (.enpeda..) project overseen by **Professor Reinhard Klette**.

Students shine at Commonwealth Games

Students from the Faculty of Science returned with medals as well as memories when they represented New Zealand in their chosen sports at the 2010 Commonwealth Games in Delhi.

Second year Commerce and Science student **Elizabeth Lamb** tied with five other competitors for sixth place in the women's high jump, with a jump of 1.78m. Liz, whose personal best is 1.83m, had earlier won the women's' high jump at the 2010 Oceania Track & Field Championships.

Adam Storey, a PhD student in the Department of Sport and Exercise Science, celebrated success as a weightlifting coach. Four of his athletes – **Richard Patterson, Stanislav Chalaev, Tracey Lambrechs**, and **Kate Howard** - competed in the seven-strong weightlifting team which ended the games on a high. The seven lifters achieved 18 personal best lifts, 12 of which were New Zealand records, and silver medals were won by both Richard (men's under 85kg class) and Stanislav (men's under 105kg class).

At the Commonwealth Fencing Championships, an event sanctioned by the Commonwealth Games Federation and held prior to the games in Delhi, Auckland Bioengineering Institute PhD student **Nancy Liu**, whose supervisors are **Professor Paul Donaldson** (Optometry and Vision Science) and **Dr Marc Jacobs**, won a bronze medal in the women's epee (individual).

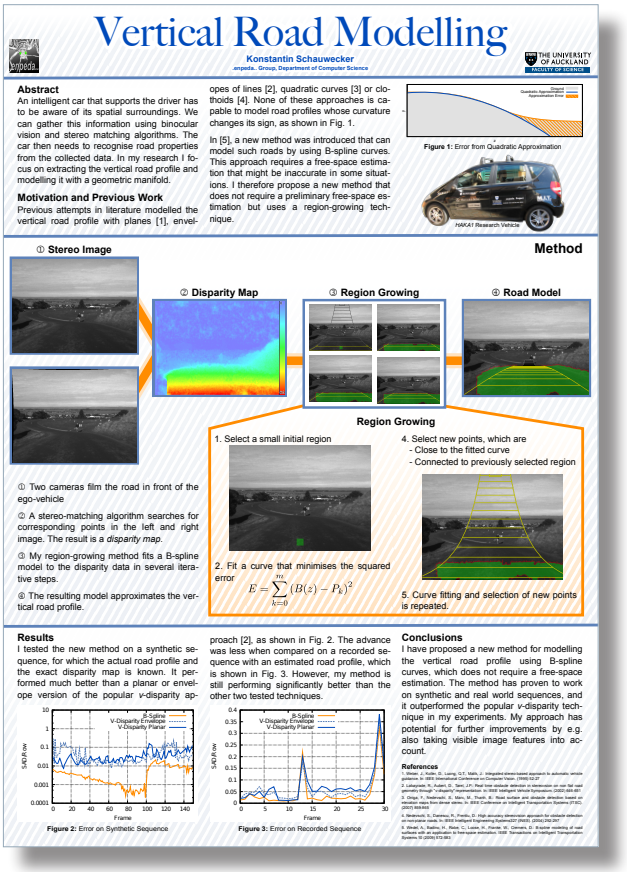
Postgraduate poster competitions

Students from across the faculty took the opportunity to showcase their research last year in the annual science postgraduate poster competition and the University-wide Exposure Postgraduate Research Exposition.

Konstantin Schauwecker (Computer Science) received first prize in the faculty competition for a poster on his research on driver support systems. He is investigating novel ways to use data collected by the car to extract and model the vertical road profile. Second prize went to **Cosmin Laslau** (Chemical Sciences). Her poster described a new operating mode of scanning ion conductance microscopy to measure the ionic fluxes emanating from an electrochemically actuated conducting polymer. Cosmin went on to win second prize for her oral presentation in the University-wide Exposure competition. Physics student **Anna Yang** won third place in the faculty competition for her poster on improving optical coherence tomography – an imaging technique that uses broadband light sources to offer high resolution, cross-sectional imaging of biological tissues.

Students who received high distinction awards at the faculty competition were: **Victoria Martin** (Psychology) who studied hippocampal activity while we imagine future scenarios, generate and recombine details into those scenarios, and encode them into memory; **Lynda-Maree Bavin** (Psychology) whose research suggested that short-bout, high-frequency physical exercise regimes may elicit greater exercise rates and more psychological benefits than more traditional, lower-frequency regimes; **Karthik Kannappan** (Chemical Sciences) whose poster described the design and efficiency of a novel pump and mixer for microfluidic devices; **Shankhamoy Maiti** (Optometry) whose studies on honey bees indicated that bees rely on colour rather than contrast vision to detect their hive entrance; and **Helen Nathan** (Biological Sciences) who studied the invasion of a small pest-free island by mice (see feature story on page 12).

Helen went on to win first prize for her poster in the University's Exposure competition. **Charlotte Blythe** (Psychology) also won first place in the multimedia division of the Exposure competition, with a film she directed as part of a school sustainability project.



Konstantin Schauwecker (Computer Science) won first place in the Postgraduate Poster Competition for his submission titled Vertical Road Modelling.

Reviving Bastion Point

Giving back to the community is a worthwhile experience in itself. Combining community work with the chance to gain valuable research experience is even more rewarding. To allow more students to gain research experience while contributing to community projects, the Faculty of Science aims at developing and enhancing relationships with existing community projects in the Auckland area to place students in those projects during the summer semester break.

The first student to benefit from the faculty's new approach on summer scholarships was Biological Sciences student **Tracey O'Conner**. From November 2010 to February 2011, Tracey monitored native and introduced wildlife in different aged types of vegetation at Bastion Point, an area of 35 hectares, set on a cliff between Orakei and Mission Bay on Auckland's Easters Bays.

The project titled Ko Te Pukaki ("the eternal source") began in 1990 in a bid to return 35 of the 48 hectares owned by the Ngati Whatua o Orakei tribe back to native bush.

Origins of language

Language is incredibly rich as a source of information about what it is to be human. "It is a window into past social processes, as well as the human mind and how culture works," says Professor Russell Gray.

Russell and colleague Dr Quentin Atkinson, from the Department of Psychology, study language evolution using computational methods derived from evolutionary biology.

Their research is based on the idea that components of language can be treated the same way as pieces of genetic information. This allows them to work backward, reconstructing the changes that have occurred over time and how languages have split and diversified, providing insight into the cultures they belong to.

"Language is a model system for understanding cultural change more generally," agrees Quentin. "Languages are great because we can break them up into little bits – words or sounds – and model their evolution quantitatively to test hypotheses about geographical expansion or rates of change. There's lot of potential for using language to tell us about how culture evolves."

The two scientists are pioneers in the field, and their research, which has led to nine articles in *Science* and *Nature* so far, is providing answers to fundamental questions debated by linguists for hundreds of years.

Quentin's latest work, in *Science* this year, argued that it is possible to trace the origins of human language back to Africa.

"Most traditional methods build family trees of languages based on shared features and can only go back 8-10,000 years. But humans expanded from Africa around 80,000 years ago so there's a big gap in what we know about how languages evolved," he says.

Quentin wanted to see how far back he could go and whether the gap could be bridged. To test this he studied the geographic distribution of one feature of languages – the number of sounds or "phonemes" they use.

"In population genetics there's a model called the serial founder effect, which predicts that genetic diversity is highest at the point of origin, where a species has lived for a long time and accumulated a lot of changes. As small groups break away, they take only a subset of that diversity with them, and as the process repeats there is less diversity moving away from the centre."

Recently it was shown that the number of phonemes a language has is related to the number of speakers. "This fits with the idea of a serial founder effect, in which phonemes would be lost as small groups break away. It gave me the idea of using the same model that geneticists had applied to genetic diversity to phonemic diversity."

Analysing 504 languages, Quentin found that phonemic diversity was highest in Africa and decreased moving out. The pattern is the same as for genetic diversity, supporting an "out of Africa" theory of language evolution.

The study was reported around the world and, since some linguists still believe that it's impossible to go back this far "it's fair to say that it has been controversial," Quentin says. His next step is to build on the research, studying human prehistory in Central America and Eurasia.

In the same week Quentin's paper appeared, Russell published an equally bold article in *Nature*, concluding that culture is more important than biology in the evolution of languages, at least with regard to word order.

"Some linguists claim that the innate structure of the human mind imposes strong constraints on language," he says, "and universal patterns of dependencies in word order have been seen as one sign of these constraints."

"But we didn't find this at all. In fact, there were very few generalities in word order, and those that existed tended to be specific to a language family."

To reach this conclusion Russell, with postdoctoral fellow Dr Simon Greenhill and colleagues from the Max Planck Institute for Psycholinguistics in Nijmegen, examined four large language families that make up more than a third of the world's 7,000 languages. They built evolutionary trees for each family based on lexical (vocabulary) data and then mapped the evolution of word-order features on the trees. They found that, while some structural rules applied within a family, they did not hold true across families.

"The patterns were of the kind you would expect if there were a lot of local linguistic processes going on. This doesn't mean that there aren't some universal rules, but the extent to which they're wired into our brains by a language specific faculty has been exaggerated. This is part of a broader trend in psychology. We're learning that there is much more plasticity in the human brain than has previously been assumed."

Looking to the future Russell would like to see how "big-picture" the research can go. "What we'd really like to do is apply it on a global scale. We want to create a database of the words of the world, to make inferences about patterns of migration and the processes that have generated all the languages we see."

During the course of his research, Russell and colleagues have built up their own database of Pacific languages (http://language.psy.auckland.ac.nz/austronesian/).

"We've taken data from a range of sources, coded it so that it can be analysed systematically, and made it available online. A lot of the information has never been published – it was in people's field notes, sitting in dusty drawers and slowly rotting. We want to do this on a global scale, and it's pretty urgent given the rate at which languages are going extinct."

It has been suggested that half of the world's languages may disappear in the next 100 years, so there is a real race against time.

Much of the scientists' work to date has focused on cultural origins. In 2000 Russell and Fiona Jordan used computational methods to prove that Polynesian languages originated as part of the Austronesian expansion from Taiwan, and in 2003, as part of his PhD research supervised by Russell, Quentin traced the origins of Indo-European languages.

"People are fascinated about cultural origins, and we've focused on it a lot," says Russell. "But more recently we've broadened our focus to the links between culture and the human mind and processes of cultural differentiation

"The models we're using are relevant to other aspects of culture," says Quentin. "Just as we can trace the evolution of languages through time, we may also be able to trace the evolution of cultural norms, institutions and technologies. I'm interested in what these methods can tell us about the evolution of social systems such as religion and our ability to sustainably manage resources."

As to why the University is such a powerhouse in the field, Russell says: "Historically New Zealand has had strengths in evolutionary biology and we were lucky enough to realise that those methods could be used more broadly." Quentin agrees that the researchers have carved out a niche in applying the methods to study language evolution.

They have also benefited from collaboration with researchers like Associate Professor Alexei Drummond in the Department of Computer Science, who works at the cutting edge of computational evolutionary biology and has adapted models designed for biology to the study of languages.

www.psych.auckland.ac.nz/languagegroup

An experimental invasion

Deliberately releasing mice onto a predator-free island might not sound like the work of conservationists, but that's exactly what biosecurity researchers did in late 2009, to learn more about the threat the species poses.

In a carefully managed experiment, a single pair of house mice *(Mus musculus)* was introduced onto Saddle Island in the Hauraki Gulf. Within five months the six-hectare island was overrun by more than 60 mice and the population appeared to have reached capacity.

The research was done in collaboration with the Department of Conservation (DOC), which manages the coastal scrub-covered island as a scenic reserve. The mice were eradicated at the end of the study.

"Our experiment showed that a single pair of mice can very rapidly establish a viable population. This means that surveillance for mice is important and that any invasion should be acted upon quickly," says Helen Nathan, who did the research for her MSc in biosecurity, supervised by Professor Mick Clout from The University of Auckland and Dr Elaine Murphy from DOC.

"Mice tend to be overlooked as a conservation threat and we know comparatively little about them," says Helen.

"They aren't as obvious a threat as rats or cats, and tend to be less visible when they're present in the same area. Rats or cats can suppress mice, but as we're getting better at eradicating them, the mice are becoming more of a problem. The greatest impacts of mice have been recorded in places where these other species are absent."

Helen explains that mice affect native ecosystems in a variety of ways. "The direct impact is on the things they eat – mainly invertebrates and seeds." In severe cases this can lead to changes in nutrient cycling and reduced plant populations.

"Mice also eat lizards and have been known to eat bird's eggs or even chicks – in fact, they'll eat pretty much anything they can manage. They will also compete with other species, such as native birds that use the same food sources."

The idea for the invasion study came from PhD student Jamie MacKay's work. Having eradicated mice from Saddle Island as part of his research, he was interested in what would happen if animals capable of repopulating it somehow made their way back. In a series of experiments, he released one male and one female mouse on different parts of the island and tracked their movements to see how long they took to find one another. The animals were removed at the end of each trial period.

"Jamie's work showed that the mice could find each other very quickly – usually within eight days," says Helen. "They found themselves in a new environment and seemed to have a strong exploratory instinct. They travelled much further than normal and within a couple of weeks had covered the entire island."

"The natural question that follows on from this is what would happen if we left the mice there – could they establish a viable population." So after Jamie released his final pair, the mice were left on the island and Helen's study began.

"Normally when an invasion occurs we don't know how long the animals have been there, and whether or not it has taken a long time for the population to grow or be detected. The premise of my study was to follow an invasion event from a known starting point. We knew exactly when the mice arrived on the island and could therefore monitor the rate and pattern of population growth."

Helen followed the mice until mid-winter, when the conditions were best to eradicate them. She measured the population every month using a grid of 62 live traps spread over the island.

She used a capture-mark-recapture method to estimate the size of the population. Mice caught in the traps were given a unique ear-punch mark so they could be identified if they were captured again. The number of mice recaptured, taken as a proportion of the total number caught, gave an estimate of the total population size.

"The pattern of population growth over time looked very much like a logistic curve, which is what you'd expect. It grew exponentially at first and then tapered off as the population reached the island's carrying capacity. At the population peak in May 2010, five months into the experiment, there were 10 mice per hectare."

"Based on my study the estimated winter carrying capacity was 69 individuals. This was very close to the number of wild mice that Jamie had found at the same time of year, before they were eradicated. This proves that my model of population growth was probably a good one."

In between her trapping work, Helen built on what Jamie had discovered about the movement of mice around the island. She followed 16 individual mice, using tracking tunnels to identify their uniquely-marked footprints.

The results showed that as the population increased, the animals travelled much less. "They only exhibited the really wide movement that Jamie saw when the population was at low density. As the number of mice increased, their home range became much smaller and more fixed."

Since the experiment gave a good estimate of the number of mice on the island, it also presented an opportunity to see how easily mice were detected with some of the routine surveillance methods used by DOC.

"The great news is that the detection methods I used – tracking tunnels and wax tags that collect footprints – worked really well even at very low population densities. It's really encouraging to know that these commonly used surveillance systems are likely to detect mice early on, at least on a habitat like Saddle Island."

Helen's research and her communication skills have already won her recognition. She was awarded first prize in the poster section of The University of Auckland's 2010 Exposure postgraduate research exposition, and was highly commended for her student oral presentation at the 2010 New Zealand Ecological Society Conference. First prize went to her colleague Josie Galbraith, the first student to graduate from the University with an MSc in biosecurity.

Helen will graduate this spring, and is about to begin her PhD, focusing on the detection of mammalian pests.

www.bioscienceresearch.co.nz/research/biodiversity-biosecurity

Stroke rehabilitation

Learning how to walk again, and recover arm and hand function, are major challenges for many people who have had a stroke. Researchers and clinical specialists from the Department of Sport and Exercise Science and Centre for Brain Research are pioneering new ways to help stroke survivors regain function in their limbs.

"Upper limb impairment is very common following a stroke, and can have a huge impact on people's quality of life and independence," says Professor Winston Byblow. "But because many patients also need speech-language therapy and help re-learning to walk, rehabilitation of the arm and hand often becomes a lower priority."

Together with Dr Cathy Stinear from the Department of Medicine, Winston leads a research programme to improve upper limb function. They work closely with Professor Alan Barber, Director of the Auckland City Hospital Stroke Unit, and all are involved with the Centre for Brain Research.

Much of their research focuses on "priming" the brain to become more receptive to rehabilitation, so that it can re-learn how to control limb movement.

"We are investigating ways to increase neural plasticity – the ability of the brain to change and make new connections – so that people can get more out of physical rehabilitation," Winston explains.

In one series of studies the researchers are trialling a mechanical device, invented by Winston and former PhD student Dr Jim Stinear, that controls movement of the stroke-affected limb. It couples the user's hands so that when they move their strong hand, the stroke-affected hand goes through a mirror-image movement.

The device is used to prime the brain prior to rehabilitation. It has already successfully been used with patients six months or more after stroke, contributing to sustained improvements in upper limb motor function. As well as raising hopes that the device may be widely used in future, Winston says that "the results challenge conventional thinking, by showing that it is still possible for people to benefit from rehabilitation some time after their initial brain injury."

A three-year study is now underway with patients at Auckland City Hospital and RehabPlus within two weeks of a stroke. Conclusions about whether the device will enhance rehabilitation in this setting cannot be drawn until the study ends, but the preliminary results are already providing useful insights.

"As part of the study we're using magnetic resonance imaging (MRI) to monitor people's brains while they squeeze a hand grip. This allows us to see the areas of the brain responsible for producing force in the hand, and how they change over time."

Earlier this year Cathy published a study in *The Lancet Neurology* which showed that MRI measures like these could be used to determine the extent of damage in a patient's motor pathways and help predict their recovery trajectory, to better prioritise their rehabilitation. The goal is to use this information to tailor the rehabilitation prescription to each individual to improve outcomes.

In parallel studies the team is using magnetic stimulation as another way to prime the brain. Painless bursts of stimulation are delivered across the skull to the parts of the brain that control upper limb movement.

In a study published in *Stroke* last year, Winston's PhD student Suzanne Ackerley showed that combining magnetic stimulation with rehabilitation helped people to recover arm and hand function, six months or more after a stroke. Participants achieved substantial improvements in their ability to grip and lift an object with their index finger and thumb – a task that requires manual dexterity as well as coordination of muscles along the entire arm.

A new study is now underway at the University's Brain Recovery Clinic to determine whether the combined therapy can produce long-lasting benefits when used for an extended period.

"All the work we've been doing has been going in the right direction in terms of improving motor recovery after stroke," says Winston. "Our studies to date have focused on the upper limb but now, with Jim's appointment, we can also start to look at improving outcomes for people with difficulty walking."

Jim, a rehabilitation expert, returned to the University after a period in the United States, where he set up a neural plasticity laboratory focusing on the lower limb motor cortex.

"It's so important to be able to walk around," he says. "Difficulty walking can be a real barrier to reintegration into the community and, because it reduces exercise levels, it increases the risk of other health conditions such as cardiovascular disease. But walking recovery is probably the poorest studied and understood of all movement rehabilitation goals. The parts of the brain involved in activating leg muscles are technically very difficult to study, so the research is 15-20 years behind what is being achieved with the upper limb. We have made some recent breakthroughs, and over the next few years we expect to catch up to Winston and Cathy's research."

Right now though, Jim is being kept busy with clinical work. He has taken up the new role of academic head of the exercise and neuro-rehabilitation programme in the Department of Sport and Exercise Science. "In the past our Exercise Rehabilitation Clinic was run separately and focused on musculoskeletal conditions like arthritis and chronic pain," he explains. "But in recent years we've learned a lot about how exercise positively affects the brain so it makes total sense to combine exercise and neuro-rehabilitation."

Along with others in the department, Jim contributes to the Brain Recovery Clinic established at the University in April. The clinic will eventually expand to work with people with a range of neurological conditions, but is focusing initially on stroke.

In the standard medical model, specialist consultations occur in some isolation and patients rarely see their neurologist after being discharged from hospital. In contrast, the clinic provides patients with full case reviews by a neurologist and a wide range of other specialists in everything from exercise rehabilitation to speech language therapy and optometry, all in a single visit. Jim for instance, assesses whether a patient would benefit from exercise rehabilitation and may refer them to the Exercise Rehabilitation Clinic.

"We all work very well together and make sure that we're on the same page," says Jim. "Our patients find it very reassuring to have their case reviewed, hear that they're doing well, and get a new direction. It has been very successful so far and people are coming from all over the country. Now we're looking at how to increase capacity, to serve all the people with stroke who want to come, let alone those with other neurological conditions."

Many people who attend the clinic also become interested in the University's research, and sign up to the Centre for Brain Research's volunteer register. "It's a unique opportunity to expose people to the kinds of clinical trials going on here, which, in many respects are unique in the world and right at the forefront of science," says Winston.

"Often people have no idea that this kind of research is happening, and that they might be able to take part," adds Jim. "We find that, on the whole, people love being part of a study and feel that they're doing society a service by getting involved."

www.clinics.auckland.ac.nz/brainrecovery (click "Cutting edge research programmes" for the Research Volunteer Register)


HOUSE HOSPITAL
BIRD
Symphony
MR 7b73
MR 2002B
06/01/98:6Y
HFS
STUDY 1
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Auckland volcanoes

A swarm of earthquakes triggered by rising magma will be the first sign of a volcanic eruption in Auckland, says Dr Jan Lindsay, a volcanologist from the School of Environment and Institute for Earth Science and Engineering (IESE).

Together with Dr Gill Jolly from GNS Science, Jan co-leads DEtermining VOlcanic Risk in Auckland (DEVORA), a seven-year project funded by the Earthquake Commission and Auckland Council to learn more about volcanoes in Auckland and how to respond.

The scientists predict that the magma responsible for an eruption in Auckland will rise from a depth of around 80km, moving up through the ductile mantle until it reaches the crust around 30km from the surface. As the pressure builds, it will cause brittle fractures and the tell-tale earthquake swarm, setting the clock ticking for an eruption one to two weeks later.

In the days before the eruption, the earthquakes will become shallower and centre in on a particular site. Carbon dioxide will seep from the earth there, the ground will swell and deform and surface cracks will appear. Steam will emerge and, as magma meets water in or above the ground, a series of explosions will mark the start of the eruption.

This scenario is based on past eruptions. While it's reassuring to learn that there is likely to be up to two weeks' warning, "we won't know where the volcano will be until we see the cracks and earthquakes become localised" says Jan. "From what we've seen in other parts of the world, and the theory of how eruptions progress, this should happen one to three days beforehand but it's hard to know exactly how far in advance it'll be."

Jan says that Civil Defence needs two days to evacuate everyone from around the suspected vent location, and "it's likely that a wide evacuation would be needed to start with. But once we know where the volcano is going to erupt, establish its eruption style (for example how much ash there is), and what critical infrastructure has been damaged, it may be possible for people to return and continue business as usual outside an exclusion zone around the vent."

One of the challenges is learning how to communicate hazard and risk in a meaningful way, and DEVORA researchers are looking at precisely this question. "Risk can be a difficult concept to get your head around," says Jan. In this context, risk is a measure of the impact on society, which combines information about the hazard itself as well as our vulnerability to it.

"The volcanic hazard in Auckland is very low, with an eruption every 2,500 years on average. But since it would be right on top of a big city our vulnerability is extremely high, which means that the risk is moderate to high. Other hazards like landslides or storm surge happen more frequently but the risk is much smaller because they affect fewer people." Jan likens the volcanic risk in Auckland to living next to a nuclear power station: "The chance of something happening is remote, but if it does the consequences could be disastrous."

DEVORA aims to learn more about how a future eruption may progress and the danger that it poses. It brings together everyone in the field, from a wide range of disciplines and institutions, to coordinate their research and ensure that there are no gaps or overlaps. Many University of Auckland researchers are involved, with expertise ranging from petrology to social science. The DEVORA scientists work closely with Civil Defence and Auckland Council, to communicate their findings and help plan the response to an eruption.

The project has three interrelated themes. "The first theme examines the geology of the volcanic field, in particular the nature of the magma from past eruptions and the physical controls on magma movement to the surface," Jan explains. By learning about existing volcanoes, scientists can more accurately predict the behaviour of a future eruption.

"The second theme looks at the hazard – understanding what happens when the magma hits the surface. For instance we're studying the magnitude and frequency of past eruptions, examining ash layers to date the Auckland volcanoes and assess the impact on Auckland of eruptions further afield, and looking at the city's topography and where lava has travelled to predict the path of future flows."

"The third theme focuses on the risk, or impact on society. We're building a database of vulnerability across the city, covering all elements of society from the human population to infrastructure and the economy. This will feed into a powerful risk assessment programme that can evaluate losses in different scenarios. We're also helping to develop a decision-making tool so that Civil Defence can use the information we've gathered to decide when to consider evacuating people."

DEVORA is now in its fourth year, with the geology theme wrapping up and the risk component building steam, and already the research is providing valuable new information.

Jan says that a highlight was discovering that Rangitoto erupted not once, but twice. "Usually in fields like Auckland, each eruption produces a new volcano, but Rangitoto first erupted 600 years ago and then again 10 to 50 years later. This means that after a new eruption we cannot assume that the vent is finished until maybe 50 years have passed. We also cannot assume that, in the past, one volcano equals one eruption, which has implications for all of our statistical hazard models."

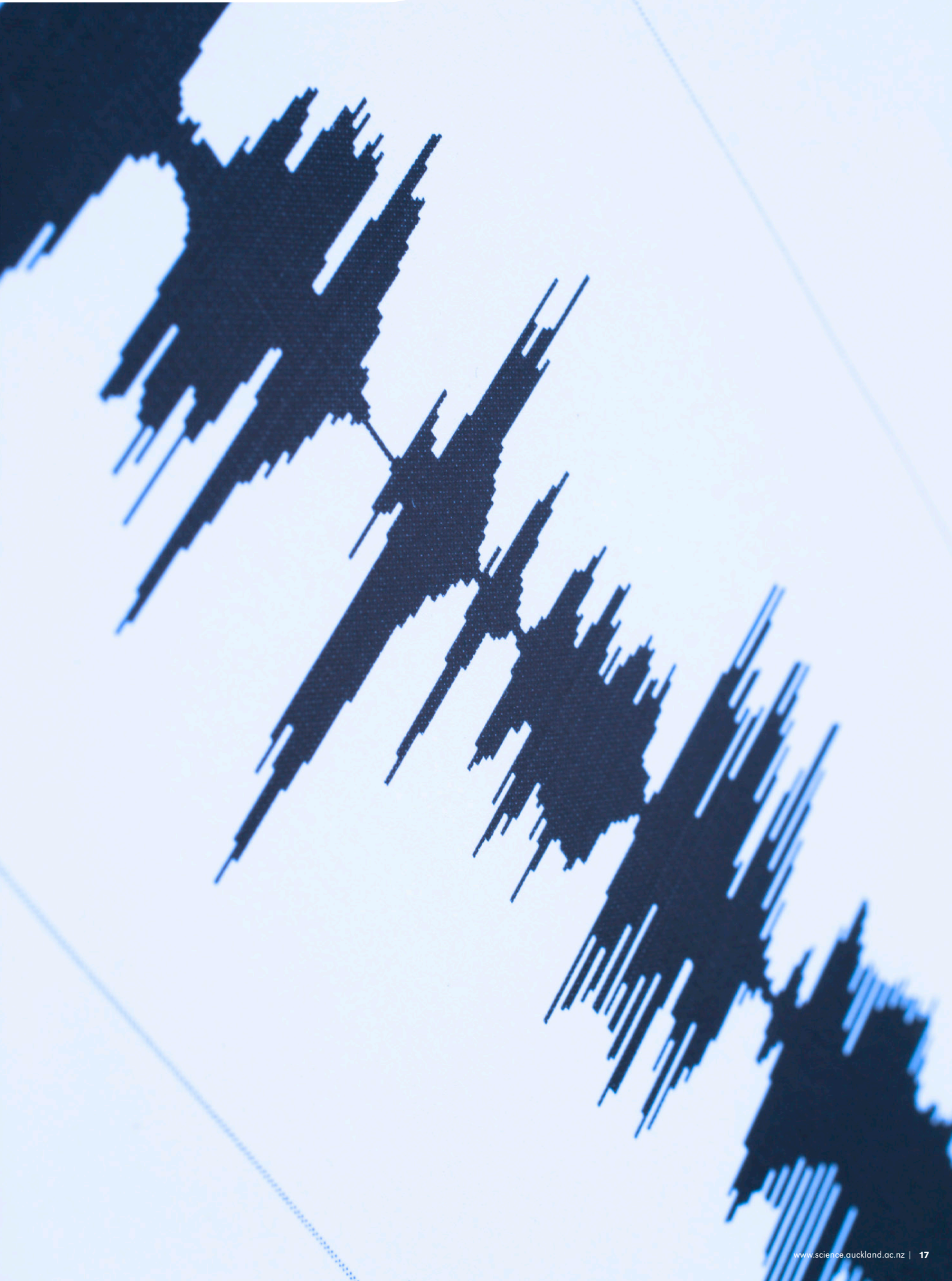
A cautionary finding is the absence of an eruption pattern in space or time. "There was a flare-up in Auckland around 30,000 years ago, with at least 5 and maybe as many as 20 eruptions in 1,000 years, and we're trying to get the bottom of why that happened. But overall, there's no discernible pattern, which means that we have to be ready for an eruption at any time."

The research has also shown that ash from distant volcanoes, like Taupo and Taranaki, have a much greater impact on Auckland than previously believed, so eruptions outside the region need to be included in the city's disaster response plans.

A further highlight was rediscovering a volcano in Grafton, which included using a new database of boreholes drilled by engineering companies. "Creating the database is a major achievement," says Jan. "We can use it to map things like lava flows, areas with a lot of groundwater that have the potential for explosive eruptions, and even volcanoes and faults that haven't been identified before."

Looking to the future, Jan hopes that DEVORA may secure funding beyond its 2014 completion date. "All too often, scientists hand over their reports and hazard assessments and the authorities don't know what to do with them. What we're really trying to do with DEVORA is work closely with Civil Defence and Auckland Council so that they understand what we've done and can use the science to inform their plans. We want everything we have learned to make its way into policy, and with additional funding we could focus even more on achieving this."

www.iese.co.nz/OurResearch/Volcanology/DEVORA.aspx



Alumni News

From straight A+ in Mathematics to second Oscar

Alumnus Dr Mark Sagar, whose landmark work modelling the human eye and face landed him key technical roles in films like Avatar and King Kong, won his second consecutive Oscar in 2011. He received a Scientific and Engineering Award for his "early and continuing development of influential facial motion retargeting solutions". The annual prize, awarded by the Academy of Motion Picture Arts and Sciences, recognizes discoveries and innovations that have contributed in significant, outstanding and lasting ways to motion pictures.

Mark holds a Bachelor of Science degree, with majors in physics and mathematics and a PhD in engineering from The University of Auckland. From his early research on computation models of the eye, he went on to develop tools for modelling and simulating facial expressions and has become one of the leading figures in the field. He works for award-winning Wellington-based visual effects company Weta Digital.

"I think science and art are much more closely related than they appear," said Mark in his acceptance speech, "and making computer generated faces which are essentially a bunch of ones and zeros seems as is if they are a conscious living being which has emotions has been a passion of mine."

Donation to fund new lectureship and postgraduate programme in Climate Risk Management

Funded by a charitable donation from the Ockham Foundation, the Faculty of Science will close the educational gap between theoretical and hands-on meteorology. A new Senior Lectureship in Climate Risk Management will be the first step to establish a Bachelor of Science (Honours) programme that provides students with an in-depth understanding of how weather and climate information is generated and how this information can be used in reducing risk in weather and climate sensitive sectors of society and the economy. The programme is planned to start in 2013.

Funding of US$225,000 over the next three years will come from the charitable Ockham foundation, which Arts and Business alumnus Ben Preston and Science alumnus Mark Todd set up from the proceeds of their Auckland property development company Ockham investments. Ben received a BA in Mathematics and a BCom from The University of Auckland while Mark holds a Bachelor of Science degree in Mathematics.

Ben Preston, who describes himself as a meteorology hobbyist, realised the importance of well-educated operational meteorologists through his work as Executive Director of the energy markets division of the Macquarie Bank, based in Houston, Texas. "Trading of US power and gas markets is very weather dependent, especially in the day-ahead markets," explains Ben, "and we employ three meteorologists as part of our team, the same as many of the energy companies in Houston."

When researching current educational pathways for meteorologists, Ben found that neither the New Zealand nor Australian system provides both the specialised scientific basics and hands-on training. "In New Zealand meteorology is more like a 'trade' qualification with Met Service training mathematics, physics or geophysics graduates that are able to forecast", he says. "Australia, on the other hand, produces graduates with undergraduate degrees in Meteorology, but they are unable to forecast and require further practical training."

To close this gap, industry placements and internships will be an integral part of the programme, providing students with an understanding of the applications of the strong science base gained during their lectures and seminars. "I think there is a great opportunity for The University of Auckland to turn out operational meteorologists and oceanographers who have a strong mathematics and physics background but are also able to interact with industry and government throughout the world."

New scholarship opportunities

With the help of generous donations from its alumni, the Faculty of Science has established new scholarship opportunities to celebrate the academic achievements of Māori and Pacific students. The alumni appeal raised more than $15,000 last year towards the Science Student Support Fund that supports 20 Māori and Pacific students.

The Faculty of Science Tuākana Awards will support academically meritorious undergraduate students in their second or subsequent year of a Bachelor of Science while the Tuākana Student Support Grants will provide providing financial assistance for ten undergraduate or postgraduate students to further their studies.

Talking Science

After last year's success with "Global warming – why can't scientists agree?" the faculty decided to dedicate the 2011 Talking Science event to the social aspects of climate change.

The informal evening, held at the Business School's Owen G Glenn Building, drew more than 120 alumni and members of the public to discuss to participate in a lively discussion with the University's leading social scientists.

The next Talking Science event will be held on Thursday 27 October 2011 and the topic will be "Green growth - the role of science".

Getting involved

If you would like to support the University there are many different ways to contribute, from participating in Women in Science events to donating to the Science Student Support fund through the faculty's annual appeal. All money raised will go towards the Leading the Way campaign which funds groundbreaking research and programmes, undergraduate and postgraduate scholarships or infrastructure and development such as the South Pacific Centre for Marine Science.

For more information please contact Champak Mehta on 09 367 7187 or c.mehta@auckland.ac.nz or visit www.givingtoauckland.org.nz.

Alumni events

Upcoming alumni events for your diary include:

- **Rugby Reunion Dinner with the 1987 Former All Blacks team**
  Auckland Racing Club
  80-100 Ascot Avenue
  Auckland
  Tuesday 11 October

  Participants panel discussion:
  former All Blacks greats, Sir Brian Lochore, David Kirk, Sean Fitzpatrick, and Grant Fox

- **Talking Science: Green Growth – the role of science**
  Main Lounge, Old Government House,
  Corner of Princes Street and Waterloo Quadrant, Auckland
  Thursday 27 October

Please visit the alumni website for more information or to register for these events, or to find out about events in New Zealand and overseas later in the year.

www.alumni.auckland.ac.nz

Alumni profile

Name: **Abigail Forbes**

Position: **Ecologist, Environmental Services, Auckland Council**

Class of: **2005 (BSc) and 2007 (MSc first class honours)**

I'm passionate about conservation and biodiversity. As an ecologist at Auckland Council I help protect and restore indigenous ecosystems and biodiversity. There's a huge amount of variety in my work – one day I could be surveying species and ecosystem health in forests or wetlands and the next evaluating the ecological effects of a proposed housing subdivision.

One thing that I hope to achieve in my role is to increase public awareness of the importance of biodiversity and how fundamental it is to all aspects of our lives. People tend to see the protection of biodiversity as a separate concern, or something that is "nice to do" or "for greenies", rather than central to our everyday lives. In fact, biodiversity and the ecosystem services that biodiversity provides are essential to our economic, social and cultural survival and wellbeing.

I've been interested in the environment ever since I was a child, going on walks in the bush and family camping holidays. So I decided to train in an area I was passionate about and where I wanted to see change. I studied for a BSc in Biology, followed by an MSc in restoration ecology.

During my MSc I had two short summer contracts working for the then Auckland Regional Council and that was how I ended up in my current role. In the first year I had what must have been the best summer job in the world, walking the east coast beaches surveying for the weed *Rhamnus alaternus*, and in the second year I was lucky enough to land a role doing more ecology focussed work. It was a great opportunity to get a foot in the door and to gain experience.

Having passionate lecturers – people who were extremely knowledgeable and internationally recognised in their field, yet were happy to give extra time to share their experiences – was a real highlight of my studies. Working with them in the field gave me a taste of where my career in science might lead me in the future. It was impossible not to be inspired by their expertise and affinity for the environment.

Community links

Adding value to food through science

A new programme bringing together expertise in food and health from across the University is expected to deliver substantive benefits to public health and the economy.

The Food and Health Programme, established in 2010 and led by the Faculty of Science, is a multidisciplinary initiative involving 150 leading researchers in food science, engineering, nutrition, medicine, sport and exercise science, public health, marketing, supply chain and economics.

It provides a single point of contact for industry and the health sector to access a wide range of University expertise.

"The Food and Health Programme aims to help enhance innovation and growth in the New Zealand food and beverage sector, and find new ways to add value to New Zealand's primary products," says Dean of Science Professor Grant Guilford who chairs the programme's steering committee.

"We're achieving this by working directly with companies to help tackle their applied research problems, as well as making fundamental discoveries that have the potential to be used by industry in the future."

"We're building on the very successful relationships with companies and the health sector that University researchers have developed over many years, as well as creating new opportunities for collaboration."

Examples of research under the banner of the new programme include cutting-edge studies of food processing techniques, clinical nutrition trials, work on the microstructure of food, large-scale public health interventions, and even screening for anti-cancer compounds in mushrooms.

"Much of the research involves collaboration across traditional academic disciplines and the Food and Health Programme actively encourages this," says Grant. "For instance food scientists are working with engineers, medical scientists or marketing and supply chain experts to address questions that would have been impossible for any single discipline to answer alone."

"Real synergies can be achieved by bringing together research teams with complementary expertise."

Alongside its research focus the programme is involved in a range of other activities.

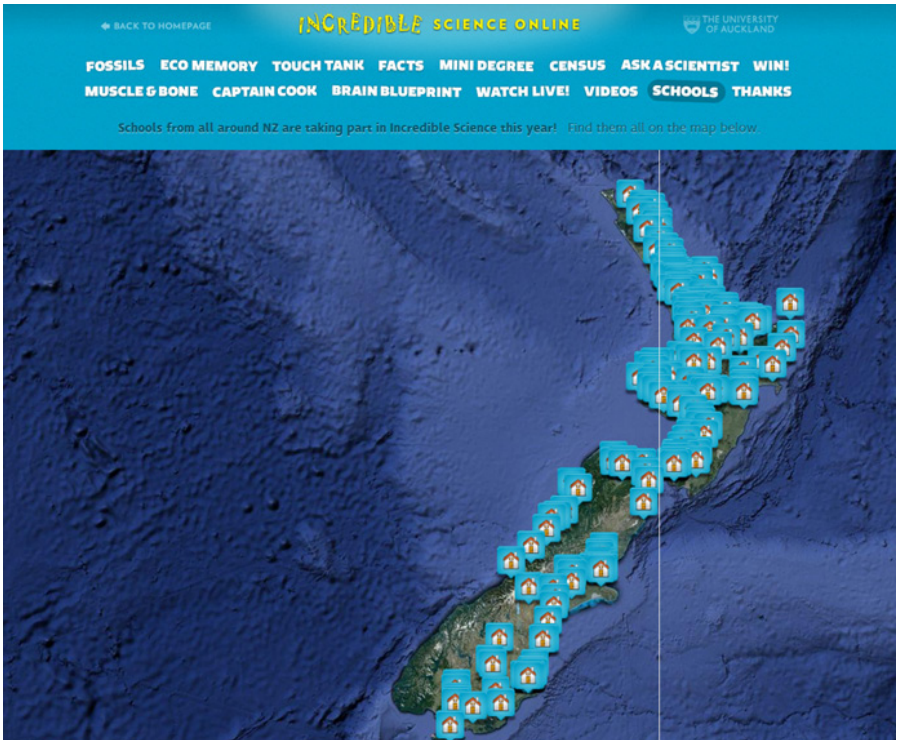
In collaboration with Auckland Tourism, Events, and Economic Development Ltd (ATEED) it is running a series of free seminars for industry, on topics from new food processing techniques to food for the ageing consumer market. It is also engaging with industry through innovation workshops, allowing company management and research and development staff to brainstorm with key academics.

Within the University, the programme has been underpinned by the appointment of several new academic staff specialising in food and health, and is contributing to the development of new undergraduate and postgraduate programmes in food science, food safety, food process engineering, and nutrition and dietetics

"One of our aims is to supply a growing number of highly-qualified graduates, to support industry in the long-term," explains Grant.

To share its expertise with the wider public, the programme also ran the very popular 2011 Vice-Chancellor's Lectures, on common myths and misconceptions about food and health. Recordings of the lectures will be made available on the programme's website at the conclusion of the series.

www.foodandhealth.auckland.ac.nz



More than 800 classrooms from all over New Zealand registered to participate in Virtual Incredible Science

Incredible Science goes virtual in 2011

Due to changes in the July school holidays, the annual Incredible Science event for 8-12 year olds and their families could not be held on campus. Instead, the inaugural "Virtual Incredible Science" was held from 5-7 July.

For the first time, the Incredible Science experience was available nationwide, with more than 800 classrooms from around New Zealand registered to participate. Registered schools received a kit of classroom materials as well as access to the website. In addition to the registered schools, families around Auckland that have attended Incredible Science in the past were emailed and invited to visit the website and experience the online event.

For the first time, five shows streamed live from the University: "Glassblowing Displays", three "Origami Fold-Alongs" and the grand finale "Chemistry Magic Show". As well as the shows, science-based games and activities were available online for the duration of Virtual Incredible Science.

The online event was a great success, with positive feedback from teachers and families alike. One Auckland mum says: "We have done the activities tonight at home and loved it - even me (mum). We have loved attending the day at the University over the years, and I know the children I take have missed it this year. So it has been great to keep the passion there with the online quizzes and activities."

www.incrediblescience.co.nz

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