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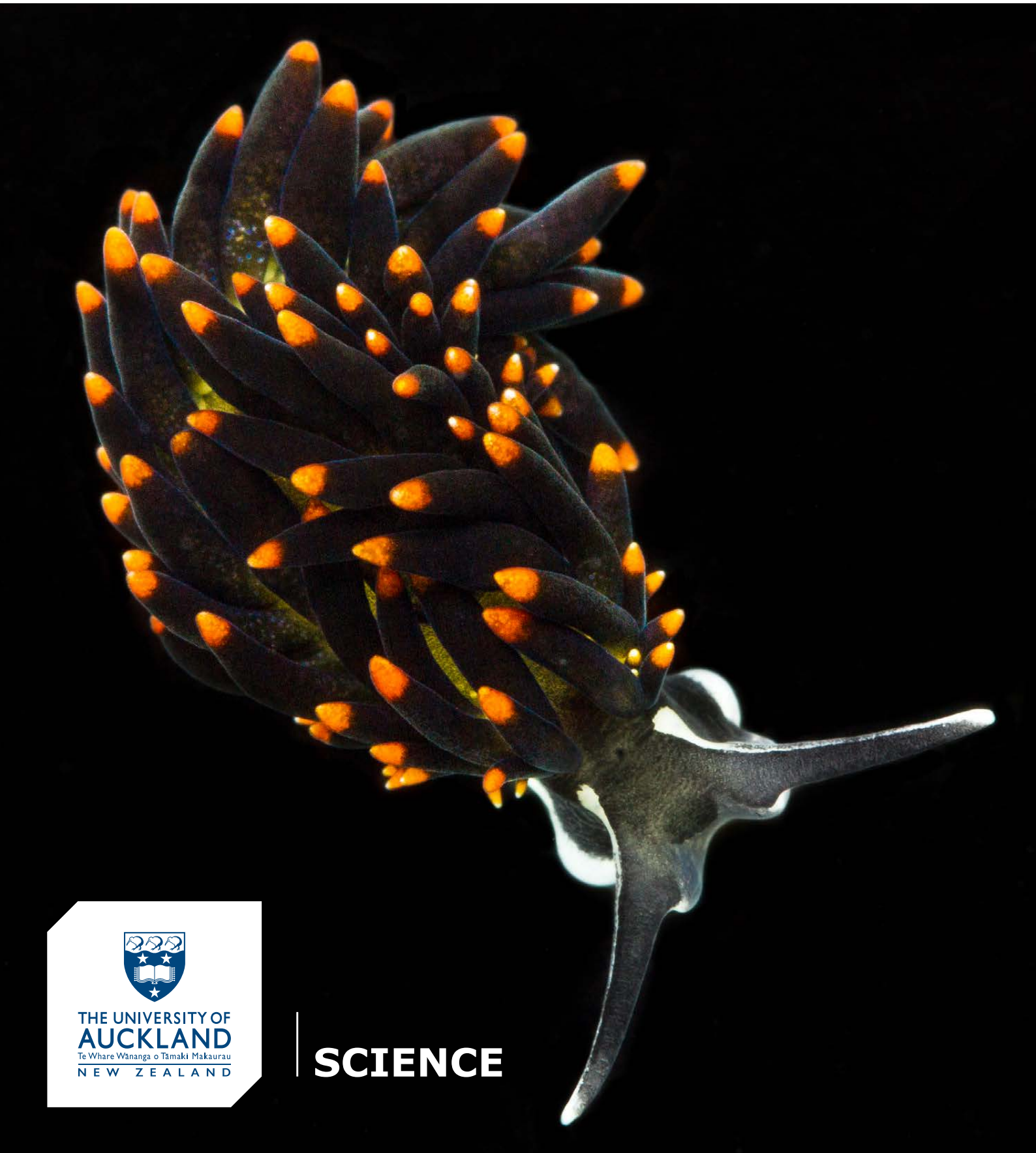
Faculty of Science Alumni Magazine

November 2015

InSCIght

in this issue



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

SCIENCE

InSCight

The University of Auckland Faculty of Science alumni magazine 2015

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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.

Contact: fos-marketing@auckland.ac.nz

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Cover page photo: Ercolania boodleae taken by Paul Caiger at the Leigh Marine Laboratory at Goat Island. Read the story of page 7.

A word from the Dean

As a fitful Spring stutters towards Summer, it's useful to reflect on the year and the many changes in our Science landscape. Externally significant national change includes the new National Statement of Science Investment (NSSI), charting the Government's direction in Science funding. This has much to applaud but is counterbalanced by the uncertainty of the well-publicised job losses at Agresearch. Good Science requires stability of funding mechanisms and a view to the long-term rather just short term opportunism. Something we don't disagree with is the NSSI's focus on the two pillars of excellence and impact, something our new Faculty mission and values statement also espouses:

We undertake excellent scientific research and education that are valued for their contribution to evidence-based global discourse and for the way they underpin and support New Zealand and New Zealanders to:

- *Understand the processes that shape our physical, natural and social environments and their implications;*
- *Be responsive and responsible in addressing challenges that might affect them or their environments;*
- *Live lives that are healthy in mind and body in habitats that are rich and diverse;*
- *Transform our economy to one based on what we know not just what we grow;*
- *Grow a population that irrespective of background is well educated in science, including mātauranga Maori, and its ethical application and, through our local actions, provide global leadership.*

We hope you also identify with our mission and support us to achieve it.

In this issue, you will find many examples of excellence exhibited by our staff and students, through awards gained or good Science explained. There are also many examples of the impact of our research and teaching and the impact our alumni are having globally. You'll see recognition of milestones such as the centenary of Chemical Sciences (p2), the 25th anniversary of Tuākana (p2), 21 years of Sport and Exercise Science (soon to be Exercise Sciences – p 1), and a year of Te Pūnaha Matatini (p3). We also celebrate a new approach to gender equity (p4) and some practical realisation of it (p9).

Achieving excellence and impact requires investment. The $200M Science Centre building (p 1) now dominating the Symonds St skyline, will be "topped off" in the next few weeks and occupied over the next year. This will allow the bulk of the Faculty to be co-located, with better supporting synergies that bring smaller initiatives together, such as ASAS, Agritech, and our Sustainability Network (all p 4) are, however, just as important.

Finally, it's not everyday you can discover a new species (cover and p7) or have an apartment block named in your honour (p 18). I do hope you find something of interest and, as always, do let us know what you are up to.

PROFESSOR JOHN HOSKING
Dean of Science, The University of Auckland

Around the Faculty

Science building update

Over 300 subcontractors from Fletcher Construction are working on-site at the Science building construction on Symonds Street, and staff are preparing to relocate to the new building in 2016.

According to Property Services project manager Grant Johnstone, work on the 13-storey building which includes impressive aluminium fins on the lower podium level façade, is "progressing well", and is within its approved budget of just over $200 million.

The structure and façade are nearing completion. The internal fit out is progressing on all levels and the contractors are working on the top floors of the tower.

The building, which is being erected by the tallest freestanding crane in the Southern Hemisphere, is the first in New Zealand to use Buckling Restraint Braces. The braces were designed and fabricated in the US to extremely strict specifications and form part of the structural seismic system; this system is a response to the Christchurch Earthquakes and the ability of the building to function following a major earthquake. As well as 110 buckling braces, the tower consists of 2,600 tons of steel, 24,000 square metres of gross floor area and 4,900 cubic metres of concrete.

"The fit-out is well underway. It is exciting to see the façade being completed and the building really taking shape."

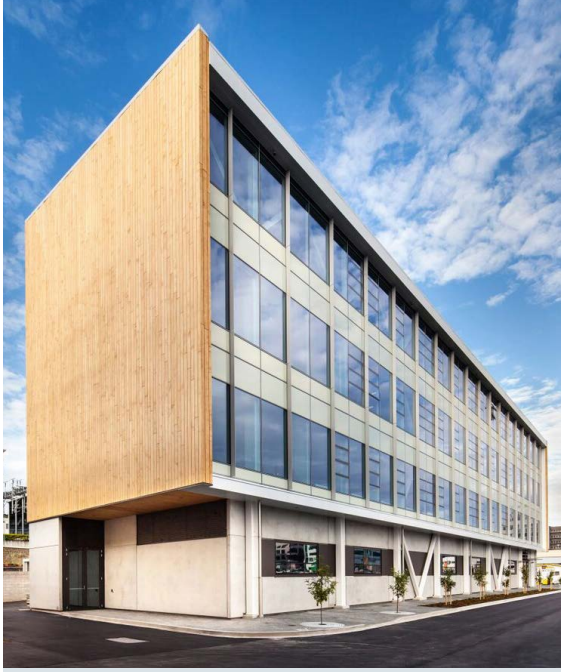
Grant Johnstone, project manager.

Exercise Sciences

The Department of Sport and Exercise Science has had many reasons to celebrate this year, including hosting a 21st birthday celebration that brought alumni, students and staff together to acknowledge those who have contributed to its rich history. Earlier this year, the department received an international accreditation for the taught postgraduate programme in Clinical Exercise Physiology. In addition, the department will soon undergo a name change.

From 1 January 2016, the Department of Sport and Exercise Science is to be called the Department of Exercise Sciences. The name reflects the department's academic focus as a discipline, with the objective to understand movement and its contribution to sustainable health through exercise, sport, physical activity and rehabilitation. It is the department's focus on exercise sciences that underpinned its successful application to CUAP to initiate the taught postgraduate programme in Clinical Exercise Physiology in 2012. The programme received international accredited by the Commission on Accreditation of Allied Health Education Programs (USA), the first programme outside North America to be accredited.

CAAHEP Commission on Accreditation of Allied Health Education Programs



The Polymer Chemistry Laboratory at the new Newmarket Campus

The University of Auckland's Newmarket Campus officially opened in May 2015, a milestone for the campus that began with the university's purchase of the site in 2013. At the industry open day in June, the Polymer Chemistry Laboratory was on show, with guided tours of the lab.

Tour groups were introduced to the lab's function by Senior Lecturers Dr Jianyong Jin and Dr Neil Edmonds from the School of Chemical Sciences.

The campus is at the heart of Newmarket on the former 5.2 hectare Lion Breweries site. The Polymer Lab is currently the only non-engineering entity located at the Newmarket Campus, but is strongly integrated with the Faculty of Engineering due to its longstanding co-location with the Centre for Advanced Composites Materials and Plastics Centre of Excellence at the Tāmaki Innovation Campus. The high level of crossover between the two disciplines, with their work on plastics and structural composites, requires continued co-location that Neil says, "is beneficial to all."

The new lab complex has become a hive of activity with a "sharp increase in the number of research students accessing the facility," now it is housed at the handier Newmarket Campus, says Jianyong. The lab has a multipurpose function catering to postgraduate research and industry needs.

Research students from across the University plus outside universities, industry and government research organisations use the facilities. The Newmarket Campus has a strong bias towards industry research and development and the School of Chemical Sciences' Polymer Lab is pivotal in this activity.

"Both students and staff will benefit from this dedicated research space with a clear focus in these vital areas of research."

Dean of Science, Professor John Hosking.

A celebratory photograph taken outside the Auckland War Memorial Museum.

School of Chemical Sciences' celebrations

The School of Chemical Sciences' Centenary was celebrated with two days of events showcasing the wealth of talent that resides within the school. Guests looked back at a rich history of transformation, from humble beginnings in an old courthouse in the 1800s, to a diverse school thriving across campus.

The annual Research Showcase was held at the Auckland War Memorial Museum where the school's PhD students presented their research in a variety of categories. Matthew Calvert took first place for the Oral Presentation by Invited PhD Students, "A Biomimetic synthesis and Structural revision of Yuremamine," winning the $500 dollar ThermoFisher prize. Katherine Herbert took first place in the Three Minute Selected PhD Students Talks for her presentation, "Sweet as: Assessing the impact of glycosylation on the bioactivity of adiponectin," winning the $300 Fonterra Prize.

After a keynote address from Professor Robert H Grubbs and a lecture by Professor Russell Egdell, the school posed for a Centenary Celebration photo. The day ended with cocktails and canapés and a self guided tour of the WWI exhibition.

The next day, a range of lectures were presented to an enthusiastic public audience, including a talk by Professor Gordon Miskelly about the history of the school and the "academic lineage" of its alumni.

The Whizz Bang Chemistry display entertained the audience and was a highlight of the day that saw the children in the audience mesmerised by exploding balloons and frothy, fizzy and bubbly lab experiments.

Tours of the glassblowing laboratories proved popular as did the tours of the newly renovated Chemistry laboratories.

Two days of celebrations concluded with the exclusive Gala Dinner in the University marquee on the Old Government House lawn.

Public lectures by our Seeyle Fellows

The Faculty of Science enjoyed hosting two public lectures by Seeyle Fellows in August.

Associate Professor Anne Whiteworth from Curtin University in Perth, presented a public lecture about her research on reviewing therapy generalisation following intervention with post-stroke aphasia. And Professor Chris Budd from the University of Bath, provided a thoughtful and well-balanced public lecture looking at how mathematics can be used to understand some of the changes in climate we see today.

Anne's talk explored how theory and evidence is used to measure results for people with the language disorder aphasia, using examples from her work to explain the importance of being supported by theories in order to have predictions for change.

Chris's lecture explored the change that has occurred with the earth's trend of warming and cooling periods. He spoke about the role mathematicians play in working alongside climate scientists to understand climate patterns using equations which allow the assessment of different factors upon the climate.

The Seelye Fellowship was first established in 2006, and aims to attract distinguished academics who are leaders in their field to the University of Auckland for a short period of time where they can share their research and expertise.

Tuākana in Science celebrates 25 years

This year, the Tuākana in Science programme celebrates 25 years since it was first established in the School of Biological Sciences.

To mark this special occasion, the Faculty of Science hosted two key events – a full day Tuākana in Science symposium in September for staff and students from across the University, and a celebration evening in October for alumni, staff and other key individuals who have been involved in the programme.

The symposium in September was opened by our Kaiārahi Michael Steedman and the Acting Dean of Science, Professor Jim Metson. Professor Mike Walker from the School of Biological Sciences provided a brief look into how the programme first started to take shape in 1991 and some of the initial discussions that took place. He was followed by key representatives from each of our departments, who shared the unique approaches they have developed over the years to support their Māori and Pasifika students. Attendees also heard from other key staff within the University, along with some external contributors who are involved in work supporting Māori and Pacific Island students in the education space. In October, a celebration event was held in the marquee on Old Government House lawn where alumni and staff came together to celebrate the success of the programme, and to acknowledge the key people across the faculty who have shaped the programme into what we see today.

Four 'Tuākana in Science Long-Service Awards' were also presented which recognise the contribution of key individuals who have led their programmes for an extended period of time. Awards were presented to Professor Michael Walker from the School of Biological Science, Dr Sina Greenwood from the Department of Mathematics, Lyndsay Blue from the School of Environment, and Susan Wingfield from the Department of Statistics.

For more information about the unique stories from each of our Schools and Departments who have a Tuākana programme in place, visit **www.science.auckland.ac.nz/Tuākana-stories**

Postgraduate study options in ICT

Postgraduate Certificate in Information Technology

Students will gain fundamental skills in software development, including object-oriented programming and design, Web technologies and databases.It provides an alternative pathway for students who do not have the relevant academic background to gain direct entry into the Master of Information Technology.

www.science.auckland.ac.nz/pg-cert-info-tech

Master of Information Technology (MInfoTech)

The MInfoTech is a new programme designed to help students become "industry ready" by providing them with advanced skills in a specialist area, an increased understanding of workplace norms, and an enabling experience of the development and commercialisation of technology products and services.

A key feature of the MInfoTech is a directed research internship ensuring students gain industry specific skills and experience.

www.science.auckland.ac.nz/info-tech

Master of Professional Studies in Digital Security (MProfStuds)

The demand for digital security specialists is soaring in Zealand and worldwide.

The Digital Security programme brings together the University's strengths in Computer Science, Information Systems and Operations Management, and Software Engineering. Graduates of the programme will learn the fundamentals of secure IT design, planning, and management.

www.science.auckland.ac.nz/digital-security

Master of Professional Studies in Data Science (MProfStuds)

Data has evolved into the most important asset for many companies. The ability to turn data into information, knowledge and innovative products often separates success from failure. Data scientists have the skill set to drive innovation and affect the success of start-ups, established businesses and organisations, governments, science projects, as well as media, broadcast and cultural events.

The new specialisation for the MProfStuds draws together courses from Computer Science, Statistics and Information Systems to address a need for professionals with a specific skill set. The qualification enables graduates to be readily identifiable as holding the skills to participate in the field and to contribute to its advancement.

www.science.auckland.ac.nz/datascience

The people of Te Pūnaha Matatini.

Te Pūnaha Matatini: A year in reflection

It has been an exciting year at Te Pūnaha Matatini – 'the meeting place of many faces' – as we established ourselves on the national scene. Unlike most of the other national Centres of Research Excellence we didn't build on an existing research centre. When we opened our doors for business in January, we didn't have any infrastructure. We didn't have any staff. But the interest out there in the type of work we do left us with little choice but to put ourselves together on the fly. People were knocking on our door even before we officially launched.

We chose data, knowledge, and insight as our by-words. We want to take advantage of the increasing availability of big data sets to better understand the economy and the environment, and to solve problems for business and government. Few of these problems fit neatly into disciplinary silos, which is why we have brought together a team that includes physicists, mathematicians, economists, ecologists, and social scientists from universities and research institutes across the country.

Big data has become quite the buzz-word, but is genuinely starting to transform the way our government and many companies do business. Graduates with skills in data science are in high demand, and there many opportunities to work collaboratively with external organisations. We have joint projects with larger organisations, such as the Ministry of Social Development, as well as with smaller companies like Wellington's Dragonfly Data Science.

The burgeoning availability of data is transforming the science of complex systems. Government datasets give us insights into the issues that affect the lives of New Zealanders, which will eventually allow us to slow down the transmission of communicable disease while speeding up the spread of knowledge. Our researchers are using crowd-sourced bird song recordings to help monitor ecological restoration projects, and applying methods from network science to understand the advantages that result when companies collaborate on research and development.

Professor Shaun Hendy,
Director of Te Pūnaha Matatini

Auckland ICT Graduate School

The Auckland ICT Graduate School is a joint initiative by the University of Auckland and the University of Waikato, tasked with delivering industry-relevant information and ICT education built on connections between tertiary education providers and businesses. Two new qualifications will be offered under the umbrella of the Auckland ICT Graduate School: The Postgraduate Certificate in Information Technology (PGCertIT) is for students who hold an undergraduate degree in a non-IT related discipline, while the Master of Information Technology (MInfoTech) is for students with an undergraduate degree in an IT-related discipline.

The skills taught are designed to complement the technological capabilities of the students alongside internships in industry, to development leadership, project management, commercial understanding and effective collaboration.

ICT graduates are primed to partake in a thriving industry where the demand currently exceeds supply for skilled graduates to fill a wide variety of ICT roles around the country.

The first cohort of students enrolled in the PGCertIT begin their journey towards an ICT career in November 2015, while the first intake of MInfoTech students begin their studies in Semester One 2016.

Key Strategic Initiatives

Agritech Initiative

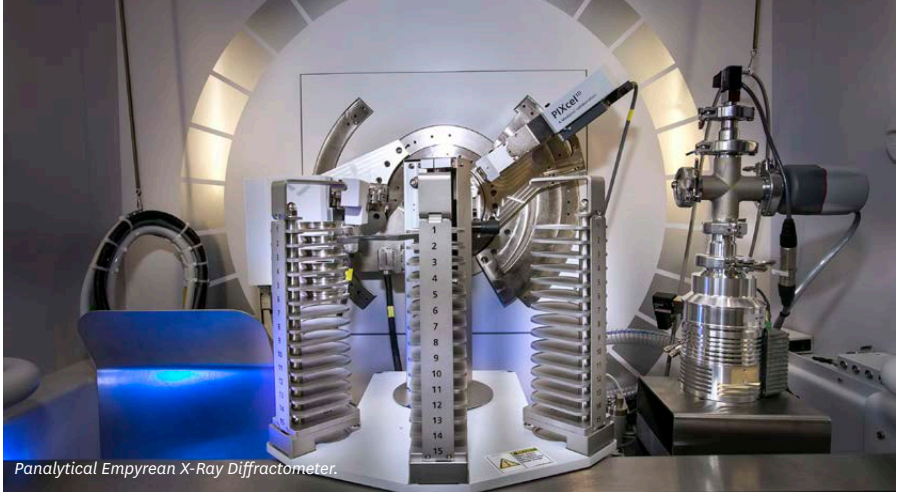
Agritechnology is an area of significant innovation and global opportunity for New Zealand. In response to this opportunity, the University of Auckland has established the Agritech Initiative – a multidisciplinary hub that draws on research strengths from robotics to methane mitigation, sensor technologies and agribusiness. Approved through the university's contestable strategic research initiatives funding programme and lead by Mark Burgess, the initiative aims to foster collaboration between its many partners and provide access to the University of Auckland's world-leading expertise in this area.

Platform for Gender Equity

The Platform for Gender Equity was launched in November 2014 at a reception in Old Government House. The aim of the platform is to provide a foundation for the Faculty of Science to systematically move toward a more equitable working environment. A recent initiative that has developed out of the Gender Equity Platform, is the Post Parental Leave Research Grant – a new funding initiative available to academic staff, who meet certain criteria. Professor Virginia Braun (Associate Dean Equity) says, "This grant offers a very tangible and flexible means of (re)engaging with research upon return to work following parental leave."

Sustainability Network

There are many examples of sustainable practise throughout the Faculty of Science. The Sustainability Network, launched this year, aims to increase the internal and external visibility of sustainability-oriented activities within the faculty and facilitate sustainability-oriented initiatives. The working group, facilitated by Dr Niki Harre (Associate Dean, Sustainability), meets regularly and is working at putting the Network's core values into practice within the University setting. "The network has attracted a vibrant group of energetic people who are enthusiastic about taking action to increase the sustainability of our university and to forward research and teaching in this domain. I am very optimistic about what we will be able to achieve," says Niki.



Panalytical Empyrean X-Ray Diffractometer.

Auckland Science Analytical Services

Analysing soil types for building foundations, testing alloys for rocket engines and co-ordinating resources for sometimes lengthy academic research projects is all in a day's work for Auckland Science Analytical Services (ASAS) – the Faculty of Science initiative that brings specialised equipment and expertise under a single administrative umbrella.

Since going live in late 2014, ASAS now has five virtual 'centres' presented as comprehensive packages of functionality which typically combine sets of similar or complementary pieces of analytical equipment and their expert operators. "We are trying to portray each centre as a one-stop-shop" says Business Development Manager Kevin Daish, pointing to services which range from Bioinformatics, Genomics and DNA Sequencing through to Imaging and Mass Spectrometry.

The logic behind ASAS from a management perspective was compelling. The "overwhelming desire" says Kevin, was to increase the utilisation of scientific of equipment.

"It's much better that we support a piece of equipment, work it hard, and then the University as a whole can say we need to upgrade or replicate the equipment and it has the usage information to put together a strong business case."

At the heart of ASAS is a web-based centre management software package provided by iLab Solutions that handles service requests, project reporting, invoicing and usage tracking. "You can get a very clear view of users on a daily basis. It gives you complete transparency" says Kevin.

While the primary focus will always be on academic research and teaching, excess capacity is made available for external use. Kevin says external clients bring the prospect of new research initiatives – and funding opportunities. "These commercial collaborations will hopefully keep on going and then the academic and commercial partners can seek external funding."

Among the external clients is Tonkin + Taylor, the environmental and engineering consultancy which ordered mineralogy tests to confirm whether clay at a Pukekohe construction site may have shrink-swell issues which would require stronger foundations. T+T Geotechnical Engineer Shiraz Soysa says specialised equipment was needed and the University's X-Ray Diffraction analysis revealed that the risk of potential soil expansivity was not as significant as more conventional laboratory testing had indicated. As a result he says that "T&T had more confidence about the design and avoided unnecessary expense."

T+T is no stranger to drawing on University expertise and Shiraz says they get information not available anywhere else because of the wider range of understanding. Academics also tend to be "more forthcoming and bring a different way of thinking" because they look at the geology first rather than the potential solution.

Another commercial client is Rocket Lab who wanted quality control tests conducted on the composition of an alloy used in engine construction. Rocket Lab Design Engineer Michael Connaughton says the equipment available through ASAS offered the chance to analyse "a very much less run-of-the mill material." What's more, he says "there's essentially much stronger science, an awareness of the science required to perform a new type of analysis."

Rocket Lab needed to have "100 per cent confidence" that the alloy in question would behave in the way it was intended in an extreme operating environment so it was subjected to inductively coupled plasma mass spectrometry (ICP-MS) to determine that its constituent elements were in the right ratios. As such, Michael says the analysis "enabled us to use a material with a much higher degree of confidence than we would have otherwise had."

External work currently represents around ten per cent of ASAS revenue generated mostly through word of mouth, though Kevin is quick to point out that it isn't offering itself as a full contract lab so care needs to be taken in how it's promoted. And while still in its early days, the concept could eventually grow into other faculties and be rolled out across the entire University.

To discuss potential projects and services with the ASAS team please contact:

Dr Peter Cattin
Operations Manager
peter.cattin@auckland.ac.nz

or

Dr Kevin Daish
Business Development Manager
k.daish@auckland.ac.nz

www.asas.auckland.ac.nz

News about our staff

Dean's Teaching Awards

Congratulations are in order for the School of Biological Sciences for their success in taking out all three of the Faculty of Science Dean's Awards for Teaching Excellence in 2014.

Associate Professor Debbie Hay (SBS) – While Associate Professor Hay's application demonstrated excellence in all of the criteria for this award, the Committee was impressed with the leadership that she has demonstrated in her teaching and to the discipline by publishing her laboratory examples.

Dr Mike Taylor (SBS) – Dr Taylor demonstrated excellence in his student-centered teaching approach as evidenced by his strong teaching evaluations and recent efforts at developing a Peer Mentoring programme in his School.

Dr Brendan Dunphy (SBS) – Dr Dunphy demonstrated remarkable reflection regarding his teaching practice, dedication towards professional development and the leadership that he has shown both within the University and the broader discipline.

These awards are part of the Faculty's wider commitment to encouraging and celebrating excellence in teaching, with the aim of promoting a more active and reflective approach to teaching across the Faculty. Selection for the award is based on demonstrated excellence in teaching, with the following selection criteria taken into account:

- Teaching that is student-centred and which promotes student engagement and effective learning;
- Continuing professional development and critical reflection;
- Leadership in teaching practice within the University and the nominee's discipline.

Hood Fellowship

Congratulations to **Professor Bakh Khoussainov** from the Department of Computer Science who has been awarded an outgoing Hood Fellowship.

Professor Bakh Khoussainov is a highly respected expert in the mathematical/theoretical end of computer science. The aim of his fellowship is to establish research collaborations with Japanese experts in computer science and logic, especially with experts in proof theory and algorithms, and to strengthen current research collaborations with North American experts in computability and group theory.

The Faculty of Science welcomes **Professor Alan Kingstone** (Department of Psychology) from the University of British Columbia as an incoming Hood Fellow.

Professor Alan Kingstone is a leading figure globally in Cognitive Science, having conducted research on human cognition and behaviour in complex real world environments ranging from social attention to video game playing to behavioural sustainability. He is a leading scholar who has pioneered several new directions in the field of "social attention" with international impacts both in scholarship and in applications of these concepts in communities.

The Hood Fund was created to mark Dr John Hood's Vice-Chancellorship at the University of Auckland. The Fund provides travelling fellowships for selected academic staff to undertake short-term research at prestigious international institutions and enables overseas academics to challenge and inspire research at the University of Auckland.

Rutherford Fellowships

Four of 12 new Rutherford Fellowships named by Science and Innovation Minister Steven Joyce have been awarded to researchers from the Faculty of Science.

The prestigious Rutherford Discovery Fellowships recognise talented future research leaders among early and mid-career scientists.

Dr Miro Erkintalo, Department of Physics, for research entitled: "Lighting up New Zealand: Next-generation laser sources for scientific and industrial applications."

Dr Annette Henderson, School of Psychology, for research entitled: "Born and raised to cooperate: Identifying how experience shapes our cooperation foundation."

Dr Cate Macinnis-Ng, School of Biological Sciences, for research entitled: "Thirsty forests under future climates: impact of drought on native ecosystems."

Dr Gwenda Willis, School of Psychology, for research entitled: "What stops convicted sex offenders from reoffending? Developing a strengths-based framework for sexual violence prevention."

"This reflects the excellent work of these rising stars and continues a considerable record of success for the Faculty in these prestigious fellowships – well done."

Professor Jim Metson, Deputy Dean of Science.

The Fellowships provide funding of up to $800,000 over five years for each Fellow, covering salary and research costs and are administered by the Royal Society of New Zealand.

Faculty of Science funding with MBIE

Faculty of Science research in environment and agriculture is to receive up to six million dollars in funding from the Ministry of Business, Innovation and Employment, announced in September.

Funding of $1.20 million over three years is provided to develop a smart acoustic sensor for estimating pasture biomass, a critical part of modern farming. The project is led by **Professor Stuart Bradley** of the University's Department of Physics in partnership with AgResearch and agricultural supplies industry leader Gallagher.

Other Faculty of Science projects include developing sustainable fish aquaculture foods from seaweed which receives $990,500 over two years. The project is led by School of Biological Sciences Professor Kendall Clements.

Development of dairy goat milking output for increased production of dairy goat infant formula is led by **Professor Russell Snell** and **Associate Professor Klaus Lehnert** from the School of Biological Sciences. The project receives $3.63 million over three years.

Modulating pathogen-host communication to develop new targets for antimicrobials receives $999,346 in funding over two years and is led by **Dr Anthony Phillips**, also from the School of Biological Sciences.

A project to mitigate methane emission from livestock receives $836,000 over two years and is led by **Research Fellow Dr Verne Lee** from the School of Biological Sciences.

(Left to right) Marie McEntee with fellow awardees Dr Alana Curtis (Faculty of Medical and Health Sciences) and Dr Eleanor Hawe (Education).

National Teaching Excellence Award

Senior tutor Marie McEntee's success in teaching communication skills particularly to science students has been recognised with a Sustained Excellence Award at this year's AKO National Tertiary Teaching Excellence Awards.

Marie received her award from the Hon. Steven Joyce (Minister for Tertiary Education) at Parliament's Banquet Hall on August 11 with 11 other recipients from tertiary institutions across New Zealand. Three of this year's recipients came from the University of Auckland.

Marie has taught in the School of Environment (and its predecessors) for 23 years where she coordinates and teaches two of the School's interdisciplinary courses, SCIGEN 101/101G which focuses on science communication (taught jointly with Mathematics) and SCIGEN 201 which focuses on science innovation (taught jointly with Business and Economics).

"My lectures are interactive and student-focussed which encourages students be creative and innovative. I really believe that good communicators are better scientists." says Marie.

This sentiment is shared by Professor Paul Kench, Head of the School of Environment, "Science Communication is increasingly seen as a critical skill required of our graduating students," he says. "Marie has devoted considerable effort in building and developing meaningful curricula in this area."

New Heads of Department

Associate Professor Ilze Ziedins (Department of Statistics) became the new Head of the Department of Statistics in September after joining the department in 1993. Her BA is from Waikato University and PhD from Cambridge. Her research interests are stochastic networks and queueing theory. Ilze's primary research interest is the modelling, analysis and optimisation of stochastic networks, with particular application to communications networks, transportation networks, and latterly, healthcare systems. Particular themes that she is currently working on include phase transitions and controls in tree loss networks; system optimal and user optimal admission and routing controls in queueing networks; and modelling and optimisation of patient flow in hospital systems.

Professor Eileen McLaughlin (School of Biological Sciences) was working as the Acting ProVC (Science and Information Technology) at the University of Newcastle, Australia when she accepted the position as Head of the School of Biological Sciences in March. Eileen began her new role in September, has a BSc(Hons) from Glasgow a PhD from Bristol and a Teaching from from Newcastle.

She has had positions at The University of Bristol and the CSIRO Pest Animal Control CRC in Canberra before moving to the University of Newcastle. Her research is in the area of reproductive biology with particular emphasis on: testicular biology, notably spermatogonial development; cytokines that control the activation of primordial follicles in the mammalian ovary and ovotoxic xenobiotics which cause oocyte loss and early menopause; and cell and molecular research in human and animal assisted reproduction.

Professor Gill Dobbie (Acting Head, Department of Computer Science) worked in industry for a couple of years before she became an academic. She has held permanent and visiting positions at the University of Melbourne, Victoria University of Wellington and the National University of Singapore.

Gill has a wide range of research interests, including databases, the web, and software engineering. She is interested in structured and semistructured data. More specifically, she is interested in how data can best be organized and managed, how the semantics of the data can be retained and expressed, and how querying can be carried out efficiently.

New Professors

The Faculty of Science welcomes the appointment of two new professors for our faculty.

Professor Kathleen Campbell (School of Environment) came to the University of Auckland in 1997 to take up paleoecological and paleoenvironmental teaching and research in the Geology Department, now part of the School of Environment. Since then she has co-supervised 60 post-graduate students, and has worked with numerous colleagues on multi-disciplinary research projects, both in New Zealand and overseas.

Kathy was educated along the geologically active margin of the western USA – from the University of California (Santa Cruz, BSc), to University of Washington (Seattle, MSc), to University of Southern California (Los Angeles, PhD).

Field work in coastal Washington's rain forest prepared her for the often wet and bush-clad conditions she regularly encounters on North Island field excursions. Her Current research is focused on marine hydrocarbon seeps and terrestrial hot-springs as analogues for early life settings at field sites in New Zealand, Patagonia, South Africa and the western USA.

Professor Nicola Gavey (School of Psychology) trained as a clinical psychologist and worked for a few years in the community before taking up an academic position. She has a strong interest in the possibilities for teaching, research and scholarship to inform social debate and change, and maintains ongoing conversations with those working in the community on education, support, advocacy and activism around sexual violence and gender issues more broadly.

The central focus of her research has been understanding and challenging the ways that normative cultural values and practices support rape and sexual coercion.

Her current work looks at the place of pornography within the 'cultural scaffolding of rape', and the ways in which critical engagement with the misogyny, sexism and racism within it is defused through the rhetoric of (neo)liberalism and postfeminism.

She is working with colleagues on a Marsden funded project that aims to revitalise wider critical engagement around these issues (www.sexualpoliticsnow.org.nz). Other key interests include violence against women and biomedicalisation.

News about our students

Prestigious Potentia Scholarship for Computer Science student

Third year Computer Science student **Xindi Zhang** is the recipient of the prestigious 2015 Potentia Scholarship. Xindi is majoring in Economics & Finance as well as Computer Science with a specific interest in software development. She was the 2014 winner of the SPARK ideas Challenge: Musical Minds and is the 2015 Co-President of the student-led organisation MADE (Make a Difference with Economics). In 2013, Xindi spent a year on exchange at McGill University in Montreal where she also volunteered to give free music lessons to disadvantaged children. In her summer break she worked at the Leatherback Sea Turtle Hatchery and Research Centre in Costa Rica while living with a local family. Xindi's ambition is to be an entrepreneur that helps shape new technologies. Potentia is a recruitment agency that specialises in careers in Computer Science. Along with the $5000 scholarship, Xindi will also receive mentorship to help her find her perfect job in the future.

(Left to right) Abinesh Krishan, Client Strategy Director Potentia; Professor Gill Dobbie, Head of Computer Sciences; Xindi Zhang, Potentia Computer Science Scholarships winner 2015; Nathan Bryant-Taukiri, General Manager Potentia.

Woolf Fisher Scholarship success

Congratulations to **Matthew Conder**, a BSc(Hons) student in the Department of Mathematics, and Research Engineer **Reece Oosterbeek** from the Photon Factory who have been awarded Woolf Fisher Scholarships which allows them to pursue doctorate degrees at the University of Cambridge in the UK.

The scholarship has a value of approximately $300,000, and covers full tuition and living costs. While Matthew aims to start by completing Part III of the Mathematical Tripos – a one year programme of Master level courses – before proceeding into a three year doctorate programme, Reece is planning on studying biomaterials (degradable implant materials) at the Department of Materials Science and Metallurgy. Reece cites his experience working with Associate Professor Cather Simpson from the School of Chemical Sciences and the Department of Physics, as contributing to his success with the Woolf Fisher Scholarship, he says, "Cather has been a great mentor and I've gained both technical and leadership experience under her guidance."

Head of Department in Mathematics, Eamonn O'Brien, is particularly pleased to see the award going to Matthew, he says "a talented and deserving student in maths – this is a splendid achievement by one of our excellent students".

(Left to right) Fellow winners Reece Oosterbeek and James Gawith with Matthew Conder.

Vice-Chancellor's prize for best doctoral theses

The Faculty of Science was well represented in the Vice-Chancellor's prize for best doctoral theses in April.

Jason Busby, from the School of Biological Sciences, won for his thesis on 'Structural studies of the Yersinia entomophaga toxin complex,' which looks at the natural insecticide produced by a New Zealand soil bacterium.

Christy Wang, from the School of Chemical Sciences, won for her thesis on 'Extending Traditional Organopalladium Chemistry in the Total Synthesis of Heteroaromatic Natural Products,' which focuses on the total syntheses of two natural products named terreusinone and schischkiniin.

Stephanie Hittmeyer from the Department of Mathematics, **Sally Prebble** from the School of Psychology and **Jessie Wu** from the Department of Computer Science were also nominated for best doctoral thesis.

Nineteen nominations were received from the faculties for the five prizes, out of a total of 389 doctoral degrees successfully awarded.

Criteria include the demonstrable significance of each thesis in its field, the originality and excellence of the research, exceptional academic and intellectual achievement, and timely completion.

New species: Ercolania boodleae

A new species of 'Sap-suckling Sea Slug' has been discovered by Institute of Marine Science PhD student, **Paul Caiger**; making *Ercolania boodleae* a new species record for New Zealand.

The specimen was found by Paul on a research dive at Ti Point, Auckland. Paul was looking for triplefin nests when the small black sea slug, one among several, caught his eye.

"I dive a fair amount in northern New Zealand, and I knew it was something I hadn't seen before, therefore I suspected it might be fairly rare," says Paul.

"It's always exciting finding rare and new things, and highlights the huge diversity and the fact that there is still much to be discovered in the marine realm."

Paul Caiger, Institute of Marine Science.

See a photo of Ercolania boodleae, taken by Paul, on our cover page.

Sporting prowess from Faculty of Science students

Our Faculty of Science students were very well represented in sporting achievement this year. In particular the Blues Awards saw a generous representation from the faculty.

Pole vaulter and Blues Awards Sports Woman of the year, Eliza McCartney.

Congratulations to Blues Sports Woman of the year, **Eliza McCartney** who pole vaulted her way to a silver medal at the World University Games in South Korea. The School of Psychology student cleared 4.40m, just five centimetres short of her personal best which is also the New Zealand record! Eliza holds all of the age group and senior New Zealand records for women's pole vault and was a finalist in the Emerging Talent category for the Halberg Sports Awards earlier this year.

Roisin Giles who won a Blues Award for Most Meritorious Performance in the Sports category, is a Bachelor of Science/ Bachelor of Law student. Roisin was the gold medal winner for Senior Female 1st Degree Patterns and also won the silver medal for New Zealand in the Senior Female Team Patterns at the 2015 ITF Taekwon-Do World Championships.

Eleanor Adviento 'curling' at the Audi Quattro Winter Games.

Eleanor Adviento who is a Blues Award nominee, placed 3rd at the New Zealand Mixed Fours Championships in Auckland for the sport of curling. Eleanor, who is studying toward a degree in Biomedical Science, recently returned from the Audi Quattro Winter Games where she and her partner placed 7th out of 12 international teams. Next up for Eleanor is the Pacific Asia Curling championships in November held in Almaty, Kazakhstan.

Alice Boyd and the fencing team at the World University Games.

Elsewhere, Bachelor of Science student, **Alice Boyd** represented New Zealand in fencing at the World University Games in Gwangju, Korea. Alice was supported by the University's Sport Support Fund, placing 46th. Congratulations to **Campbell Blake**, who was part of the New Zealand men's Under 19 team which won gold at the Underwater Hockey Age Group World Championships. While Ngā Tauira Māori team manager and Bachelor of Science / Faculty of Arts student **Waimirirangi Stone**, was part of the University of Auckland Waka Ama paddlers who came away with a silver medal in the international race and were the only New Zealand team to compete at the Hawaii competition.

Dr Nicolette Rattenbury, Yasmin Esapour and Jessica Patterson.

Science Scholar for a day

The Science Scholars programme hosted Green Bay High School student Yasmin Esapour for a day in September, to give her a taste of what life will be like at university as part of the programme.

Yasmin who is a year 12 student, is smitten with the university after spending time with the current scholars and attended Physics, Bio-chem and Clinical Psychology lectures. The day included tours of the Chemistry, Physics, Biology and The Photon Factory laboratories. "I'm completely blown away by The Photon Factory, they lasered an image of Batman in a nano-second, it was incredible," says the talented student.

Yasmin was buddied up with Jessica Patterson who is in her first year of the Biomedical degree and enjoys the social aspect to being a scholar, she says "belonging to a group of likeminded people is a great way to start life at university."

Science Scholar's programme administrator Dr Nicolette Rattenbury is happy with how the day went. "It's great to see such enthusiasm from a high school student,"says Nicolette. "I hope we will be seeing Yasmin's application for the programme in the future!"

www.sciencescholars.auckland.ac.nz

Postgraduate Poster Competition

The annual Postgraduate Poster Competition showcased the inventive side of Faculty of Science students in September. Scientific research presented on a poster, with an emphasis on the balance between academic content and visualisation of research, made for the creative use of limited space.

School of Chemical Sciences entrant, **Patricia Albani** came first place for her poster (pictured above) "Message in a Stain: Messenger RNA profiling enables the identification of menstrual fluid." **Louise McMillan**, from the Department of Statistics, came second for her poster Where Did They Come From: Genetic methods for eradicating rats. While, Biomedical Science student **Elina Ashimbayeva** came third for her poster "The role of FOXA1 in Breast Cancer."

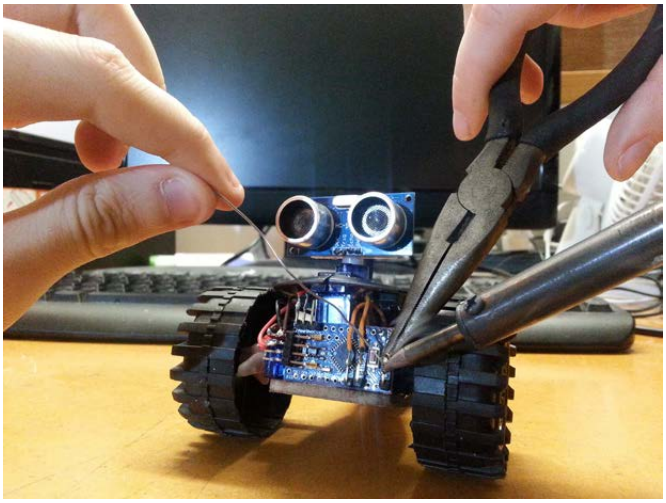
The winning trio, including the top 20 entrants, are also entered into October's Exposure poster competition where they will be eligible for generous cash prizes.

Science through the lens

The Faculty of Science's inaugural photo competition generated hundreds of entries from keen photographers with an eye on the prize.

The moments that were captured included a variety of subjects relevant to the scientific discipline of the photographer.

1st Prize: "Eye to Eye" by Paul Edward Caiger (PhD, Marine Science).



2nd Prize: "Two people working on a robot" by Hayden Moore (BSc, Computer Science).

3rd Prize: "Unexpected Visitor" by Rachael Lillian Sagar (PhD, Biological Sciences).

Science Communicators to follow...

Our researchers share interesting observations and insight using their specialist knowledge on different social media platforms.

Bloggers

the psychologizer

A psychological look into popular culture and casual analysis of all kinds of social issues.

See http://thepsychologizer.com
Written by Professor Will Hayward, Head of Department, School of Psychology

Excursionset

Excursions into cosmology, astrophysics, particle physics, science news and scientific perspectives on everyday life.

See http://excursionset.com
Written by Professor Richard Easther, Head of Department, Department of Physics

StatsChat

The improvement of statistical literacy and the scrutiny of facts and figures used in the media to create awareness of misleading statistical information.

See http://www.statschat.org.nz
Written by the Department of Statistics

A measure of Science

Complex systems and a look at how innovation works in New Zealand and overseas.

See http://sciblogs.co.nz/blogs/a-measure-of-science
Written by Professor Shaun Hendy, Department of Physics

The CS Blog

The improvement of the public's understanding of computer science.

See http://uoacomputerscience.blogspot.co.nz/
Written by the Department of Computer Science

Connect with our researchers on Twitter....

@ginnybraun
(Dr Virginia Braun, School of Psychology)

@MyPlasticBrain
(Professor Winston Byblow, Department of Sport and Exercise Sciences)

@REasther
(Professor Richard Easther, Department of Physics)

@nickgantnz
(Dr Nicholas Gant, Department of Sport and Exercise Sciences)

@LoraxCate
(Dr Cate Macinnis-Ng, School of Biological Sciences)

@DrPaulRalph
(Dr Paul Ralph, Department of Computer Science)

@SiouxsieW
(Dr Siouxie Wiles, Faculty of Science and Faculty of Medical and Health Sciences)

www.science.auckland.ac.nz/science-communicators

Marine Reserves – living databases and surprises

Forty years after it was established as New Zealand's first Marine Reserve, 'Goat Island' north of Auckland continues to surprise and inspire researchers at the University of Auckland's neighbouring Leigh Marine Laboratory.

Nobody foresaw that the recovery of the snapper and crayfish populations would lead to a regeneration of seaweed, or that average annual sea temperatures in the reserve would not increase despite increasing concerns about global warming. Certainly no one predicted that hundreds of thousands of people would come to witness the abundance of marine life there.

For marine ecologist Associate Professor Mark Costello, it's the unexpected discoveries from basic research at the Leigh Marine Reserve that proves its worth as a safe habitat – and a valuable living database. Collecting good baseline information like species inventories, maps and other fundamental information "is a pre-requisite for everything else we look at later" he says, pointing to the seabed habitat map published in 1981.

"If they hadn't done this first map of the reserve we'd never have been able to quantify how the habitat has changed. It's the only marine reserve in the world that's got a habitat map from when it was created."

When the seabed was resurveyed in 2006 it was discovered that rocks once laid bare by grazing sea urchins were now covered in seaweed. Subsequent experiments revealed that young sea urchins were being eaten by lobsters and snapper which allowed the kelp to recover, a phenomenon known as 'trophic cascade' whereby predators in a food web suppress the abundance and/or alter the behaviour of their prey, thereby releasing the next lower trophic level from predation.

Importantly, Mark says the Goat Island reserve provides a valuable comparison with fished areas, "because a marine reserve is basically your control site – a reference to judge human impacts elsewhere" What's more, their value increases over time as information and knowledge accumulates.

Unlike other New Zealand Marine Reserves which may have only tens to a few hundred species documented, the Goat Island reserve has inventoried over 1,000 species. And new species to science are still being discovered. Within days of his arrival, a visiting American scientist found a small amphipod shrimp that lives inside water-filtering sea squirts just a few centimetres long. "There are probably things that we don't even realise we've got that are sitting there waiting to be discovered" says Mark.

Looking back in time also has benefits and Mark is convinced that fresh sets of scientific eyes could learn from the fifteen years of historic video tapes taken by the Leigh Laboratory. To that end, discussions are underway about making them accessible online. "People could go back and look at this data with questions that we never thought of asking at the time we were collecting it. We hope to be at the forefront of making that available as well."

When Leigh Laboratory founder Dr Bill Ballantine started collecting a bucket of water every day to measure sea temperature some people at the University thought he was wasting his time because they couldn't understand what the research question was. However Mark says sea temperature is fundamental to growth, feeding, activity and reproduction in almost all marine species because they cannot control their own body temperature like mammals and birds. "Now of course people have linked this data to snapper spawning success, so in the warmer years you get faster growth in fish and better production. You can use the data for all kinds of things."

While small snapshots of data indicate increased temperatures such as during El Nino events, Mark says that "it shows no change in average annual temperature over the forty years. But that doesn't mean it hasn't been affected by climate change."

What is evident is the recovery of fish populations at Goat Island and other reserves like the Poor Knights. When the Goat Island reserve was created in 1975 people believed that the environment was near pristine. However, it soon became apparent that fish were increasing in numbers faster than could be explained by growth – they were moving into and staying in a safe haven. "Fish probably behave like birds in that they know what places are safe" says Mark.

Recent studies have focused on the increasing numbers of smaller fish now finding sanctuary as fishing intensifies around the 547 hectare reserve. "There may now be more of these smaller fish species in the reserve than outside because more people are spear fishing smaller fish outside than in previous years."

What's more, there's also now an "export" of young fish and crayfish to non-protected areas thanks to a phenomenon known as 'spill-over'. Some snapper in the reserve are now forty to fifty years old and as they get bigger and older they have access to the best food supply and produce far more eggs than the smaller fish outside.

Recent studies have shown that fish in reserves contribute proportionally more to wild populations than those outside. Biological models prepared by Le Port, Montgomery and Croucher in 2014 suggest that – under favourable conditions – there would be a substantial level of larval subsidies to wild populations up to 40 km from the reserve. In fact, one student estimated that if you increased the number of marine reserves in the Hauraki Gulf the Government wouldn't have needed to reduce the snapper quota for recreational fishermen "because the number of snapper would be greater because of the spill-over from the additional reserves" says Mark.

The appearance of seals at the reserve within the past decade is yet another sign of how species can recover from hunting. In a recently published paper entitled *'Biodiversity conservation should focus on no-take Marine Reserves'*, Costello and Ballantine argued that so-called Marine Protected Areas (MPAs) create 'an illusion of conservation of marine diversity' given that 94 % of the world's roughly 9,000 MPAs allow fishing.

"Only areas that are no-take should be regarded as truly protecting ocean ecosystems and if countries can't accurately report from no-take areas within MPAs, then conservation gain should be assumed to be zero"
Dr Bill Ballantine, founder of the Leigh Laboratory.

Despite public perceptions that up to a third of New Zealand's seas are protected, the 44 Marine Reserves cover less than 0.5 % of our Exclusive Economic Zone. The beauty of the reserves, says Mark, is that they're nice and simple. "You can enjoy seeing everything but can't take anything." Without limits being imposed, increasing numbers of people and improved technology can easily over-fish areas – whereas Marine Reserves protect reference populations that show fishing effects and can export fish to help stocks recover.

When it comes to conservation, Mark believes that the world should look no further than countries like Kiribati which depends on fishing for its survival but has placed 80 % of its Exclusive Economic Zone around the Phoenix Island off-limits to fishing. "The idea that developing countries can't afford to have no-take areas is thus nonsense. Obviously those people know they need to protect their environment for their own future well being and that of their children. So these places where marine biodiversity is left under natural conditions are not only of aesthetic and spiritual value, they also make common sense for our well-being." ■

Dr Bill Ballantine passed away at the beginning of November. A pioneer of marine conservation and tireless campaigner to create New Zealand's first marine reserve, Bill was 78 years of age.

Taupo Gold

A School of Environment tag-team with a mutual passion for hydrothermal systems has embarked on a new phase of mineral research that could unlock some of the underground secrets of New Zealand's precious metals heritage on the Coromandel Peninsula – and perhaps ultimately confirm the possibility of life on Mars.

Having spent years studying the relatively modern Taupo Volcanic Zone (TVZ) Professor Kathy Campbell and Associate Professor Julie Rowland, have switched their attention to the ancient Coromandel Peninsula that hosts ten million year old hydrothermal rocks. Combining the expertise of a palaeontologist and a structural geologist means that "we're very much linked" in this project says Kathy. "This affects not only searching for precious metals, but earlier signs of life on earth and possible signs of life on Mars because of the hydrothermal volcanic links."

Interestingly, Julie says the Coromandel and Taupo volcanic zones are contiguous in space and time. "One is an older version of the other, and there's continuity right across from Coromandel to the TVZ. You can track volcanoes, you can track the old hot springs becoming the new hot springs." Or as Kathy puts it, "it's a hot spring conveyor belt from one place to the other."

But whereas ancient hydrothermal systems only provide a window into the geological structures by virtue of the deposits left behind, the TVZ hot springs have provided valuable analogues to better understand the ancient zones. "The marvellous things about hot springs is that you've got some underground plumbing system that feeds it" says Julie. In the case of an active geothermal system, she says ground water is heated to some 200 °C by a magma-rich zone perhaps six kilometres below the surface. It then rockets to the surface in a "fascinating natural condensing system", a pipe-like zone that may consist of geothermal energy, mineral systems, and – at the top end – "the crucibles of early life."

On their way to the surface, high fluxes of fluid are scavenging precious metals like gold and Julie says anyone who soaks in natural hot spring water within the TVZ would be taking "a golden bath." In the case of geothermal power production however, the fluid usually ends up as wastewater or gets re-injected.

In a recent review of the literature entitled *'Gold and silver resources in Taupo Volcanic Zone geothermal systems'*, Simmons et al observed that gold and silver precipitates in hot springs, in subsurface hydrothermally altered rocks and in two-phase pipelines associated with production wells. The concentrations may be low grade, but could exceed several hundred thousand ounces worth many millions of dollars.

The biggest challenge is extraction, and the review concedes that 'new technologies need to be developed to extract the metals from the flow stream without interfering with geothermal energy production.' For instance, highly concentrated precious metal deposits are known to accumulate on back pressure plates which help control the pressure of gas and fluid coming out of wells, but these would need to be taken out of production to strip them of gold and silver. "If it's not economic it's not going to happen" says Kathy, "so it depends on the price of gold and on whether somebody can make it easy."

Which is why mineral deposits in the Coromandel Peninsula have more immediate appeal. Funded by MBIE, the current Mineral Exploration Models Programme is a new collaboration between the Universities of Auckland, Waikato and Otago – and GNS Science – to research gold deposits and characterise features that can be used to target and explore for new deposits.

While Coromandel may have a rich mining heritage, there's been no systematic study looking at the structure, faults and geology of the entire area. Under Kathy's supervision, PhD student Ayrton Hamilton – a Coromandel local – is studying sinters or silica-rich hot spring deposits that provide a geological record of the regions geothermal past. "It's like a new tool to look at the utility of hot springs in the Coromandel for exploration" says Kathy. Surprisingly, more than fifty such sites have been logged in the study so far though not all have links with previous mining activity.

"Why are some barren and some leading to gold? That's one of our questions, and we've got so many deposits now we can actually have a statistical study to maybe answer that question."

Under Julie's wing another PhD student from Ethiopia, Engda Admassu, is trying to combine all sorts of geophysical data with geological data to better interpret the tectonics behind the Coromandel volcanic zone and how it fits into the overall development of the North Island. The thinking is that hot water coming from the crust has to be flowing through faults "so we would argue that if we understand the big deep structures we'll have a better understanding of what localises those hydrothermal cells when they develop."

Yet another layer of research will examine the three-dimensional models that attempt to 'see through' what's on the surface in order to better locate areas of mineralisation. Such models are expensive, but Julie says "we're not very good at quantifying what the uncertainty is in those elements we put into our models." To that end, they've engaged the services of applied mathematics Professor Jari Kaipio who has a PhD student from Bulgaria looking at quantifying uncertainty in some of the models created for mineral deposits. "I don't know where that'll lead" says Julie, "but it's worth having a go."

While the issue of who has the legal rights to underground resources isn't their direct concern, Julie says she'd "like to hear a Māori voice" right across from Coromandel to the TVZ. Within the next six months, her intention is to start a series of conversations that explore the contribution that Māori interests could make in understanding the hydrothermal systems in aspects ranging from the environment to the resource opportunity.

Given that their research has been variously funded by the geothermal and mineral industries, Julie says it's interesting how those different pots of money are viewed from a social perspective. "For us it's the same deal. We're studying hydrothermal systems. But as the application changes so does the attitude of people who hear about the science." Hackles get raised over the prospects of an extractive economy like mining, yet Julie says people don't see dairy farming as extractive. "If you think about the damage dairying does to the environment, the footprint is so much bigger than the minerals industry."

From her vast experience with mining projects across North and South America, Kathy says she's seen more wildlife – like armadillo, flamingo, guanaco, and puma – on mining properties than anywhere else because they become sanctuaries from hunters and farmers. Also, some mining sites get rehabilitated like the McLaughlin Mine – California's largest gold discovery in the 20th century – which is now a natural reserve used by the University of California as part of an environmental science teaching programme. "So you cannot look at the situation with mining in a black and white way."

What they'd both like to see is more open discussion around the mining issue. "There's a real need to look at precious metal mining from the whole social licence to mine perspective" says Julie, "and that would be a worthwhile activity for universities to spend a bit more effort on." ■

Photo: Champagne Pool, Waiotapu geothermal area.

Mathematical modelling of animal navigation

The arrival of spring also heralds the arrival of tens of thousands of migratory birds from faraway places like Siberia and Alaska. Precisely how birds like the bar-tailed godwit navigate their way up to 12,000 kilometres to New Zealand and back has long remained a mystery, but Department of Mathematics PhD student Rebecca Turner is trying to crack the code. In the process, she's also challenging previously held assumptions about long distance flight.

Mathematical models of the navigational processes are at the heart of her three-year Marsden-funded research project, and these are being used to scrutinise ideas such as the long held belief that birds use the earth's magnetic field to navigate long distances. But Rebecca says "it's still a bit of a mystery HOW they do that." Her role is to look at how these models can be applied to real experimental data in order to test the hypotheses and further develop the models.

Given the difficulties involved with conducting direct experiments on migratory birds, homing pigeons are commonly used as a substitute because they give researchers the added advantage of knowing where they're going. However Rebecca has questioned claims in a recent edition of Navigation News that "homing pigeons navigate using two orthogonal coordinates derived from the Earth's magnetic field."

Applying a model designed to replicate an orthogonal map, she found that it didn't match experimental data collected in the 1960s and 70s by Cornell University zoologist William T. Keeton who released pigeons in the New York state area to understand the influence of magnetic fields and other factors on navigation. Navigation errors tended to increase in magnitude with distance from the loft so understanding and modelling those errors is a key part of the research.

After all, if they can explain the systematic errors made by the pigeons then it may be possible to predict those errors and subsequently understand the tools being used to correct them. As Rebecca puts it, the pigeons are making assumptions about things in their navigation mechanisms "so we basically want to know what assumptions they're making. And because they make assumptions they make errors."

Likewise, Rebecca is also questioning the human assumptions behind the existing model given that it didn't match the New York pigeon data set. "I'm saying that the initial combination of assumptions is wrong but I can't tell you which part is wrong." Debunking myths and challenging assumptions goes with the territory, and because she hasn't been involved in this particular field of animal navigation before she says she doesn't have any bias. "In that sense I am coming at it from a different angle and being more willing to try other ideas that might not have been thought so reasonable by a particular group." Which is why she says collaboration is so important.

"Even if the idea is really cool mathematically it might not be relevant biologically. And if there's a biological idea, you've got to ask what that actually means and how you can get that down to a mathematical formula. My job is to try and bring those two things together and make sure the idea's actually useful and working."

Importantly, Rebecca isn't ruling out the role that magnetic fields play in pigeon navigation. The problem with the New York data set was that there were "bumpy" magnetic fields around the Cornell University loft "so you have to make a whole lot of assumptions about what the birds actually think the field looks like."

The basic idea is that birds use some sort of map and compass system. The map gives the bird's position relative to home or target location, and the main compass is the sun – backed up by the magnetic field. "Just because they can sense it doesn't mean they're paying attention to it, but we have reason to believe that they are."

The presence of chemical gradients, such as trace gases, in the atmosphere are a potentially confounding factor. Migrating birds could be smelling different concentrations of compounds at various points in their journey, however Rebecca says it's hard to test the possibility because they don't know what the fields look like. To that end she uses imaginary fields to see whether they produce predictions that match the experimental data. "It's a possibility that they're using chemicals but we're not sure exactly what those chemicals are."

The next phase of Rebecca's research will involve field trials, and unlike Keeton – who tracked the New York pigeons with binoculars until 'vanishing point' to determine their direction – she'll rely on a more high tech GPS solution to log longitude and latitude every second.

Trials have been conducted with pigeon racing enthusiasts to determine the best method of attaching navigation devices to the birds. Initial tests using an elastic 'backpack' with straps around the chest were only useful for flights of around 20 kilometres, so the aim is to attach even smaller devices to feathers on the back for longer journeys of up to 100 kilometres. But with a price tag of $300 each, the tracking devices have been substituted with pieces of plastic until the method is proven.

Choosing a suitable location to release and track the birds has been another challenge. Auckland has been ruled out because its numerous volcanic cones produce bumpy magnetic fields so Hamilton has been chosen as the preferred 'home' destination given its fairly smooth magnetic field. The release point will be some 100 kilometres away in the volcanic zone between Taupo and Rotorua where Rebecca says the magnetic field anomalies will help test her models. "If they were using the magnetic field we'll predict them to make errors in their navigation because of the anomalies in the magnetic field."

As for the godwits, Rebecca believes that they might use magnetic fields as their map, but they also demonstrate a mix of innate and learned behaviour. For instance, other young birds are known to make their first migration journey without parental guidance. But when researchers took similar species a hundred kilometres east of their starting point they appear to travel south in a pre-programmed direction whereas adults taken east will correct their flight path. "They've learnt something along the way that tells them that they're east of where they want to be, and it's that kind of ability that we want to understand."

Apart from it being a "cool thing" to be able to explain the godwits navigation system, Rebecca says any new findings in her research on animal navigation could be incorporated into current GPS systems as a backup and could potentially help navigation in outer space where there are no satellites. "It's that kind of engineering inspired by biology." However that's very much a long term possibility. "We're not going to be doing that anytime soon because I don't think we're close enough to cracking what they're doing."

In the short term, she believes it's important to simply appreciate the birds for their amazing navigational skills. "Just appreciating that is really important as well." ■

Climate physics

While the current debate about global warming and rising sea levels has focused on the long term threat to island nations like Kiribati, Faculty of Science climate physicist Dr Gilles Bellon is looking to the skies above the Pacific for answers to more immediate issues such as the factors that influence tropical rainfall and trigger potentially devastating consequences.

Unlike more developed nations with sophisticated observation techniques and funding to analyse and predict weather patterns, many Pacific Island nations like Fiji and Samoa lack those resources so little is known about the mechanisms that create intense precipitation and floods. "If we don't understand the mechanisms in the present climate, how are we going to understand them and predict them in the future?" asks Gilles.

With that in mind, new research is being undertaken to gather weather data and model climate variability in order to help island nations become better prepared for adverse weather patterns. Planning and building the appropriate infrastructure is one obvious benefit, and Gilles says it's also a good way to prepare for climate change. "Just getting the policies in place and the training and the knowledge that this type of extreme event is going to come every 10 years or 100 years and be able to prepare for it."

One of the key challenges is to understand what influence the local diurnal cycle of land sea breezes has on precipitation when it interacts with larger scale variables like the Madden-Julian oscillation which stretches thousands of kilometres from the Indian Ocean to the Pacific. What's interesting says Gilles is that a lot of the influence of those larger scale modes over islands is through the diurnal cycle, "so it's a change in the diurnal cycle that will change the precipitation of the area."

"The idea is to try to relate the type of diurnal cycles we get on each island to its geographical characteristics and also the characteristics of the larger air circulation around the island."

One example is the differing impact of El Nino events on opposite coasts of islands. For example, Gilles says those living in Suva on the eastern side of the Fijian Island of Viti Levu experience less perturbed weather than those living on the western side. "That's due to the fact that the diurnal cycle on the eastern coast is completely different and not as much affected by El Nino than the western side."

From an observational perspective, Gilles will draw on satellite data freely available from the NASA Global Precipitation Measurement (GPM) mission which provides worldwide observations on rain and snow every three hours. But while satellite observations are reliable over the ocean, there are validation issues over land where geographical features can influence precipitation levels. As Gilles puts it, "large-scale variability is very robust and tends to be very consistent, but an island in the middle of a large-scale pattern will have behaviours that can be really different because of local influences."

Rain gauges and radar networks can help identify local precipitation events and fill in knowledge gaps, but most Pacific countries lack the sophisticated networks that exist in other countries. As a result, Gilles will also use high resolution cloud-resolving models (CRMs) to create virtual islands with differing geographic features and wind directions to reproduce basic weather mechanisms. Lower resolution models will also be used to conduct climate studies on real islands such as New Caledonia and Fiji.

"The idea would be to see how those models could be used in an operational way. Whether they reproduce the observations and whether we can get some mechanisms in those models as we do in the higher resolution idealised configuration model."

Given that a CRM sometimes involves tens of thousands of lines of code and can eat up all the available computing power, Gilles also uses what he describes as 'toy' models, based on the same equations as the big climate models but simplified, that can be run within a few minutes on a desktop computer so researchers can play with different configurations and parameters. "Toy models are very simple. They're designed to capture one mechanism, so we just put in the processes that are involved and see whether we get that mechanism out of the model."

While he lays no claim to being a weather forecaster, Gilles says his models could ultimately have an impact on forecasting if they succeed in simulating weather. Indeed, he says meteorological services are in a transition at the moment with many moving to next generation higher resolution models which he wants use, and validate, in the regional modelling work.

"Those models can be used for weather forecasts and it's important to understand whether they do a good job simulating weather and whether they can also be used as climate models to try to see what's going on in the future."

Criticising forecasters when they get it wrong may be commonplace, but Gilles says weather is "chaotic and highly non-linear" so you never really see exactly the same weather twice. Which makes modelling all the more difficult given the enormous range of scales – from micron-sized droplets in a cloud, to global circulation that spans thousands of kilometres. "You have all these scales from the smallest to the largest, so it's very complicated science."

The rotation of the earth and heat release by condensation also provide added complexity and can lead to very "explosive phenomena". In addition to the impact of tropical cyclones, water resources are a key issue in the Pacific because of the short hydrological cycle that sees rainfall dissipate rapidly into the ocean. Which makes it all the more important to understand the impact of diurnal cycles and plan for them in terms of infrastructure investment.

Interestingly, there's a strong French connection to the research. As a graduate of the University Pierre and Marie Curie in Paris, and having recently studied climate systems in the Maritime Continent between the Indian and Pacific Oceans, Gilles was able to convince France's Foreign Ministry to co-fund a collaborative project involving New Caledonia's Institute for Research for Development and the University of French Polynesia through the French Pacific Fund. Other partners include Meteo France/New Caledonia, NIWA and the University of the South Pacific in Fiji, and it's hoped the project will lead to an exchange of students and expertise between New Zealand and Fiji which will boost academic interest in climate science and the environment.

As for the El Nino currently gathering strength in the Pacific, Gilles says previous events have been well documented but the next one will be really interesting in terms of precipitation changes. Pacific sea subsurface temperatures are currently up to six degrees warmer than normal which should fuel the El Nino, and Gilles says it might be as strong as the 1998 El Nino and propel 2015 global temperatures to record highs.

However his focus will be on harvesting rainfall data to help prepare Pacific Island nations for what lies ahead. "Its nice to have climate variability and various islands so we have different landscapes and conditions and we can look at the sensitivity of the diurnal cycle to those large scale conditions and geographical characteristics. So for us it's great."■

Alumni news

Dr Rex Mirams visited the School of Biological Sciences in March.

First Botany graduate

Dr Rex Mirams (Botany – BSc (1947), MSc (1949), PhD (1951)) was the first student to graduate with a PhD in Botany from the University of Auckland, or the University of New Zealand as it was known back then. To celebrate Rex's 90th Birthday, he visited the School of Biological Sciences in March. A visit organised by his daughter Sarah Mirams, BSc in Linguistics and Scandinavian Studies (1981), LLB (1993), MEdMgt (2000), as a surprise for her father.

Upon gathering in the MacGregor Museum, Rex shared recollections of his time as a student at the University, including the challenges of research without modern technology, and how he met his wife, fellow alumna, Karen Mirams (Botany – BSc (1953)). Rex was presented with a specially designed birthday gift from Head of School, Professor Gillian Lewis – an illustrated and framed copy of the title page of his PhD thesis and a bottle of Goldie wine.

First recipient of the George Mason Trust

PhD student Jenny Hillman from the University of Auckland's Institute of Marine Science is the first recipient of the George Mason Charitable Trust Award.

The award supports an annual postgraduate research exchange with the University of California, Davis. Jenny will visit UC-Davis from September to November this year and will be based at the UC Davis Stachowicz Marine Community Ecology Lab and the Grosholz Lab, broadening her research into ecosystem processes, mapping and management. She will also spend time at the Bodega Marine Laboratory.

The scholarship to UC Davis was established by the George Mason Trust. George Mason is an alumnus of the University of Auckland, holding a Masters with Honours in Botany, as well as a PhD from the University of California, Davis, in Plant Physiology. This scholarship allows students from both institutions to benefit from his experience.

Opening of Station R

The R programming language, developed by Associate Professor Ross Ihaka and former Lecturer Robert Gentlemen from the Department of Statistics, is the most widely used statistical programming software around the world, and the inspiration behind the naming of a new apartment building in Mt Eden.

Station R is the latest building project for Auckland development firm Ockham Residential, founded by Ben Preston and Mark Todd who are Faculty of Science alumni from the University of Auckland.

Ben and Mark established the Ockham Foundation in 2009 – an education-based charity that supports a number of projects and funds a number of scholarships, including two Ockham Foundation Postgraduate Scholarships in Statistics, to honour the work of Ross and Robert.

Generous donation helps to restore shellfish beds

Thanks to a generous donation from the McCrae family, scientists at the Institute of Marine Science are embarking on an ambitious project to help understand the benefits of shellfish beds and restore them around New Zealand's coasts.

"Human activities on both land and at sea have degraded and destroyed shellfish beds, a vital ecological component of our marine environment that once thrived around New Zealand's coasts." Says Professor Simon Thrush, head of the Institute of Marine Science.

Work has begun alongside Auckland action group 'Revive Our Gulf' and Ngati Whatua to restore 500 square kilometres of lost greenshell mussel beds in the Hauraki Gulf.

Alumni events

November 2015 to December 2015

November 20	Golden Graduates Luncheon*
November 28	Elam School of Fine Arts Reunion*
December 8	Society AGM and Christmas Function*

January 2016 to May 2016

February	Society Summer Shakespeare*
February	Summer Jazz Concert*
February 26	Whangarei Alumni & Friends Reception
March 10	Bright Lights: An audience with distinguished alumni*
March 11	Distinguished alumni awards dinner*
April 7	Vancouver alumni and friends reception
April 11	Seattle alumni and friends reception
April 12	San Francisco alumni and friends reception
April 14	Los Angeles alumni and friends reception

**Auckland based events*

Don't miss out on an invite to network

For more information or to ensure you receive an invitation to an event being held in your area please visit www.alumni.auckland.ac.nz/update to update your details

Getting involved

There are many ways you can contribute to the Faculty of Science, from volunteering as a speaker at our Futures Evening to making a donation to the Science Student Support Fund through the faculty's annual appeal.

The generosity of our alumni and friends help us to ensure that our science students have the opportunity to realise their academic potential. The money that we raise from donations funds groundbreaking research and programmes, undergraduate and postgraduate scholarships, lectureships and professorial chairs, and the development of our facilities. For more information on how you could support the Faculty of Science, please contact:

Dr Nicole Bassett, Faculty of Science Development Manager | Phone: +0064 9 21 246 2801
Email: n.bassett@auckland.ac.nz | www.givingtoauckland.org.nz

ALUMNI PROFILE

Name: Fiona Van Rooyen

Position: Actuarial Analyst

Studied:

BSc(Hons) First Class in Chemistry

Diploma in Teaching (Mathematics)

Masters in Public Health

"I'd always had a passion and talent for maths at high school and was fascinated by how chemistry explains the world around us. My Honours Degree in Chemistry was a perfect way to combine these two areas.

"After working in the chemistry field I wanted a more mathematics based job and trained to become a maths teacher. I enjoyed helping the students understand difficult concepts and the relationships I formed with colleagues but wanted to learn something new so I embarked on my MPH where I again applied my mathematical knowledge in epidemiology and biostatistics.

"My career path has been more of a cobweb than a path. I've applied my qualifications in a number of different roles from research into rechargeable battery technology, working in the pharmaceutical industry, analysing the economic impact of the NZ fishing industry to running a mini clinical trial. The common elements in everything I've done has been solving problems through the use of mathematics.

"Wanting further intellectual challenge I embarked on studying to become an actuary and completed my Associate Actuary qualification with the Actuaries Institute (Australia) 18 months ago.

"I'm an Actuarial Analyst at AMP, one of New Zealand and Australia's leading life insurers and retirement savings providers. An actuary's job is to evaluate (and balance) risk and opportunity. I do this by investigating the business' claims experience, analysing the impacts of customer price changes and helping to inform the Leadership Team and Board on relevant issues for the business.

"I enjoy applying my maths and statistical skills in different situations solving problems in the context of the real world business environment. I also get a lot of satisfaction from working collaboratively with other teams."

Community Links

Children enjoy learning about New Zealand's unique marine environment.

Goat Island Marine Discovery Centre

This year, there was fun to be had for the young, and not so young, at the Goat Island Marine Discovery Centre.

Seaweek celebrations concluded with a lot of sparkle and a very lively lobster at Goat Island Marine Discovery Centre in March.

Face painting, a fishy Dress-Up competition and a Feed the Fish and Invertebrates session, provided a fun-filled family day out for children and their parents and a chance to learn about life under the sea.

Community groups take part in our marine educational programmes.

Face painting at the Goat Island Marine Discovery Centre Seaweek celebration.

The Goat Island Marine Discovery Centre School Holiday programmes provided activities for mini marine scientists to construct each part of the life cycle of a marine species with coloured paper and plasticine to learn about how animal or algae is made. There was also the opportunity to make a paper mache rock pool animal, and for the 10-15 year old age group a chance to dissect a mussel.

Activities for a more senior age group saw community groups such as Probus, take advantage of our marine educational programmes and workshops to learn about New Zealand's unique marine environment.

Unlocking Curious Minds

Three public outreach science projects funded through the new 'Unlocking Curious Minds' fund will be hard to miss for anyone in Auckland over the summer.

United Nations Educational, Scientific and Cultural Organization

INTERNATIONAL YEAR OF LIGHT 2015

Associate Professor Cather Simpson, from the Department of Physics and the School of Chemical Sciences, was awarded $134,464 for the Illuminating New Zealand project which celebrates 2015 as the International Year of Light and Light-based Technologies.

The project includes two gala events featuring demonstrations by leading researchers and including hands-on science experiments for children and their families with talks by top science teachers and communicators. The project is supported by the University of Auckland, the Dodd-Walls Centre for Photonic and Quantum Technologies and New Zealand museums, particularly the Otago Museum in Dunedin.

A project aimed at engaging Māori and Pacific students from South Auckland schools in mathematics receives $19,700 in funding. Associate Professor Caroline Yoon, PhD student John Moala and a team from the Department of Mathematics will work with students from low-decile South Auckland schools to develop mathematical modelling activities of relevance to their communities in the project entitled *COSMIC: Community Owned Stories of Mathematical Innovation and Curiosity.*

Also awarded $20,000 in funding is an 'Interactive Playground' by Dr Frederique Vanholsbeeck and Professional Teaching Fellow Anna Yang of the University of Auckland's Department of Physics. The project is in collaboration with Auckland Live and AUT University and supported by the Dodd-Walls Centre for Photonic and Quantum Technologies. It includes an education programme and public workshops aimed at attracting community groups which traditionally have a low level of science participation.

The Playground will be installed at Auckland's Aotea Square during *Summer in the Square* in December.

Reaching out to schools

This year, the Faculty has run a number of outreach activities for schools.

The Incredible Science Roadshow was held at Devonport Primary School in June, where scientists visited the school for the day and engaged students in a range of activities – including forensic finger printing, safe sun gazing and more. The Virtual Incredible Science website went live in July, where primary and intermediate students from 300 schools across New Zealand received new online activities and science lesson plans to use in their classrooms.

In August, the annual Science Futures evening was held – a free event for Year 12 and 13 students to come to the University of Auckland and hear about the different kinds of science-based careers that they might consider. The L'oreal Girls in Science event in September, bought over 100 girls currently in Year 11-13 who are interested in studying science on campus, to see some of our top science labs and hear from esteemed women scientists, including Professor Margaret Brimble.

Professor Kathy Campbell.

Spaceward Bound

Spaceward Bound New Zealand brings high school teachers together with New Zealand and NASA scientists, to show them how research is done in the fields of astronomy and astrobiology to help create resources for the new earth and space sciences curriculum.

In January, Professor Kathy Campbell from the School of Environment took part in the project – a six day expedition to the Taupo volcanic zone which is a region that has analogous features to planets like Mars. Spaceward Bound is the first project of the New Zealand Astrobiology Institute and is a part of NASA's international programme.

With educational outreach being the primary goal of Spaceward Bound, Kathy is excited to help develop the new science curriculum.

"Spaceward Bound and its partnership with the University, is an integral part toward the growth and understanding of science in New Zealand and the world."

Professor Kathy Campbell, School of Environment.

The Faculty of Science helped to sponsor the field trip, which saw an eclectic mix of 50 teachers, research scientists and senior students conducting sampling out in the field using rovers and drones.

Reality Since Einstein

In celebration of the 100th anniversary of Einstein's general theory of relativity, the Department of Physics organised a live stream of the Reality since Einstein panel discussion being held in New York, as part of the World Science Festival.

Curious minds assembled at the Fisher and Paykel auditorium on a rainy Sunday, to collectively watch the discussion that was also available to download from the World Science Festival website.

The discussion focused on insights from the subjects of cosmology, gravitational waves and black holes; a subject which presented a lot of opportunity for humour from the panel, with Steven Weinberg from the University of Texas in Austin commenting on Einstein's refusal to acknowledge their existence at all, citing them to be 'too weird to exist.'

The panel discussion was followed by a question and answer session by Professor Richard Easther. Such questions as "how will the universe end?" generated nervous laughter from the audience.

The Auckland Lablet

Supported by a 2014 Learning Enhancement Grant, The Auckland Lablet was created by the Department of Physics and is used by physics students and their teachers in laboratory classes.

The Auckland Lablet is a physics learning environment on an Android tablet. It not only captures and analyses data, the fully customizable Lablet environment guides students through activities and experiments. It can also be used by teachers for grading assignments and enables students to give feedback.

"We hope to see the Lablet finding a home in highschools, studio based classrooms and flipped classrooms," says Anna Yang, Professional Teaching Fellow and Project lead from The Auckland Lablet team.

www.science.auckland.ac.nz/lablets

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