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October 2013 | **Faculty of Science Alumni Magazine** Issue 07

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THE UNIVERSITY OF AUCKLAND
FACULTY OF SCIENCE

InSCight

The University of Auckland Faculty of Science alumni magazine 2013

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Contact us!

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

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

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

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A word from the Dean

New Zealand has always had an impressive reputation for innovation, and there's growing awareness that science and innovation are critical to our future economic success.

Professor Grant Guilford, Dean of Science

In recent years the Faculty of Science has developed a comprehensive suite of initiatives to support key sectors of the New Zealand economy, from the dairy industry to biotechnology and high-tech manufacturing. Examples of just some of these initiatives – which are designed to complement our curiosity-driven research programmes – can be found on page 4 of the magazine.

We're also providing more opportunities for students to work directly with industry, for instance through our Joint Graduate Schools, and to develop their entrepreneurial skills. The aim is to produce graduates with industry-relevant experience who will be highly valuable to employers and have the edge in the workplace, as well as to nurture scientists with a flair for creating new business opportunities.

The appointment of Deputy Dean Professor Jim Metson to the newly created role of Chief Science Advisor for the Ministry of Business, Innovation and Employment is further indication of the national focus on science and innovation. Jim, who is also continuing in his role at the University, will provide a much closer link between the ministry and the New Zealand science community.

The research articles in this year's magazine provide some fascinating examples of how our scientists are answering important questions for New Zealand, while also making significant contributions to the international body of knowledge in their fields. They're working on subjects as diverse as how to protect endangered native species to learning how to manage Auckland's air quality and working with local businesses to help get the best from new employees.

You can also read about how our mathematics department is keeping us at the forefront of research and innovation in tertiary education. We're very proud of the quality of teaching in the Faculty. Our researchers' success in their bid for this project, and the 2013 national teaching excellence award to Associate Professor Cather Simpson, are just two examples of this.

Congratulations too, to the many other staff, students and alumni who have won accolades this year, from honours for lifetime achievement like Distinguished Professor Margaret Brimble's Rutherford Medal, Professor James Goodman's Eckert-Mauchly Award, and Dr Jilly Evans' Distinguished Alumni Award, to Dr James Russell's Prime Minister's MacDiarmid Emerging Scientist Prize.

And finally, we're delighted with the progress that has been made in the ongoing redevelopment of the Faculty's research and teaching facilities. The project is all about communication and interaction, and the newly opened science plaza provides a foretaste of what is to come. Completed ahead of the rest of the project, to give our students a comfortable new covered space, it connects the chemistry, mathematics / physics, and computer science buildings, which together will eventually house all of our schools and departments.

There have been many exciting developments this year. We hope you enjoy reading about them.

PROFESSOR GRANT GUILFORD
Dean of Science
The University of Auckland

Leading creativity and innovation in the sciences

A new face for the faculty

Although not yet obvious to passers-by on Symonds Street, the Science Redevelopment Project is well underway, and the faculty's new modern and colourful face is slowly emerging in the newly-built and refurbished spaces.

Wood, concrete, steel and a touch of colour – the new face of the Faculty of Science. Inset - A red footbridge connects buildings 301 and 303 at level 4.

Although not yet obvious to passers-by on Symonds Street, the Science Redevelopment Project is well underway. The Faculty's new modern and colourful face is slowly emerging in newly-built and refurbished spaces.

Started in early 2013, the project took a big step forward in September with the opening of the new Level 4 Bridge, Science Student Plaza and Student Resource Centre in Building 301. This followed refurbishments to Building 303 (on the corner of Wellesley and Princes Streets), completed earlier this year.

The Student Plaza, which connects Buildings 301, 303 and 303s at ground level, creates communication and flow between the formerly disjointed areas. It reflects the redevelopment project's objective of communication and interaction.

Covered by a transparent canopy of inflatable plastic pillows, the Plaza combines the warmth of natural wood with concrete and steel elements. A large planter bench and re-designed computer science timeline invite people to linger. Red mesh on one side of the plaza adds a touch of colour, as do the new lounge seats in the adjoining Student Resource Centre, which also features computer tables, printers and an assignment drop-off and pick-up area.

The Student Plaza is overarched by the new, bright-red Level 4 Bridge, which offers another opportunity for staff and students to cross between buildings.

The new purpose-built Photon Factory and wet lab are housed in the 303 basement.

The colourful 303 basement corridor allows for views towards Albert Park.

Health and safety has driven the design of the new Chemistry Undergarduate Teaching labs.

Lounge seats invite students to spend some time in the new Student Resource Centre, which also features computer tables, printers and an assignment drop-off and pick-up area.

A wooden staircase leads down from the plaza to the recently completed Building 303 basement, which now houses the Photon Factory, a microfabrication wet lab, and a newly established mass spectrometry lab for research in biology and medicine, led by Professor Peter Derrick who joined the Department of Physics this year.

Teaching spaces have also been extended with the opening of purpose-build chemistry undergraduate teaching labs, which join a number of new seminar rooms throughout Building 303 and Tuākana tutoring spaces in the basement.

The redevelopment is well ahead of schedule and will be completed in time for Semester 1, 2016 rather than in 2017 as previously announced. To keep up with progress visit our website: **www.science.auckland.ac.nz/redevelopment**

New postgraduate opportunities for Science graduates

From Semester 1, 2014 the Faculty of Science will add a new programme in Digital Security to its Master of Professional Studies (MProfStuds) range. These one-year programmes are aimed at professionals with an undergraduate degree and workplace experience who aspire to senior positions within their sector by building on their existing industry knowledge. The MProfStuds in Digital Security will provide insight into how to design, plan and manage a secure IT infrastructure and will cover topics like the identification of vulnerabilities within a network, physical security and surveillance, and governance and risk analysis.

Food Science and Nutrition graduates can now take advantage of a new Master of Health Science (MHSc) offered by the Faculty of Medical and Health Sciences. The MHSc in Nutrition and Dietetics provides specialised postgraduate training for graduates who seek registration with the New Zealand Dietitians Board in order to practise as a Dietitian in New Zealand.

For more information about the programmes visit:
www.science.auckland.ac.nz/digital-security
www.fmhs.auckland.ac.nz/mhsc-ntr-diet

Dairy research and innovation boost

The University of Auckland, industry body DairyNZ, farmer cooperative LIC (Livestock Improvement Corporation) and New Zealand's largest Crown Research Institute AgResearch have joined forces to establish a Joint Graduate School in Dairy Research and Innovation.

The school aims to enhance postgraduate education and increase the number of graduates in fields relevant to New Zealand's most valuable export industry. Lead by University of Auckland geneticist Professor Russell Snell and a management committee of staff from the partner institutions, the school will span disciplines that contribute to sustainable productivity on the farm, such as genetics, agricultural technology and environmental science, through to those that add value beyond the farm gate such as food science and business.

An excellent year for Mathematics

Department of Mathematics staff and students have scooped up a wealth of international honours and prizes over the last year, making it one of the most successful in the department's long history.

Emeritus Professor John Butcher was appointed an Officer of the Order of New Zealand in the 2013 Queen's Birthday Honours, for his services to mathematics. John is recognised as a leader in the development of mathematical sciences in New Zealand. His primary area of research is numerical analysis – also known as computational mathematics – which studies how to use computers to solve scientific problems. Amongst other honours, John is the inaugural recipient of the Royal Society of New Zealand's Jones Medal for lifetime achievement in mathematical sciences and winner of Society's Hector Memorial Medal, the New Zealand Mathematical Society Award for Mathematical Research, and the international Van Wijngaarden Award.

Distinguished Professor Marston Conder was selected to join the inaugural group of Fellows of the American Mathematical Society (AMS) in 2012. An invitation to become a Fellow recognises outstanding contributions to the creation, exposition, advancement, communication, and utilisation of mathematics. Marston's expertise is in algebra, in particular the study of symmetry. He specialises in the development and use of combinatorial group theory and computational methods to study the symmetries of discrete structures. The distinction is a further honour for Marston, whose work is internationally renowned. In 2011 alone he was named the first Maclaurin Lecturer by the American and New Zealand Mathematical Societies, was appointed the first Distinguished Professor of Mathematics at the University of Auckland, and received a prestigious James Cook Research Fellowship. In September 2013 Marston also received a Distinguished Alumni award from the University of Waikato.

The president of Finland awarded **Professor Jari Kaipio**, Professor of Applied Mathematics the honour of Knight First Class, of the Order of the White Rose of Finland. Jari received the decoration based on his widespread contribution to society in general, including academic research and its impact on society.

Professor Jari Kaipio was awarded the honour of Knight First Class, of the Order of the White Rose of Finland.

A founding member of the Finnish Centre for Excellence in Inverse Problems Research, Jari's research interests have a wide scope theoretically and with respect to applications. Generally, he is interested in making mathematical and physical models feasible for real world problems. With respect to applications, Jari has worked with biomedical, geophysical, environmental and industrial imaging, as well as other estimation problems, and with inverse problems in particular.

In addition to these international honours, the Department of Mathematics and the Department of Statistics secured the entire range of prizes and awards at the New Zealand Mathematical Society (NZMS) Colloquium, held in December 2012, including:

- **Associate Professors Ben Martin** and **Tom ter Elst** (Mathematics) shared the 2012 NZMS Research Award, recognising Ben's "outstanding and broad contributions to algebra including the application of geometric invariant theory to algebraic groups, the geometry of spherical buildings, and the representation growth of groups" and Tom's "deep and sustained contributions to the analysis and understanding of elliptic operators, and associated evolution processes."

- The NZMS Aitken Prize which honours the best contributed talk by a student at the colloquium, went to mathematics **PhD students Stefanie Hittmeyer** and **Jennifer Creaser**, while mathematics **PhD student Kate O'Byrne** was awarded the prize for best student poster.

- **Dr Mark Holmes** (Statistics) received the NZMS Early Career Award for "rapidly becoming a world expert in the theory of random walks, and in the analysis of high-dimensional models in statistical physics."

Dr Caroline Yoon has recently been awarded a Beeby Fellowship, which is a joint initiative between the New Zealand Council for Educational Research (NZCER) and the New Zealand National Commission for UNESCO. Caroline will be using the Beeby Fellowship to produce five booklets of modelling-based activities for secondary school students and their teachers, which use engaging real world contexts to stimulate mathematical thinking.

Professor Bill Barton and **Dr Judy Paterson** are co-leaders of a two-year, $250,000 project funded by Ako Aotearoa and Teaching and Learning Research Initiative. Read the full story on page 16.

Leigh Marine Laboratory design honoured

The Leigh Marine Laboratory redevelopment, designed by Cheshire Architects, has been awarded a prestigious New Zealand Institute of Architects award. The honour comes shortly after the redevelopment was named a finalist in the Designers Institute Best Awards.

Completed in 2011, the redevelopment was a three-phase project involving the construction of a new bunkhouse for students, an updated research facility, and a Discovery Centre that for the first time opens up the laboratory's work and expertise to the many thousands of people who visit the Goat Island marine reserve every year.

According to the citation from the NZIA, "the architects have designed a research facility ideally suited to its place and purpose. The architecture encourages collegiality and provides marine biologists with an inspiring working and learning environment."

The Leigh Marine Laboratory is a research facility ideally suited to its place and purpose.

School of Psychology's new name

In September 2012, the Department of Psychology was renamed the School of Psychology in recognition of its size and complexity. The change brings Psychology in line with other large, complex, multidisciplinary units within the Faculty, like the Schools of Biological Sciences, Chemical Sciences, and Environment.

The School of Psychology has around 1,000 equivalent full-time students and expertise in a wide range of areas from neuroscience to the causes of psychosis, early childhood development, the social psychology of interpersonal relationships and the evolution of language. In the 2012/2013 QS University Rankings the school was ranked the 32nd psychology department worldwide, making it the top-placed department in the University.

Strengthening Marine Science

The University of Auckland is internationally recognised as a centre for marine science, and has now brought the breadth of its talents and facilities from across the University together in the newly established Institute of Marine Science (IMS).

Combining ocean physics, statistics, fisheries, marine biology, geology, chemistry, aquaculture, environmental science, as well as business and engineering in its multi-disciplinary approach, the IMS aims to work towards improving our understanding of the marine environment.

"Marine science is increasingly important, as we face growing environmental challenges in marine and coastal environments, pressure on fisheries, and reliance on aquaculture," says Dean of Science, Professor Grant Guilford. "The establishment of the Institute of Marine Science reflects the University's comment to this critical field."

The institute has a strong research and postgraduate focus, and supports undergraduate teaching at the University's city campus. It maintains an outstanding field research base at the Leigh Marine Laboratory which acts as the University's 'marine campus', and incorporates the highly successful Joint Graduate School in Coastal and Marine Science established by the University and NIWA in 2011. Staff and students in the IMS also work with a broad range of New Zealand and overseas businesses and research organisations, including NIWA, the Cawthron Institute and the Ministry for Primary Industries.

Professor Simon Thrush who holds a joint appointment between the National Institute of Water and Atmosphere (NIWA) and the School of Environment will take up the position as Head of the Institute in January 2014, taking over from Professor Andrew Jeffs who led the institute as Acting Director during its establishment phase.
www.marine.auckland.ac.nz

Deputy Dean appointed MBIE Chief Science Advisor

In August 2013, **Professor Jim Metson**, Deputy Dean of the Faculty of Science, was appointed Chief Science Advisor for the Ministry of Business, Innovation and Employment (MBIE). In this role, Jim will provide independent specialist advice so that MBIE's science policy and investments are delivering high-quality science for New Zealand. He will also have a wider role in ensuring MBIE's policy and advice is based on scientific evidence and principles, and will work closely with the Prime Minister's Chief Science Advisor and other Crown department science advisors.

Jim is an expert in materials and surface science, with a particular focus on metal oxides and applications in the aluminium industry. He is the current Deputy Dean of Science, Associate Director of the Light Metals Research Centre, and a former Associate Deputy Vice Chancellor (Research) and Head of the School of Chemical Sciences at the University of Auckland.

Dean of Science Professor Grant Guilford congratulated Jim on his appointment. "We in the Faculty of Science are well aware of Jim's strengths in all of the areas stated as being required of the successful candidate, amongst them his outstanding professional scientific credibility, excellent understanding of the science and innovation system, and excellent relationship management and leadership skills. It's wonderful to see these qualities recognised."

Jim's two-year term as Chief Science Advisor is a part-time secondment from the University of Auckland, allowing him to retain ongoing links with the faculty and the wider science community.

Key strategic initiatives

Supporting the New Zealand economy

Science and innovation are critical to New Zealand's economic success, and the Faculty of Science is getting behind key sectors of the economy.

"In recent years we've developed a comprehensive suite of faculty-wide initiatives, which complement activities at the departmental level and individual curiosity-led research programmes," explains Dean of Science, Professor Grant Guilford.

"Many of these are focused on a particular sector of the economy. Such sector-aligned initiatives facilitate collaboration and multi-disciplinary research and teaching, and profile our contribution to national and international communities."

"And it's pleasing to see the close alignment of our faculty initiatives with the National Science Challenges of New Zealand and other countries. Below are just some of the ways in which the faculty is supporting key sectors of the economy.

Primary sector

The University has consolidated its links with the primary sector through the Joint Graduate Schools in Plant and Food Science (created in partnership with Plant & Food Research) and in Dairy Research and Innovation (in partnership with DairyNZ, LIC and AgResearch). By partnering with crown research institutes and industry bodies we can deliver applied science of direct relevance to New Zealand farmers with a strong fundamental science base.

In addition, a new AgriTech Initiative getting under way this year will focus on sustainable innovation in farm systems. In contrast to traditional agricultural universities, our emphasis will be on the intersection between high technology and agriculture, drawing on our scientific expertise in everything from genomics and environmental science to computer science and mechatronics in collaboration with the Faculty of Engineering.

Food and health

Scientists interested in food and health in the broadest sense, from food science to process engineering, nutrition, and business, are drawn together under the banner of the university's Food and Health Programme. Examples of its work include screening for novel bioactive compounds in mushrooms, studying gene-diet interactions and investigating the minerals in milk protein.

The programme is designed to facilitate collaboration between University researchers, and provide local industry and public health authorities with a single point of contact to access a wide range of University expertise.

One of its main goals is to help enhance innovation and growth in the New Zealand food and beverage sector by working directly with companies to tackle applied problems and make fundamental discoveries.

Marine

New Zealand is a maritime nation and the Joint Graduate School in Coastal and Marine Science (created in partnership with NIWA) is building the country's expertise in this critical area. Its research ranges from the fundamental to the applied. Some of its most industry-focused research is in the fields of aquaculture and fisheries, for instance fisheries stock assessment, optimisation of husbandry techniques, and seafood processing and preservation.

Biotechnology

Well-known New Zealand businesses like global dairy cooperative Fonterra and natural health and beauty products company Comvita have co-located aspects of their research and development divisions in the University's purpose-built Institute for Innovation in Biotechnology. The institute supports their activities by providing access to University expertise and facilities, and engaging in collaborative projects. It also provides international consultancy services, and runs networking functions and specialist workshops for the biotechnology sector.

Biopharmaceuticals

There are many innovative biopharmaceutical businesses in New Zealand, and the University has a strong track record in the commercialisation of its health research. The Biopharma Programme links and develops research capabilities across the University. Its purpose is to enable early-stage projects with good therapeutic potential by providing targeted funding. Work it has supported to date ranges from research on new anti-malarial agents to therapeutic antibodies for breast cancer.

In addition the University hosts the Maurice Wilkins Centre for Molecular Biodiscovery, the national Centre of Research Excellence focused on major human diseases including cancer, diabetes and metabolic disease, and infectious disease. The Centre draws together national expertise in discovering new drugs, vaccines and diagnostic tools that proceed to clinical trials.

Manufacturing

The Innovative Manufacturing and Materials Programme is an industry-facing research initiative drawing on University expertise in manufacturing, materials, product and process development, business and commercialisation. It supports the manufacturing industry to solve applied problems, and carries out industry-directed fundamental research that drives innovation. Examples of its work include finding faster ways to apply rumble strips for road safety, to the use of lasers to manufacture on a microscopic scale.

Extractive economy

Sustainable development is critical to our long-term economic future. The Sustainable Extractive Economy Initiative is a new multidisciplinary initiative that will explore marine and land-based resource extraction opportunities, practices and choices. It will examine how best to achieve sustainable economic and community benefit within environmental constraints. The emphasis will be on the social, cultural and environmental requirements for the various extractive industries (including minerals, geothermal energy, and aggregates) to retain a public mandate.

Entrepreneurship

As well as directly supporting New Zealand businesses, sector-focused initiatives like these allow our students to gain invaluable industry experience. They complement the Master of Bioscience Enterprise and Master of Commercialisation and Enterprise qualifications which have been established to train future science-educated entrepreneurs, and student-led entrepreneurship programmes like Chiasma and SPARK.

Staff news

New Heads of Department/School

Professor Robert Amor has again been appointed Head of Department of Computer Science, a position he held from 2006–2010. A University of Auckland alumnus, Robert is an expert in information management and provision. He has spent over 20 years working on the application and development of computer science research in architecture, engineering, and construction, including in the UK developing construction IT initiatives at the Building Research Establishment. He is currently part of the MBIE-led GeoBuild initiative to accelerate the uptake of Building Information Modelling technologies by the construction industry.

Professor Paul Kench has been appointed Head of the School of Environment. Paul holds an MA (Hons) from the University of Auckland and PhD from the University of New South Wales. Paul's principle research interests span coral reef geomorphology, coastal processes, medium-term coastal change, gravel beach processes and the application of coastal science to support coastal management. His international research focuses on understanding environmental processes in coral reef environments that control reef and reef island development and change. His national research examines coastal morphodynamics and processes on gravel beach systems, shore platform processes and medium-scale coastal change.

Professor Eamonn O'Brien is the latest Head of Department of Mathematics. Eamonn holds a BSc (Hons) from the National University of Ireland (Galway) and PhD from the Australian National University. He came to Auckland after research fellowships in Canberra and Aachen. He is a Fellow of the Royal Society of New Zealand and together with Associate Professor Jianbei An and Professor Marston Conder has received continuous Marsden Fund support since 1998. Eamonn's primary interests are algorithmic and computational aspects of algebra; in particular the theoretical development, high-quality implementation, analysis, and application of algorithms for group theory.

Professor Simon Thrush from NIWA and the School of Environment has been appointed Head of the University's new Institute of Marine Science. He will take up the position in early 2014. Simon has spent much of his career at NIWA where he is currently Principal Scientist Coastal Ecosystems. He is a Fellow of the Royal Society of New Zealand and has received numerous honours, including the New Zealand Marine Sciences Life Time Achievement Award. He is an expert in the ecology of marine ecosystems who has conducted research both here and overseas. His present focus is the ecology of marine communities, particularly in estuarine and coastal habitats. He is also interested in ecosystem function, change in ecosystems over time and space, ecosystem disturbance and recovery, and ecological impact assessment.

Professor Kevin Smith from Boston University has been appointed Head of School of Chemical Sciences. He will take up the role in early 2014. Kevin's area of research is experimental materials chemistry and physics. He currently holds three Professorships at Boston University, in Physics, Chemistry and Materials Science, and is a Fellow of the American Physical Society and the American Vacuum Society. His interests are broad and interdisciplinary, including studies of low dimensional organic and inorganic solids, thin film organic semiconductors for use in solar cells, metal nitrides with potential spintronic applications, wide band gap semiconductors, and the surface chemistry of fuel cell cathodes.

New professors

Five associate professors in the Faculty have been promoted to professor:

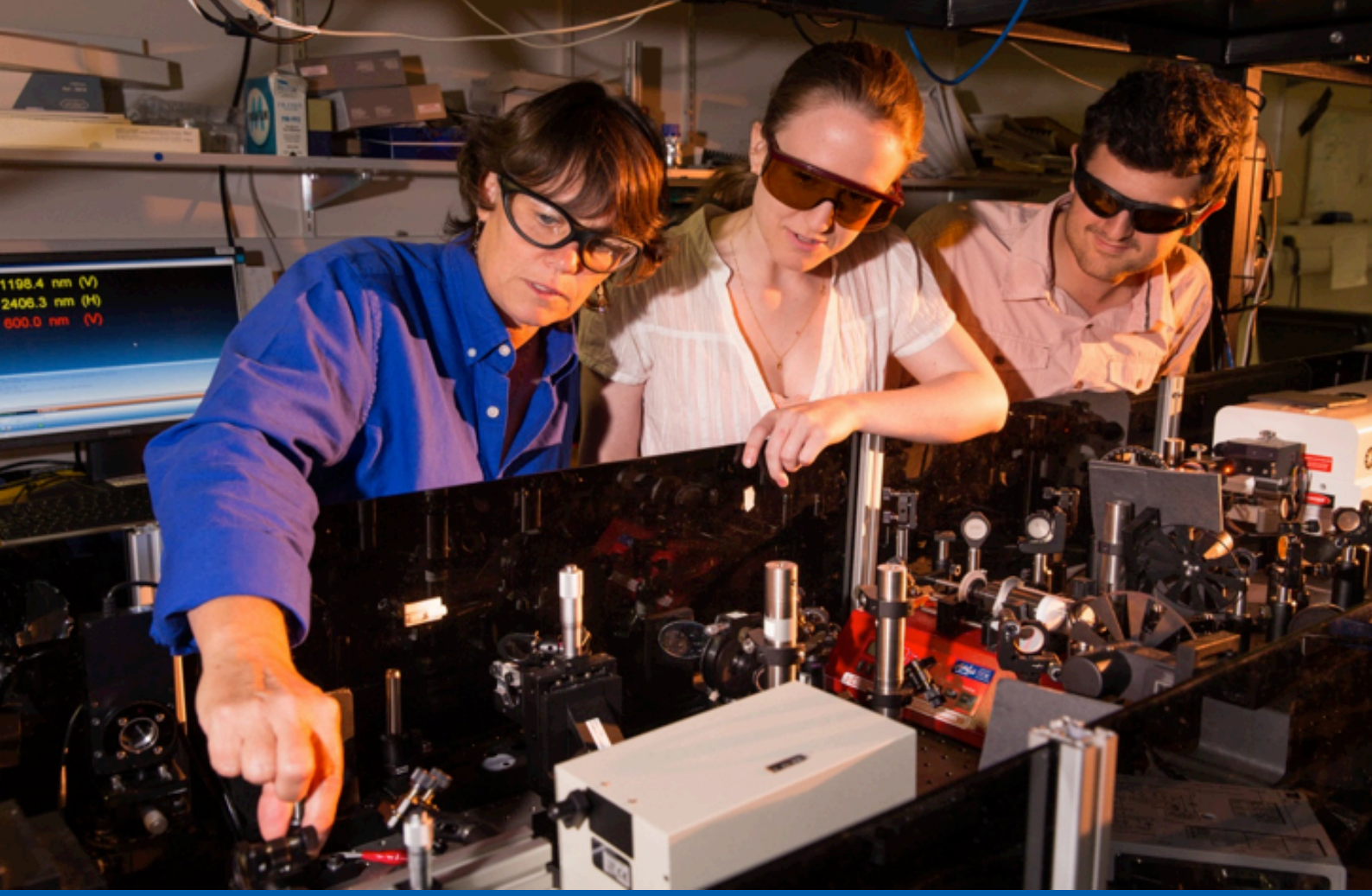
Professor James Curran (Statistics) is a leading researcher in forensic statistics, in particular statistical analysis of trace evidence, forensic genetics and expert systems for evidence evaluation. He consults with forensic agencies and his work has influenced forensic operations internationally. He has developed major commercial software packages that allow people without his level of statistical expertise to evaluate evidence. He also has interests in statistical computing and automation. James earned his BSc and MSc in mathematics and PhD in statistics from the University of Auckland. He is currently a director of the University's Bioinformatics Institute and President of the New Zealand Statistical Association.

Professor Alexei Drummond (Computer Science) is an evolutionary biologist who uses computational science to model complex biological processes to study everything from the spread of HIV to the expansion of languages. Alexei completed his BSc and PhD at the University of Auckland and spent three years at Oxford before returning. He is the developer of the software package BEAST, used internationally to analyse molecular sequences, and wrote the prototype for award-winning software package Geneious. He is founding scientist and Director of Biomatters, a bioinformatics software company. Since returning to New Zealand he has been principal investigator on two Marsden Grants and recently was awarded a Rutherford Fellowship.

Professor Andrew Jeffs (Institute of Marine Science) is an expert in aquaculture and marine biotechnology, two of New Zealand's fastest growing industries, studying a variety of commercially important species. His work ranges from applied projects working with the seafood industry to more esoteric marine ecological issues, and he consults for international companies and government agencies. Andrew has played a major role in the emergence of research on the ecological significance of underwater sound in the marine environment, and he is a leader in the ecology and aquaculture of spiny lobsters. He earned his BSc and MSc in zoology and his PhD in marine biology from the University of Auckland. Before returning as a member of academic staff, he was General Manager for Aquaculture and Marine Biotechnology at NIWA.

Professor Paul Kench (Environment) is a coastal geomorphologist. Read more about him in the new Heads section above.

Professor André Nies' (Computer Science) primary interest is in computation and its connections to mathematics. Much of his work is in computability, a subfield of mathematical logic. Over the last decade he has focused on the interaction between computability and randomness. More recently he has been examining the connection between randomness and effective analysis. André studied at Universität Heidelberg, and has held academic positions at the Universities of Wisconsin at Madison, Cornell University, and the University of Chicago. He came to Auckland in 2002, and has since won two Marsden grants. His research is internationally renowned and he is one of only three New Zealand-based mathematicians to be invited to speak at the International Congress of Mathematicians.



Associate Professor Cather Simpson has won a 2013 National Tertiary Teaching Excellence Award.

An excellent teacher

Having received the University of Auckland 2012 Sustained Excellence in Teaching Award, Associate Professor Cather Simpson went on to win a 2013 National Tertiary Teaching Excellence Award, presented at Parliament in July. "A key focus of the awards is to identify and reward teaching practices that are student-focused and promote effective learning," says Vice-Chancellor Stuart McCutcheon of the national awards.

Cather, who holds co-appointments in the School of Chemical Sciences and Department of Physics, uses lasers to study ultra-fast chemical and physical reactions of molecules to light. She teaches in Chemistry, Physics and English.

Her teaching philosophy is to help students learn what they need to succeed in their own lives, and she fosters independence and self-motivation. Active and co-operative learning are central to her classes. She provides opportunities for undergraduate students to participate in research projects; is actively involved in pedagogical research; and is involved in a number of community outreach activities.

Cather is Director of the Photon Factory – a laser facility providing micro and nano-fabrication facilities to researchers and industry. She is also an Associate Director of the Dan Walls Centre for Pure and Applied Optics which undertakes research across a broad range of optics-related topics.

Top scientists receive sought-after awards

Prestigious Rutherford Discovery Fellowships have been awarded to Dr Jessie Jacobson from the School of Biological Sciences and Centre for Brain Research and Dr Nicholas Rattenbury who joins the Department of Physics in October.

The Government-funded fellowships support our most talented early- to mid-career researchers to develop their research careers in New Zealand. Valued at $160,000 per year over five years, they support the scientists' salaries and research programmes.

Jessie is using her fellowship for a project called "Autism Spectrum Disorder: hunting for therapeutic targets using genetics" Her work will contribute to international efforts to genetically define autism spectrum disorder, the ultimate aim of which is to develop therapeutics and health and educational support systems for patients and their families.

Nicholas' research, titled "Toward Earth-II: completing the census of extra-solar planets in the galaxy", focuses on a technique called gravitational microlensing used to detect Earth-sized planets that orbit stars other than our Sun. New telescopes will soon generate more data than can be analysed by experts. Nichols aims to develop an automated analysis system to cope with these large volumes of data, and ensure New Zealand retains its leading position in extra-solar planet discovery.

Peter Lai Professional Staff Development Awards

The 2012 Professional Staff Award for Excellence in Contribution to Research and Creative work was awarded to Peter Lai, Administrator for the Maurice Wilkins Centre for Molecular Biodiscovery. Peter played a key role in building new scientific research links between China, the Centre, the University and UniServices. His efforts greatly assisted in the development of several major new scientific collaborations and in building new links in the biotechnology and commercial spaces.

University celebrates Prime Minister's Science Prizes

Dr James Russell, from the School of Biological Sciences and Department of Statistics, received the 2012 Prime Minister's MacDiarmid Emerging Scientist Prize for his internationally-recognised conservation work.

James says his love of the outdoors, and willingness to do computer analysis in the laboratory, have delivered results. He uses a combination of ecology, statistics and genetics to study how rats and other mammalian pests invade islands. His work is helping to protect endangered native species and maintain New Zealand's reputation as a world leader in island conservation. With more than 80 per cent of the world's island groups infested with rats, his expertise is also sought internationally.

James' doctoral research examined how far rats could travel to predator-free islands and how they then spread, leading to new pest management techniques. James is now focusing on the interactions between climate change, native and invasive species and ecosystem linkages, to help conserve native species.

He is involved with the Department of Conservation and philanthropist Gareth Morgan on the "Million Dollar Mouse" eradication project on the Antipodes Islands.

Prestigious honour for medical researcher

Professor Garth Cooper has been elected a Fellow of the Academy of Medical Sciences in the United Kingdom. Founded in 1998, the Academy is the independent body representing the diversity of medical science. Fellowship is based on exceptional contributions in the form of original discovery or of sustained contributions to scholarship.

Garth is Professor of Biochemistry and Clinical Biochemistry at the School of Biological Sciences and a principal investigator of the Maurice Wilkins Centre, New Zealand's Centre of Research Excellence targeting human disease. He also holds position at the University of Manchester and University of Oxford. His research has led to major advances in the understanding of disease mechanisms in diabetes and related syndromes, and to the discovery of several new experimental therapies for these conditions.

Another top honour for Distinguished Professor Margaret Brimble

Distinguished Professor Margaret Brimble ended another hugely successful year in 2012 by receiving three awards from the Royal Society of New Zealand, including its highest honour the Rutherford Medal. As Chair of Organic and Medicinal Chemistry in the School of Chemical Sciences, and a principal investigator in the Maurice Wilkins Centre, Margaret's work has proven globally significant both academically and commercially.

The Rutherford Medal was awarded for her world leading contributions to the synthesis of bioactive natural products and novel peptides with wide applications across the life sciences industry. Winning the medal rated as one of Margaret's career highlights, and one "about national pride", she said. "I have a sense of trying to do things in New Zealand, for New Zealand, with New Zealanders, and the Rutherford Medal really epitomises that. I am personally very pleased that New Zealand has now recognised me, not for being a woman in science - but for my science."

She received the MacDiarmid Medal, which recognises outstanding scientific research that could have widespread human benefit. It was awarded for her work pioneering the design, synthesis and clinical development of a small molecule drug candidate that shows promise for reducing the impact of traumatic brain injury. She also won the Hector Medal for excellence in chemical sciences.

Computer science pioneer honoured

Professor James Goodman from the Department of Computer Science was awarded the international 2013 Eckert-Mauchly Award in honour of his pioneering work in the architecture of shared-memory multiprocessors.

Presented annually by the Association for Computing Machinery (ACM) and the IEEE Computer Society, it is considered the computer architecture community's most prestigious award. Computer architecture – the interface between hardware and software – is one of the oldest and largest fields within computer science and electrical engineering.

James is an expert in high-performance memory systems, particularly for parallel systems which use multiple processors in combination to solve a problem. His innovations led to the development of hybrid approaches to high-performance shared-memory computer systems that can achieve nearly the performance of complex, finely tuned software from software written by naive programmers, including a concept known as "lock elision".

The ACM is the world's largest educational and scientific computing society, and the IEEE Computer Society is the world's leading computing membership organization. James was made a Fellow of the IEEE in 2007 and of the ACM in 2010.

Excellence in Equity

The School of Environment Tuākana Programme Team, and Dr Sina Greenwood from the Department of Mathematics, were recognised for Sustained Achievement in the University's 2012 Excellence in Equity Awards.

The School of Environment Tuākana programme were recognised in the University's 2012 Excellence in Equity Awards.

The Tuākana Programme aims to provide a friendly, supportive and inspiring learning environment for Māori and Pacific students, foster networking and encourage students to strive to achieve their full potential. It began in 2003 and is continually refined to meet students' evolving needs. This year marks its tenth anniversary, and the team is pleased that it has become accepted as an integral part of day-to-day life within the School. Team member Bes Lironi-Irvine has been involved since 2007, when as a Masters student she was encouraged to apply for scholarships, and she now gives back in her role as Programme Co-Ordinator.

Over the past 10 years Dr Greenwood has devoted a huge amount of her time to improving the educational experience of Māori and Pacific students, initiating and leading major programmes and showing enormous initiative, creativity and thought in all her work. This includes establishing a mentoring programme; the Aidis Scholarship, which is involved with low decile schools and aims to encourage Māori and Pacific school leavers to study Mathematics at Summer School and the CoMPaSs orientation programme run by Mathematics, Statistics, Computer Science and Physics.

Student News

Scholarship winner Elizabeth Lamb

Science women receive Mahe Drysdale Sports Support Fund

It takes a lot of dedication to compete in sport at an elite level and at the same time keep on top of academic study commitments. The University's Mahé Drysdale Sports Support Fund recognises this struggle and six students studying towards a Bachelor of Science are among the first recipients. The fund provides financial assistance to high performance athletes and teams who are competing and achieving at the highest levels of their sport and goes toward travel, accommodation and other costs associated with attending international events.

Elizabeth Lamb is a New Zealand senior women's high jump champion and represented New Zealand at the World University Games in July. "It was absolutely fantastic having money contributed from the University as it was a self-funded trip and it was a real tangible help" says Elizabeth. "It was great to feel connected and supported by my university as I went into the competition." Elizabeth, who is studying towards a conjoint degree in Commerce and Science, majoring in Finance and Biological Sciences, placed 10th out of 25 competitors.

Both **Renee Beveridge** and **Laura Robertson** represented New Zealand at the World Junior Orienteering Championships, which took place in the Czech Republic in July. Renee is studying towards a double major in geology and anthropological science while Laura is studying towards a double major in geology and geography. Having participated in four types of event – long distance, middle distance, sprint and relay, Renee says it's "a really worthwhile and amazing experience". She also expressed her appreciation for the funding which went a long way and helped to cover costs such as uniforms and tracksuits.

Biological Sciences student, **Rose Crooks**, has won selection as the heavyweight sweep for the New Zealand U21 Rowing Eights competing against Australia for the Trans-Tasman Cup.

Sport and Exercise student **Ashlee Caskie** represented New Zealand at the U19 Junior World Rowing Championships which took place in Lithuania in August. Having come back from a three month layoff as a result of a back injury, it was a notable personal achievement for Ashlee to qualify for the U19 Quad.

2016 Rio de Janeiro Olympic Games hopeful **Kayla Imrie** (another Biological Sciences major) represented New Zealand at the U23 World Championships in Canada, taking part in the K1 200m and the K2 500m canoe sprints. Kayla placed sixth in her semi of the U23 K1 200m, just two seconds behind the winner.

Dr Cosmin Laslau awarded Vice-Chancellor's Prize

Dr Cosmin Laslau from the School of Chemical Sciences was one of the five doctoral students awarded the Vice-Chancellor's Prize for Best Doctoral Thesis in 2012.

Faculties nominated 19 theses from the 312 successfully examined for 2012, and these were judged on their demonstrable significance, the originality and excellence of the research, exceptional academic and intellectual achievement, and timely completion.

"The extremely high standard of all nominations received this year is a credit to the many highly-talented graduate students at this University and shows the University's consistent commitment to encouraging students in innovative and meaningful research," says Associate Professor Caroline Daley, Dean of Graduate Studies.

Under main supervision of Associate Professor Jadranka Travas-Sejdic and co-supervisor Professor David Williams, Cosmin's thesis was entitled "Novel Fabrication and Characterisation Methods for Conducting Polymer Nanostructures and Microstructures." This thesis investigates the development of novel experimental techniques for the fabrication and characterisation of two prominent conducting polymers; poly (3, 4-ethylenedioxythiophene) (PEDOT) and polyaniline (PANI). This research aims to support development of devices based on conducting polymers for the benefit of humanity. Examples include artificial muscles and lab-on-a-chip diagnostics, which require the ability to reliably fabricate and understand these materials at micro and nano scales.

The Science women's team won the basketball tournament in Semester One, 2013.

Interfaculty sports

A fantastic win by the Women's Basketball team in Semester One has got the Science Spartans off to an excellent start in 2013.

The Interfaculty Sports Tournament began in 2010 and has grown in popularity each year with increasing numbers of students participating and more sports added to the tournament . The teams compete in Basketball, Cricket, Netball, Badminton, Futsal, Rugby, Touch Rugby, Ultimate Frisbee and Volleyball. Faculties are awarded points which equate to the rankings within each tournament.

The tournament provides students with a great opportunity to show Faculty unity and support and simply have fun cheering on the Spartans who came came third overall in the 2012 Interfaculty Sports Tournament thanks to the successes of the mixed volleyball and rugby teams.

Our Fulbright science scholar

Business and science are twin passions for 2013 Fulbright scholarship winner **Graeme Fielder**.

Graeme was awarded the 2013 Fulbright-Platinum Triangle Award in Business. The award is for an emerging New Zealand business leader to complete a Master of Business Administration (MBA) degree at a United States institution and gain professional work experience in the United States and New Zealand. One award, valued at up to US$75,000 plus a paid internship, is offered each year.

During his time at the University of Auckland, Graeme studied at the Liggins Institute as a member of the Breast Cancer Research team led by Professor Peter Lobie. He completed a Bachelor of Technology in Biotechnology with first class honours. Following the completion of his PhD in biomedical science at Auckland, he left for Stanford University, California in August to study for a two-year MBA.

Graeme's research investigated the role of growth factors in endocrine dependent cancers, particularly breast cancer. Graeme hopes that the MBA from Stanford University will give him the skills and knowledge to pursue his passion – working in both business and science. He intends to return to New Zealand after the programme and use his experience in the two areas to pursue his own bioscience venture here.

"Early in my academic training I was attracted to the fusion of business and science, taking science developed at the lab bench to a market application, whether it's a new drug, or a new diagnostic test," he says. "And it's great to have been at Auckland University where they foster this cross faculty development of students with such an interest."

While studying for his undergraduate and postgraduate degrees, he also played a pivotal role in developing the University's entrepreneurial environment through the Spark and Chiasma organisations (both as a participant and organiser) and helping postgraduate students and staff to get involved in entrepreneurship.

More recently he has been working as a business development manager with Plant & Food Research in Mt Albert in food innovation, bringing new foods and food ingredients to market for the New Zealand food industry.

He enjoyed working in the space of both science innovation and business management and looks forward to doing this with his own venture in future.

FoSSA

Science students now have their own dedicated association. FoSSA – the Faculty of Science Students Association, was developed late last year by Faculty class representatives. Co-President Kate Boersen says the association aims to better the academic and social life of its members and also hopes to encourage broader scientific learning.

Judging by the demand for membership, FoSSA is off to a flying start. During Orientation week the committee succeeded in signing up over 800 new members at its stand, as well as winning the best stall.

Typical events run by the association include academic mixers with science students and staff, science themed pub quizzes, a science white-water rafting trip and joint steins with Medicine, Nursing and Pharmacy associations as well as with students from Tāmaki Innovation Campus.

FoSSA signed up over 800 new members during Orientation week.

Membership continues to rise and Kate says there is ''a real sense of satisfaction on the part of the executive and committee to see FoSSA so well received by the student body". The numbers participating in the event and activities prove what a welcome addition this association is to student life. The Faculty of Science has been pleased to support FoSSA in 2013 and looks forward to collaborating more in years to come.

New chemistry transforms vaccine manufacture

Honours student **Tom Wright** has created a new kind of chemistry to dramatically simplify the manufacture of drugs targeting the immune system, and the technology has been patented.

The research to arm peptides (segments of protein) to better target the immune system came out of a Health Research Council project grant to Maurice Wilkins Centre principal investigator Professor Margaret Brimble (Tom's supervisor, Chemical Sciences) and Director Professor Rod Dunbar (Biological Sciences).

Tom's discovery will be used to develop new peptide-based immunotherapies such as cancer vaccines, and there's a bonus. The new chemistry can be used in a manufacturing facility at the University of Auckland that was recently licensed by MedSafe to produce medicines for clinical trial.

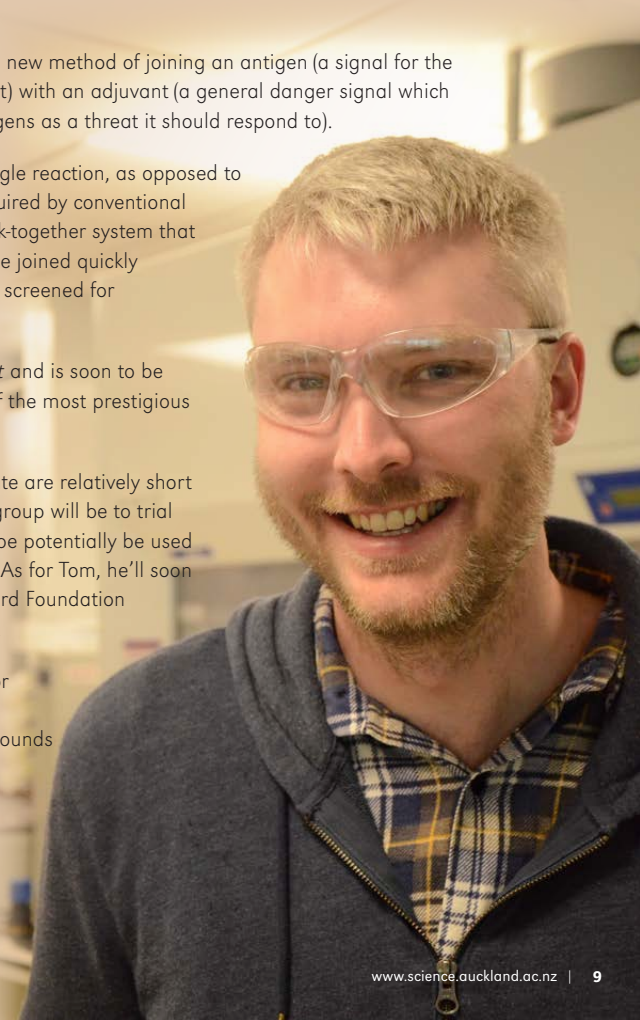
Tom has developed a simple and elegant new method of joining an antigen (a signal for the immune system to attack a specific target) with an adjuvant (a general danger signal which helps the immune system recognise antigens as a threat it should respond to).

It allows the two to be connected in a single reaction, as opposed to the more complex multi-step process required by conventional chemistry. Essentially, it is a modular click-together system that allows many antigens and adjuvants to be joined quickly and easily, with the resulting compounds screened for useful biological activity.

The work has already appeared in *Synlett* and is soon to be published in *Angewandte Chemie*, one of the most prestigious journals in the field.

The antigens that have been tested to date are relatively short peptides. The next step for the research group will be to trial the method on longer peptides that can be potentially be used to treat a wide range of cancer patients. As for Tom, he'll soon be off to Oxford after winning a Rutherford Foundation scholarship for his doctoral studies there.

Working with Dr Anna Brooks in Professor Dunbar's laboratory has also led to the creation of a new means of testing compounds like these using human blood samples. Because blood contains the mix of immune cells and chemicals found in the body it provides an immediate indication of the human immune response to these molecules.



Clearing the air in Auckland

As New Zealand's largest city looks to its future, managing its air quality is becoming increasingly important.

Air pollution in Auckland exceeds acceptable limits a few times a year, says air quality expert Dr Jenny Salmond from the School of Environment. The air is relatively clean compared with many international centres, "but the danger is that if you don't look far enough ahead, we could end up going down the same road as other big cities."

"With a growing population, and an increasing number of cars coming into the city, we can expect air pollution to get worse. If you deal with it now then you can stop air pollutant concentrations exceeding the limit 20 or 100 times a year."

"I think if they're honest, there are very few people who would be able to say they haven't seen the brown haze on the Auckland skyline, or stood on Symonds Street and smelled the bus fumes. Once you're seeing or smelling something as tangible as that, it's very hard to ignore."

Jenny says a lot of good work is being done to address air quality in Auckland, but more will be needed as the city grows. Traffic is one of the largest contributors to poor air quality, so managing congestion is particularly important. For instance, phasing lights so that cars aren't idling then accelerating too much, as that's when a lot of pollution occurs, and moving cyclists out of the main traffic flow to breathe cleaner air.

Much of Jenny's research focuses on how pollutants move around the city, and the implications of that movement for people's exposure.

Traditionally, this has been done by measuring pollutants at a small number of single points to come up with an overall estimate for the city, then working out how much pollution people encounter on average. "The problem is that you've got so much variability in the city," she points out.

Emissions in urban areas are highly complex, with variable levels from traffic, domestic and industrial sources across the city. They occur in a complicated space, with wind flows travelling around buildings and other obstacles in ways that can't easily be predicted. And people move through the space in a variety of different ways. "So the assumption that what you're measuring at one point is what people are actually exposed to is not very reliable."

Jenny explains there are two ways of overcoming this. One is to increase the number of measurement sites, to create a finer resolution picture. That's work she has been doing with Professor David Williams, a chemical sensor expert from the School of Chemical Sciences. The other is measuring how much pollution people actually encounter, through personal monitoring which is work she has undertaken with colleagues around the country.

Jenny, David and their team are focusing on ozone at present. New Zealanders may be familiar with ozone in the upper atmosphere where it forms a protective layer. But at ground level ozone is a major pollutant, created from nitrogen dioxide which in large part is derived from vehicle fumes.

Last summer they installed fifty of David's new ozone sensors around Vancouver's Lower Fraser Valley. Levels were measured once per minute for three months to build up an extremely detailed picture. The region's high ozone levels provided the ideal testing ground for this new approach.

"With colleagues at the University of British Columbia we were able to look in much more detail at how pollution was moving up the valley and see when hotspots occurred. That helps us to understand more about what's controlling ozone concentrations," Jenny says. "We also saw that pollution can hide – it can get into little tributary valleys, and sit there before coming out again. It's a complicated scenario."

Based on the success of the research, the scientists are initiating a similar study of ozone and nitrogen dioxide across the Auckland region. "We've never been able to look at ground level ozone in Auckland in detail before, because we've only had one or two monitoring sites. What we're proposing now is to have forty." Jenny explains. The work is sponsored by the University of Auckland and Air Quality Ltd, a new company that has spun out of David's research, with expertise in sensor arrays.

As well as providing valuable information about the city, the study allows some fundamental questions to be examined for the first time. That's because, unlike other major cities, Auckland has no "trans-boundary" pollution spilling over from neighbouring centres.

"You can't control trans-boundary pollution, but you can control local emissions," says Jenny. "So if you've just got local pollution then you can work out how effective changing the level of emissions really is. These are important questions internationally, but it hasn't been possible to address them before."

In the second strand of her air pollution work, Jenny examines how much pollution people actually encounter, for instance by having volunteers wear personal monitors, or measuring pollutants in their blood or breath.

"One of the things we're pretty sure about is that you get most of your exposure during the commute. So if you nail down what's happening there, then maybe there are some things you can do in the design of a city to affect how much pollution people are exposed to."

For example Jenny has been working with Kim Dirks from the School of Population Health, Professor Simon Kingham from Canterbury University and Ian Longley from NIWA. "The study led by Simon was the first one to look at personal exposure in New Zealand," she says. It examined carbon monoxide gas and the ultrafine particles which can get into the blood stream and cause damage.

They compared Auckland and Christchurch, finding that commuters in the two cities are exposed to less carbon monoxide but similar levels of ultrafine particles as people in some of the world's biggest cities. That's despite having lower traffic volumes and congestion.

Car drivers were consistently exposed to more pollutants than people in buses, trains or cycling. But people cycling on the road were worse off than those on a dedicated cycle way.

Jenny has also worked with Kim Dirks for some years doing similar work with a wide range of commuters around Auckland. And they've just begun research, with NIWA, AUT University, and Auckland Council, to study air quality and the soundscape in the Queen Street valley, with the goal of making it a better environment for pedestrians and shoppers.

Jenny's background is in both urban climate and applied climatology, and alongside her air pollution research she works on more fundamental atmospheric science. "I don't think you can understand how pollution works if you don't understand the atmosphere. So bringing a lot of ideas from pure atmospheric science into pollution science is really important," she says.

In fact, air pollution research draws on a wide range of disciplines, and Jenny says that she could never do the work on her own – her colleagues and students are critical to the research. She's also grateful for the interest and support of Auckland Council.

How coffee can benefit your job

Socialising with your colleagues is one of the best ways to succeed in a new job. That's the advice of organisational psychologist Dr Helena Cooper Thomas, based on her research into proactive strategies which help newcomers adjust.

Her advice applies not only to recent graduates but also to experienced workers starting a new role, and managers who want to help their staff settle in well. And the benefits aren't restricted to people who are naturally more gregarious.

"If you're introverted, you have to try and find ways you feel comfortable being proactive. You don't have to be the life and soul of the party – you just have to turn up, talk to people, and find out what they do," she suggests.

Helena points out that how we behave is determined not only by our personality and experiences, but also by our environment. "If you know the environment is really going to support behaviours that you're slightly uncomfortable with, but which you know will be useful, then you're more likely to do them."

That's where good leadership comes in: "If you're managing a new employee, it's really about giving them the opportunity to meet others in a convivial atmosphere, and enjoy and learn from them." Meeting colleagues helps new employees to ask questions of them later and learn more quickly, but it also helps them to feel a part of the organisation by getting to know the people and values.

Looking at how new employees adjust in the workplace is one of Helena's main areas of research. Of particular interest is how proactive people are, and how that influences their adjustment.

"When new employees are more proactive they tend to learn more quickly, achieve better job satisfaction and work engagement, want to stay with their organisation, and show better performance," she says. "So proactive behaviour is good in general, and it's also good for new employees."

In order to examine exactly what the benefits are, it made sense to study people who tend to rely on their own resources to figure out how to fulfil their role, often with little organisational support. So, in research just submitted for publication, Helena and her colleagues looked at the behaviour of temporary agency workers.

"We found that overall, general socialising was the strongest predictor of better adjustment in terms of attitudes, wellbeing, engagement, and learning," she says. The best kinds of proactive behaviours new employees could engage in were things like going for coffee or lunch, meeting up with colleagues, and joining in with work events.

"I know it can be really difficult for new employees when they start a new role, and feel they haven't got time because they need to demonstrate their job performance, but it's worth doing."

Other work by Helena's group, based on a more general sample of office employees, has confirmed that the more proactive people are when they're new, the greater their sense of "fit" with the organisation and the greater their engagement with work.

So how can workplaces create an environment which makes this possible? Helena says one way is to be very explicit during a new employee's induction about the company culture and expectations of behaviour. But also, companies should value and recognise colleagues who make the effort to help new staff adjust and feel appreciated, for instance by making it a formal part of their work appraisal.

She refers to research by other groups showing that there's a critical early period for employees to develop a sense of belonging. "When you're leaving an organisation you start to detach from it emotionally, and start to see its flaws and acknowledge them more. Whereas when you start at a new organisation you go through a kind of honeymoon period."

"And I always think it's a missed opportunity. When you're at that stage where employees are excited – asking what they can do, what their role is, and how they can make a difference – you really need to capitalise on that."

One of the studies presented at an international conference she attended last year demonstrates the difference a well thought-out induction process can make.

In Indian call centres, some new employees had a run of the mill induction with their manager, whereas others met first with a supervisor. The supervisor asked them to consider what was unique about what they could contribute, and would make a difference to the organisation.

The manager then followed up with a conversation on the same topic. "It was such a simple intervention, but they found much better performance and retention from those employees – it's amazing," Helena says.

She cites another example of a New Zealand office which changed its induction process to focus entirely on relationships. Managers were required to help new employees meet people around the organisation, and several months later a very senior member of staff would call the employee to ask what their manager and colleagues had done for them.

"It worked really well," she reports. "The fact that a really senior manager called up to ask how your day was going, and whether everyone had done their jobs to help you, was really prioritising it."

Helena's background is as a practicing organisational psychologist. "I was a consultant originally, so I didn't expect to have an academic career," she explains. She worked independently, and for an agency in the United Kingdom, before taking up teaching positions and then joining the University.

"I really loved consulting – solving the problems of organisations and trying to help them. I also really enjoy the puzzles of academia."

Her research now is done almost exclusively with New Zealand companies, for instance a big name soft drink company, appliance manufacturer, law firm, advertising agency, and branches of local and national government.

All of her projects involve postgraduate students, and she says that a real pleasure of her job is having excellent students who can see how exciting organisational psychology is. In general her approach is to have them negotiate directly with companies to offer research, and her group is always looking for organisations willing to take part in their projects and reap the benefits.

"We always write reports for the organisations we work with, to make the research as useful as possible," she says. "Even in my postgraduate courses, students either do proposals for real clients or do white papers so that the research can get out there."

Iconic species – from bats to weta

Studies of our native bats are providing new insights into their behaviour, and have even revealed an unexpected link between weta and whales.

Associate Professor Stuart Parsons and members of his research team in the School of Biological Sciences study aspects of the behaviour, ecology and biodiversity of New Zealand's two bat species – from how they mate to how they're affected by wind farms.

But it was how they use sonar to navigate and hunt on the wing that first captured Stuart's interest as a PhD student; and questions about an iconic prey species – the weta – that led to one of his team's recent discoveries.

"Around the world there's an evolutionary arms race between bats that echolocate and insects that can hear," Stuart explains. Predation by bats provides a selective pressure for prey like crickets and moths to evolve to hear the sonar and escape. Bats counter this by shifting their sonar frequency outside of the prey's hearing range.

"*Mystacina* – the lesser short-tailed bat – eats weta, and they have coevolved here for 24 million years, which made me wonder whether weta could hear bats," Stuart says. So PhD student Kate Lomas tested the ability of weta ears to detect sonar, and how the insects respond to bat calls.

Surprisingly though, the insects couldn't hear the calls. "Their hearing is actually tuned to the sound that other weta make," Stuart says. "But, by coincidence perhaps, they can also hear bats running through leaf litter on the ground."

The short-tailed bat is highly terrestrial, to the point of having small pockets on its sides to protect its wings while on the ground. It's one of the features – along with an unusually varied diet, mutualistic relationship with the wood rose (*Dactylanthus*), and specialised tongue for extracting nectar – that makes the species unique in the bat world.

"It may be that while the bats are a threat to weta, sonar doesn't equate to that threat because bats take them on the ground." Stuart explains. So while their original question had been answered, Kate had become curious about how weta actually hear.

She looked at the anatomy and structure of the ear, using 3D imaging in combination with traditional cross-sections, and discovered a tiny new organ. "Other researchers had seen bits of tissue floating around in their sections but thought they'd just damaged something," Stuart explains.

Named the olivarius (after Kate's son Ollie) the organ is a collection of fat cells sitting in the fluid of the ear. With biochemist Associate Professor David Greenwood, Kate found that the fluid was a new class of lipid, not the insect equivalent of blood as had been assumed.

"The interesting thing is that the only other animal which has a lipid associated with its hearing is whales," Stuart says. Toothed whales have lipid in their jaw and melon (a fatty mass in the forehead). It serves to concentrate sound beams and, because the lipid is the same density as water, efficiently transmits sound between the liquids.

"Kate's theory is that, because of the density of the lipid it helps take sound from the ear membrane, without loss of signal, to another compartment, which houses the insect equivalent of hair cells in our ear and senses the sound."

Weta belong to a sub-branch of the large Orthoptera family, which includes crickets and katydids, and scientists around the world are now looking at whether those species also use lipids to hear.

Back to the bats, however, the research team is studying both of our native species: the lesser short-tailed and the New Zealand long-tailed bat. The animals vary from nationally vulnerable to endangered around the country. They live in old-growth native forest, and are susceptible to predators like cats, and competitors like wasps which occupy potential roosting holes.

Long-tailed bats can also live in other habitats, though, and "we're starting to understand how they interact with the city and with people," says Stuart, questions that had not been addressed before.

Working on the urban fringe of Hamilton, PhD student Andrea Dekrout found that the bats roost in introduced trees like oak, a species that wouldn't have been thought important for their survival. And they make use of remnant native forest in gullies which feed into the Waikato River, an important source of insects and vegetation.

The bats can also live in pine forest, and doctoral candidate Kerry Borkin was the first person to track a single group of bats before and after logging. She found that, in the absence of roosting holes, the bats live in small groups under the bark on the pines, moving often because their homes are so ephemeral.

Logging opens up forest edges, where bats like to forage, but it also removes the oldest trees, which are their preferred roosts. So maintaining a mosaic of trees of different ages can help the bats to survive. This has led to recommendations about how to protect bats during planting and logging, which have been welcomed by forestry operators here and overseas.

The lesser short-tailed bat, in contrast, is restricted to native forest, and much of the team's work on the species is done at Pureora Forest Park west of Lake Taupo.

The only fully-temperate bat which pollinates plants, it feeds on a wide range of forest flowers. In other ecosystems plants often flower at different times to avoid competition for pollinators and, by tracking the bats' movements, MSc student Georgia Cummings showed for the first time that a similar system appears to operate in the New Zealand forest.

She also looked specifically at *Dactylanthus*, the world's only bat-pollinated ground-dwelling plant, and found that while the bats feed on its flowers and can carry the pollen several kilometres, its flowering does not drive changes in the bats' movement patterns. So the endangered plant may rely more on the bats than they do on the food source.

Questions about how the bats mate are also being addressed by PhD student Cory Toth. He is using everything from tagging to genetic analysis and video recording, to painstakingly piece together evidence that the bats may be "lek" breeders. Only one bat species is known to lek – a system in which males gather in dedicated areas to advertise to females. The system tends to be seen in species with highly mobile females, and Cory's theory is that it's more common amongst bats than has been appreciated.

Stuart is also excited about a new project, by PhD student Zenon Czenze, investigating whether there are north-to-south variations in how subspecies sleep and hibernate and how differences in their diet might play into this.

While Stuart's initial interest was in how bats use sonar, his group's work now spans a wide range of questions about their biology and ecology. It is providing important information for the protection of these iconic species, and complements work by the Department of Conservation, the only other research group in New Zealand studying bats.

Holy Grail of educational research

"Linking student learning to what you do when you deliver or teach a course – that's the Holy Grail of educational research," says Professor Bill Barton, an education expert in the Department of Mathematics.

"There are so many variables, that to make that link is very, very difficult, but that's what we've set ourselves to do. We have no expectation that we can do it completely – it's an impossible task – but we hope to be able to make progress."

Bill and fellow mathematics education expert Dr Judy Paterson are co-leaders of a two-year, quarter of a million dollar project, funded by Ako Aotearoa and TLRI (Teaching and Learning Research Initiative), to investigate learning and innovative practices in the tertiary environment. They are working with colleagues across the University including in the Faculty of Education.

They're examining how undergraduate students learn in the mathematical sciences, including mathematics, statistics and engineering science. And they're engaging with colleagues in psychology, law, English, and dance, to understand how some of their findings may be generalised to other subjects.

The study will first look at the learning outcomes expected of mathematics students, far beyond the knowledge and skills that can be tested in an exam.

For instance, it will be asking whether students have a sound grasp of mathematical processes such as making hypotheses or creating examples; habits of mind like persistence in the face of difficulty, or recognising that there's more than one correct answer; affective outcomes such as whether a course increases their confidence; and general graduate outcomes like communication skills and critical thinking.

Having established all the potential outcomes, and worked out how to observe them, the next step will be to examine the spectrum of outcomes produced by different methods of course delivery. "It's thinking about what we really want people to learn, and what sorts of course structures make this more likely to happen." Judy explains.

The three methods to be examined are quite different from the run of the mill. They involve students being encouraged to access the Internet during lectures and tests; or having only one lecture per week; or working in teams to discuss and tackle problems.

The eventual goal is to enable educators, or students, to choose the course structures that provide the outcomes they want.

"We're not looking at teaching style," Judy clarifies. "It's about the mode of delivery of an entire course. And it's about observing outcomes in an entire class not individuals".

"For example you might observe a tutorial group and see the manner in which they deal with problems: Do they persist? Do they argue? What do they do when it doesn't work? You'll get a sense of the behaviours they've taken on board," she says.

"Within the mathematical sciences very little has been done that is equivalent at tertiary level," Bill explains. "There have been many studies where an individual lecturer says 'I'm going to try this and see what happens', which is useful, but only when you amalgamate lots of similar studies. No one's tried to identify the wider set of outcomes and do that at a course level."

It's no wonder international colleagues, such as at Oxford and Berkeley and leading educational research units at the University of East Anglia and Loughborough University, are keeping a close eye on the study.

And six months in, it is already yielding interesting results. The team has spoken with lecturers about what they'd like to see in their students, and they'll go on to interview students, past graduates and employers.

"One result, which confirms previous work we've done, is that lecturers are much less concerned about specific content than you might imagine," says Bill. They're more focused on mathematical processes. "If you ask what they think every BSc major in mathematics should know, they'll say that, so long as students know some things in depth, it's much more important that they know how to behave when they're faced with a problem."

Another, perhaps surprising result, is that when asked what attitudes lecturers want their students to bring to class, not one has said they want them to like mathematics.

"The basic message is: 'By the time you're at university I expect that students will either like it, or like it sufficiently to take it, so I'm not worried about that. There are much more important attitudes – I want them to be interested, or to respect mathematics'," Bill explains.

"Whether they like it as an emotive response is irrelevant," and that's quite different from what the research shows at secondary school level. "They did say they didn't want students to be afraid of mathematics, though," Judy adds.

Two of the course delivery methods that will be trialled in the study reflect Bill and Judy's particular interests.

The "low lecture" initiative comes from ideas Bill spoke about at his inaugural professorial lecture. "Lecturing has been around for hundreds of years," he says. "But based on what we now know from educational research, it's clear that lecturing is not the ideal way for imparting information. It's good for some things, but in mathematics it's not an ideal environment for imparting information or teaching a skill. Those things happen much better in an environment where students are active."

So students will receive one lecture to outline the week's work, and then be directed to online material and texts, to learn under their own steam. They will also have a new form of tutorial, working together with a lecturer on an open-ended problem. The format is much more like a postgraduate level course.

Judy, on the other hand, has a particular interest in "team based learning". It's an approach already used here and overseas, including in mathematics. Students must do preparatory reading for each two-week module and then, in teams which remain the same for the duration of the course, work together to discuss the material and tackle joint tasks.

"It's all about shifting responsibility to the students for preparation, and prioritising communication and contribution. And there's a really powerful networking aspect, with everyone having equal responsibility. What happens is that the students increasingly behave like mathematicians," Judy says.

Finally, the "intensive technology" initiative is based on an idea which has been debated in mathematics education for a long time – the use of technology within a course. Students will be asked to go online during their lectures to access additional resources, and may also be allowed to do so during assessments.

The initiatives will be run in existing courses next year, and Bill and Judy are very grateful to their lecturing colleagues for putting them into practice. They say they've only been able to do the research because of the long-standing presence of the mathematics education unit within their department, and the very fruitful history of collaboration between mathematics educators and lecturers that has resulted.

Alumni News

Dr Jillian Evens received a 2013 Distinguished Alumni Award from the University.

University honours renowned scientist and innovator

Faculty of Science alumna Dr Jillian (Jilly) Evans, who has led drug development programmes in Canada and the United States, received a 2013 Distinguished Alumni Award for her contributions to the field. The annual prizes honour University of Auckland alumni who have made outstanding contributions to their professions, to their communities and to the nation.

Jilly completed a BSc and then a MSc with first class honours in cell biology at the University of Auckland, followed by a PhD at the University of British Columbia, Canada.

Her career in the pharmaceutical industry began at Merck Frosst Canada where she was involved in the development of the asthma drug Singulair. She and two colleagues founded San Diego-based drug development company Amira Pharmaceuticals in 2005, and - more recently - PharmAria Therapeutics where they are developing small molecule drugs to treat cancer and fibrotic diseases.

Jilly is a member of the Advisory Board of the Maurice Wilkins Centre for Molecular Biodiscovery and a champion for causes including the promotion of women in science-based careers, and helping New Zealand to find a good working model for commercialising biotechnology research. She has won numerous awards and prizes during her outstanding career, including an honorary fellowship of the Royal Society of New Zealand in 2002 and the KEA World Class New Zealander Award in 2010.

Talking Science

In October 2012 and April 2013, the Faculty of Science hosted the second and third talk in its Talking Science "Origins" series - a guided tour from the birth of the universe to the origins of life and beyond.

Following on from the first talk on the origins of the universe, Associate Professor Kathy Campbell, an expert on the interactions of ancient organisms with their environments, explored the origins of life on Earth while Biologist Dr Greg Holwell discussed current ideas about the origin of the sexes in the animal kingdom.

Our third talk by speakers from the School of Psychology introduced the audience to the latest research on the origins of cognition, language, and religion. Professor Russell Gray presented his research on the remarkable tool-manufacturing skills of New Caledonian crows to illustrate incremental accounts of the origin of sophisticated intelligence. Professor Michael Corballis talked about the origins of language, with a focus on the idea that language evolved from manual gestures, and Dr Quentin Atkinson offered evolutionary explanations for the ubiquity of religion.

If you missed these inspiring talks, watch the recordings of our latest Talking Science speakers at www.science.auckland.ac.nz/talking-science

Save the date: Our next Talking Science event will be held early in December 2013 and will be Part 1 of the Sustainable Extractive Economy Series.

Tell us your story

We are always keen to know what our Science graduates are up to. If you would like to share a career story or something personal from your time at the Faculty of Science, we would love to hear from you. Everyone has an interesting story to tell. Tell us yours and inspire future Science students and graduates.

If you are interested in being profiled online or in print, please get in touch:
www.science.auckland.ac.nz/tell-us-your-story

Getting involved

If you would like to support the University there are many different ways to contribute, from volunteering as a speaker for our Futures Evening to donating to the Science Student Support fund through the faculty's annual appeal. All money raised will go towards the Leading the Way campaign which funds groundbreaking research and programmes, undergraduate and postgraduate scholarships, lectureships and professorial chairs or infrastructure and development.

For more information please contact:

Bernadette Murphy, Faculty of Science Development Manager
Phone: 09 923 6973
Email: Bernadette.murphy@auckland.ac.nz
www.givingtoauckland.org.nz.

Alumni events

Upcoming alumni events for your diary include:

- **Hamilton Alumni and Friends Reception: Wednesday 23 October**
- **Golden Graduates Luncheon: Wednesday 30 October**

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

Alumni profile

Name: **Yogini Idnani**

Position: **Software Developer**
Datacom Systems Ltd

Class of: **2011 BSc, Bioinformatics**

I love applying my mind logically. In computer science you can learn the basics and create anything you want with logic, and that's what attracted me to IT.

When I was about to start university I chose bioinformatics because it involved biology, which I loved, and a little bit of IT as well. But in computer science 101 we had an assignment making a game and I just loved how I could create something using code – something I could see. That's what got me interested in computer science and my whole path changed at that point.

My job involves a lot of development, creating things, making websites and applications, and I have both national and international clients. It's exciting to work with the latest technology, and every day is different. It's unlikely that I'll be working on the same project for a long period, and there's no scope for being bored. You're pretty much learning your whole life.

IT is a huge field and there are a lot of different career paths. I joined Datacom as part of a graduate intake, and they work hard to give you exposure to different fields and push you in your areas of interest. They also offer a lot of opportunities to build your interests outside of your day job, for instance with competitions using the latest technology, or a leadership camp I've recently gone on.

While I don't work in bioinformatics, my qualification gave me a lot of skills that I can apply in the workplace. Most of the computer science papers at university are taught using Java, and that is the main technical component I use in my job.

But the most important thing I learned was to adapt to change and be willing to learn new things. I developed that attitude at university by doing a wide range of papers, and it's something my employers really appreciate. I also enjoyed the opportunities I had as a student, for instance taking part in a national programming competition.

Students at Parnell District School learning about the properties of slime with presenter, Johnson Raela.

Community links

Virtual Incredible Science

Virtual Incredible Science continues to evolve, this year with the addition of the Incredible Science Roadshow. Schools and departments from the Faculty of Science travelled to Parnell District School on Tuesday 11 June and set up displays in the school hall, classrooms and even on the school field. During the day every student in the school had the opportunity to learn about the science behind each of the interactive displays, including the ever-popular "Coke volcano", slime and extracting DNA from a cauliflower. Some lucky children were even able to take a ride on a hovercraft! The staff and students that represented the Faculty had a wonderful time, as did the teachers and students at Parnell District School.

Virtual Incredible Science continued in 2013, once again with participation from schools around New Zealand. Four competitions were held with fantastic entries received for all: Design and Build an Android App; Most Enthusiastic Science Teacher; Budding Scientist; and Host the Incredible Science Roadshow in 2014.

Due to the popularity of Incredible Science and Virtual Incredible Science over the years, the Faculty of Science is considering various options for expanding the event in 2014, with a new focus on community groups in and around Auckland. More information will be available on the Incredible Science website as plans develop.

To find out who won each of the competitions, to watch the videos filmed at the Incredible Science Roadshow, or to keep up to date with future plans, visit **www.incrediblescience.co.nz**.

Science Futures evening

2013 saw a new format for the Science Futures evening, in which Year 12 and 13 high school students are invited to the University to learn about the exciting, inspiring, and sometimes surprising careers that begin with a Bachelor of Science or Bachelor of Technology.

In the past, Futures was reserved for female students, to encourage young women enrolling in subjects like physics, computer science, mathematics and statistics. With enrolment numbers more balanced in all of these subjects in 2012, it was time to open the event to girls and boys interested in a career in science.

Science Futures attendees benefited from a stronger representation from current students. The second keynote speaker, Sebastian Liu, spoke on behalf of the student-lead organisation Chiasma and gave an inspiring insight into the life of a passionate and ambitious student. The role-model speakers that participated on the panel sessions represented academia and industry, and were all well-received.

The change in format was successful and will remain in 2014 and beyond. For more information about the Science Futures Evening, visit **www.science.auckland.ac.nz/uoa/futures-evening**.

Zoom in on marine life at the Goat Island Marine Discovery Centre

With summer fast approaching, the Goat Island Marine Discovery Centre is gearing up for a busy season. Currently open from 10am-4pm on weekends only, the Centre will extend to open 7-days a week from Boxing Day to March 31, 2014.

There are a number of new displays and activities at the Centre that will delight visitors of all ages. A new interactive MicroEye microscope, kindly donated by alumnus Peter Fehl, allows you to get up close and personal with fascinating marine life. Rebecca Goffin, Discovery Centre Manager, says "Being able to see the moving tube feet of kina under the microscope helps people understand that while they may not look it, creatures found on the rocky shore are very much living, moving animals."

The Centre has two new multimedia displays for visitors to enjoy. The Fish ID video will be popular with those wanting an introduction to snorkelling in the Goat Island Marine Reserve. Viewers will leave equipped to identify some of the many different species to be encountered while snorkelling in the reserve. If delving deeper into current marine science research is of interest, the highs and lows of life as a marine researcher are visible to all in the Discovery Centre. Raw video footage, taken in the field on real research projects (including whale tagging, microchipping snapper, and more) is available on the Student Wall and provides a rare insight into the trials and tribulations of research.

In addition to extending the exhibits and developing new activities, the Centre hosted a school holiday programme for the first time in July 2013. The 'Rocky Shore Explorer' holiday programme proved popular with families and subsequently ran again early in October. Participants learnt about the live marine animals in the Centre's Touch Gently Tank, and how to use the Microeye microscope, before leaving with a guide to help identify marine life at their local rocky shore. "The experience was amazing. Both the kids and I thoroughly enjoyed it and learnt so much. We look forward to coming back in the summer to identify the marine life we explored in the holiday programme", said one parent who participated in the Rocky Shore Explorer programme.

For more information about the Goat Island Marine Discovery Centre, visit **www.goatislandmarine.co.nz.**

MAADI Cup

The University of Auckland once again sponsored and attended the Aon MAADI Cup Regatta at Lake Karapiro, in March 2013. The MAADI Cup is New Zealand's largest and most colourful regatta, with 2031 pupils participating, representing 120 schools from around New Zealand.

The Department of Sport and Exercise Science represented the Faculty of Science at the regatta, this year running a Vertical Jump competition that was hotly contested by student rowers, coaches, and even current Olympic champion rower Mahé Drysdale.

CensusAtSchool

CensusAtSchool NZ was once again hosted by the Department of Statistics, in association with Statistics New Zealand and the Ministry of Education. Thousands of students aged between 10 and 18 (Year 5 to Year 13) participated in the biennial project.

The 32-question survey, available in English and Māori, aims to raise students' interest in statistics and provide a fascinating picture of what they are thinking, feeling and doing. The project is part of an international effort to boost statistical capability among young people, and is carried out in Australia, the United Kingdom, Canada, the US, Japan and South Africa.

For more information on CensusAtSchool, visit **www.censusatschool.org.nz.**

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