

# InSCiight

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Issue 08



Forensic Statistics

Internet hang up

Green Chemistry could tackle 'big' problems

Brain fatigue

**Feature writer:**

Owen Poland (OP Media Ltd)

**News writers:**

Kate Pitcher, Judith Poland

**Editorial team:**

Sobia Mughal, Rebekah Holmes,  
Linda Thompson

**Design:**

Timberlake Studio Ltd

**Faculty of Science**

Email: fos-marketing@auckland.ac.nz  
www.science.auckland.ac.nz/inscight

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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.

Contact: fos-marketing@auckland.ac.nz

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# A word from the Dean



Professor John Hosking, Dean of Science

Having recently returned from my previous role in Australia to take up the role of Dean of Science, I'm regularly asked what it's like being back in Auckland and how I'm finding the role. My stock, but truthful, answers are that Auckland is a great city to live in and that I go home smiling at night because there is always something worth celebrating in a Faculty as diverse and productive as the Faculty of Science.

Whether it is one of the outstanding run of successes we have had this year in competitive grant rounds, a major scientific result on the back of that funding, a major commercialisation outcome such as success in a major drug trial or a company spinout translating research we have undertaken to societal impact, a teaching excellence award recognising the depth of teaching quality and innovation we have within the faculty, a professional staff member going above and beyond their job description, a conversation with a young staff member who is clearly going places, or presenting an award to an outstanding student achiever, there is always something to take pleasure in.

Working within the Faculty over an extended period, the quality and importance of what we do tends to become buried in the face of day-to-day business. As a returning alumnus, I have been given a fresh perspective on the Faculty and the University and have come to deeply appreciate the impact we have on the nation via the students we educate, the research we undertake and the role we play in shaping national agendas.

We are, as is often stated, chronically underfunded by comparison with other leading universities around the world, particularly the Australian universities where I have had my more recent recent experience. Nevertheless we do amazing things within those funding constraints as is evidenced by the reports in this magazine. The current investment in building infrastructure is a case in point, with a major refurbishment of many of the Faculty's buildings well underway, including the construction of the new Science Centre building (featured on p.1) and the new Newmarket Campus, housing mainly Engineering researchers, but also some of our larger research groups. These developments, in spite of our funding constraints, will afford us the quality of space needed to support the high quality research and teaching outcomes we aspire to.

So I do encourage you to read about your Faculty and to embrace its achievements because, as alumni, they are your achievements too. Do take the time to stay in contact with your alma mater, viewing it, as I have done, with a fresh perspective, and do let us know of your own achievements, so we can celebrate them as well.

**PROFESSOR JOHN HOSKING**  
Dean of Science  
The University of Auckland



*Health and safety has driven the design of the new chemistry laboratories.*

# Around the Faculty

## Chemistry Lab receives prestigious award

The Faculty of Science's renovated Chemistry laboratories have won an international design award.

Designed by specialist laboratory architects Lab-works Architecture, in association with Architectus, BECA and the University project team, the undergraduate teaching laboratories won the Refurbished Laboratory category at the S-Labs award ceremony held in September at Kings College London.

Deputy Dean of Science Professor Jim Metson and Lab-works Director Ken Collins received the award on behalf of the project team.

"It was a very adventurous project when we took it on," says Professor Jim Metson "we had to really anticipate what chemistry teaching would look like for a long time. And it was quite a challenge to fit that teaching environment into a pre-existing building."

To learn more about the renovated labs, visit [www.science.auckland.ac.nz/chemistrylabs](http://www.science.auckland.ac.nz/chemistrylabs)



*The new Chemistry labs are housed in the 303 building.*



*The Science Centre is on target to open in 2016.*

## Science Centre building update

The construction works on the Science Centre are progressing well.

The structural steelwork that forms the frame of the building has been erected to the floor of Level 4 and two of seven phases of the steelwork installation have been completed.

Concrete floors have been poured on Levels 1, 2 and 4. During the next few months the steelwork and pouring of the concrete floors will continue.

The façade and external cladding elements are being manufactured off site and will be installed early 2015.

The internal construction works to the lower levels of the building will commence prior to the Christmas holidays and continue through to the completion of the project.

Senior Project Manager Grant Johnstone is happy with the progress of the building works. Everything is progressing really well, it will be an exciting next period as the structure continues to be built up to Level 11," says Grant.

## New postgraduate study options

### MProfStuds Digital Security

The demand for digital security specialists is soaring in New Zealand and worldwide with IT systems increasingly exposed to major risks of disruption and compromise.

Graduates of the MProfStuds in Digital Security will have a unique combination of skills in digital safety design, planning and management.

They can use their foundational knowledge to rapidly gain the practical skills and expertise of a competent digital security professional. Career opportunities are found in companies that rely heavily on information systems, such as financial services, governmental services, retail, healthcare and even primary producers like Fonterra.

[www.science.auckland.ac.nz/digital-security](http://www.science.auckland.ac.nz/digital-security)

### MSc in Clinical Exercise Physiology

To meet the growing need for health professionals required worldwide, the University of Auckland's Department of Sport and Exercise Science has developed a new programme in Clinical Exercise Physiology (CEP).

The programme is aimed at science and health science graduates interested in working in the fields of health promotion and rehabilitation. It is an attractive course of study for exercise scientists and health care practitioners (eg, physiotherapists, nurses, physicians) who meet entry requirements and are seeking to advance their academic and practical knowledge of exercise prescription for specific populations.

This programme addresses growing worldwide recognition of physical activity and exercise as important promoters of community health and international efforts to reduce the incidence and impact of diabetes, obesity, cardiovascular, musculoskeletal, neoplastic, neurological and pulmonary diseases.

[www.ses.auckland.ac.nz/postgraduate-study](http://www.ses.auckland.ac.nz/postgraduate-study)

## Professor John Hosking appointed Dean of Science

Professor Hosking will be known to many in the Faculty and the wider University. A BSc and PhD graduate of this University, he has had a distinguished career as an academic in Computer Science. He was the recipient of a National Tertiary Teaching Excellence Award in 2008 and President of the Ako Aotearoa Academy of Tertiary Teaching Excellence from 2010 to 2011. He was elected a Fellow of the Royal Society of New Zealand in 2010.

John has held a number of senior positions in the University of Auckland including Head of the Department of Computer Science and Director of the Centre for Software Innovation. Since 2012 he has been the Dean and Director of the College of Engineering and Computer Science at the Australian National University.

John began his Dean of Science duties on the 9 June after Associate Professor Greg Anson's interim appointment as Acting Dean concluded.

## Data takes centre stage

Over 17,000 people have signed up to the University of Auckland's first ever Massive Open Online Course (MOOC) entitled Data to insight: A first course in data analysis. The popularity of the MOOC is due to the demand generated by an international explosion in the collection of all kinds of data, coupled with the desire to gain maximum advantage from that data.



Lead Educator for Data to Insight, Professor Chris Wild (Statistics) says, "This is certainly the biggest, most enthusiastic, and most diverse class I've ever taught!" Participants come from all over the world ranging from people who want to upskill at all career stages (including many from highly technical and even creative careers), to postgraduate research students, retired people, and even the occasional high school student.

Development of the MOOC is led by Professor Wild, an acknowledged world leader in statistics education, in a team effort with Professional Teaching Fellow Tracey Meek (Statistics), the learning-design team at the Centre for Learning and Research in Higher Education (CLear), and the University's Media Productions Unit.

Data to Insight is enabled by the home-grown data-visualisation software iNZight and is being offered through FutureLearn, a company delivering "free online courses from leading UK and international universities" which is owned by the UK's Open University. The University of Auckland is a partner university of FutureLearn, one of the first from outside the UK.

The course officially closes on 30 November. All course materials and the ability to interact with other late-starting learners will remain available to registered learners for several more months. It is a free, 8-week, 3 hours-per-week course conducted entirely online. The course pioneers new ways of giving students more extensive skills in data analysis and data visualisation more quickly using an entirely novel visualisation-based approach and purpose-built software.

[www.moocs.ac.nz](http://www.moocs.ac.nz)

## CoRE funding round success

In May 2014 the Tertiary Education Commission announced the results of the funding round for Centres of Research Excellence (CoREs).

The Royal Society of New Zealand ran the selection process and made recommendations to the TEC Board that saw The Maurice Wilkins Centre and Te Pūnaha Matatini become recipients of CoRE.

The Maurice Wilkins Centre, an existing CoRE, will target major diseases affecting New Zealanders by discovering new therapies and diagnostics for human disease. While Te Pūnaha Matatini's research programme brings together New Zealand's leading researchers in physics, economics, mathematics, biology, computer science, operations management, statistics, and social science to study complex systems and networks in the biosphere, economy and the marketplace.

## Support for LGBTI staff and students

New to the Faculty of Science, the Rainbow Science Network meets regularly to provide contact and support for lesbian, gay, bisexual, transgender and intersex (LGBTI) staff and students.

As part of the University of Auckland's commitment toward equity for an inclusive culture that respects and values the contribution that diversity makes to life on campus, the Rainbow Science Network's aim is to plan fun and interesting activities designed to raise visibility and awareness of diversity in the Faculty.

**Rainbow**  
SCIENCE NETWORK

[www.science.auckland.ac.nz/rainbow-science](http://www.science.auckland.ac.nz/rainbow-science)

## Biological Sciences 21st celebrations

The School of Biological Sciences celebrated its 21st birthday earlier this year. The reception was held in the marquee on the Old Government House lawn and was hosted by Associate Professor Greg Anson, Acting Dean of Science, and Professor Gillian Lewis, Head of the School of Biological Sciences. The occasion acknowledged the generous support that the School has been shown over the years and was a celebration of the school's contribution to society and its vast and varied collaborations. Guest speakers were Professor Rod Dunbar (Director of the Maurice Wilkins Centre for Molecular Biodiscovery) and Dr Rochelle Constantine (Senior Lecturer from the School of Biological Sciences). A jazz trio played while drinks, canapés and a large 21st birthday cake were enjoyed by all.



Guests celebrate Biological Sciences' 21st birthday in the University Marquee.

## Kalman Visiting Fellowship

Dr Tim Burness, Senior Lecturer at the University of Bristol, is the recipient of the inaugural "Kalman Visiting Fellowship".

Dr Burness, whose research area is group and representation theory, completed his PhD in Mathematics from Imperial College in 2005. He has held research appointments at St John's College, Oxford and the Einstein Institute at the Hebrew University, Jerusalem. A lecturer at the University of Southampton from 2008-2013, he has been published in world-leading international journals and collaborates with leading research institutions world-wide.

The Fellowship, which is funded by the Kalman Foundation and generously supports a visit by a 'rising star' in mathematical sciences, "attracted 22 quality applications from around the world" says Head of Department Professor Eamonn O'Brien. "We look forward to his visit in mid 2015."

## 50th anniversary of rat eradication

"We have a history of endangering our native species," says Dr James Russell, jointly appointed to the School of Biological Sciences and the Department of Statistics. "We just have to get better at making the species that we don't want, extinct; rats for example."

Dr James Russell is positive about the future of rat eradication in New Zealand following the 50<sup>th</sup> Anniversary of Rat Eradications Symposium held at the University of Auckland in September.

It has been 50 years since the confirmation of successful eradication of Norway rats from Maria Island, a process that was helped by a £5 pound grant from the Wildlife Service. Much has changed since 1964, and with the use of helicopters in 1990 to deliver bait aerially "117 of 345 islands that surround New Zealand are now rodent free" says Dr Russell. "Keeping them that way is an ongoing commitment to scientific research and education around biosecurity."

The full day symposium saw 15 speakers deliver 25 minute talks about their experiences of trial and error and eventual elimination of rats from our coastal islands.

Rat eradication pioneers such as Brian Bell and Rowley Taylor spoke about the early days of rodent control when the view was widely held that complete extermination of rats was impossible.

Due to rats' ability to swim, Dr Russell says, "it's like a war zone, you have to move the front and defend it."

For this reason, once rats were eradicated for the final time from the Noises Island in the Hauraki Gulf, it was necessary to eradicate from Rakino, Rangitoto and Motutapu Islands to ensure all three remained pest free.

"Rats are very smart, they learn quickly so that's why eradications need to be done quickly, the rats change and adapt," says Dr Russell.

The symposium celebrated how far the process of rat eradication has come, but it also showed how much further there is to go, says Dr Russell. "With the right people rodent eradication is a simple process, but what happens afterwards is crucial, as biosecurity is paramount to sustain the good work that we do."

## An influx of interesting visitors

The Faculty hosted a number of interesting visitors in 2014, including an official "World Class New Zealander".

At the end of his eight month sabbatical with the Department of Mathematics, **Professor Ben Green** (University of Oxford), delivered a public lecture titled "Patterns of Primes". Professor Green incorporated the human side of mathematics into the lecture with stories of mathematicians such as Euclid of Alexandria, a Greek mathematician who proved every number decomposed into prime factors.

**Professor Peter Cameron** (University of St Andrews) visited the University on research

visit in September as a Hood Fellow. Professor Cameron is a mathematician who works in group theory, combinatorics, coding theory and model theory. During his visit he collaborated with Associate Professor Dimitri Leemans (Mathematics) on his research about regular polytopes.

**Professor Rosemary Bailey** (University of St Andrews) gave a public lecture in September, entitled "Designing experiments to improve the lot of humanity". Professor Bailey, a Hood Fellow, gave examples of experiments in several areas. One of those was the TeGenero clinical trial for a novel type of drug to treat a type of leukaemia, which

went badly wrong; Professor Bailey was invited to examine what went wrong, and to make recommendations for the design, approval and conduct of First-in-Human clinical trials.

Ex-pat Kiwi, winner of one of the 2014 'World Class New Zealand' awards, and a Hood Fellow, **Dr Catherine Mohr** gave two public lectures on campus in October. Read more about her visit on p.21.

To keep up-to-date with upcoming public lectures, visit [www.science.auckland.ac.nz/events](http://www.science.auckland.ac.nz/events).

# Key strategic initiatives

## Literacy and ethics in the Faculty

Computing disasters, such as the 1996 Ariane 5 rocket explosion and the 1998 NASA Mars Climate Orbiter taking three years to get to Mars only to disintegrate into the atmosphere once it got there, are being used as examples for the importance of literacy and ethics in the field of science.

"Students begin their studies in Computer Science and they want to learn how to programme computers, not write about programming computers," says Dr Andrew Luxton-Reilly from the Department of Computer Science. However, "Giving students the opportunity to write and discuss best practice as part of their course is an important part of developing academically and ethically."

Because Computer Science students are primed to concentrate on the computational side of things at university, Andrew makes sure class discussions and written tasks are embedded in a context that the students can relate to, in order to give real purpose to the exercise.

For example, an online debate about whether whistleblower Edward Snowden acted ethically, required students to comment on an online notice board by writing three sentences that got them engaged not only with the topical issue, but with each other. "We found that students participated more than the minimum requirement of the assignment and that they were interested."

Likewise, Professional Teaching Fellow Andrea Mead from the School of Psychology is a strong advocate for providing opportunities for literacy in her papers.

Andrea credits the Psych 108 Teaching team, Learning Support Services and Student Learning Services for their support with helping to create a culture of learning for her and her students.

As Andrea says, "You have to think before you can write - literacy is a process." For this reason, the psychology teaching team design the labs to focus on writing an essay, then students are introduced to the assignment topic in their lecture.

"Students develop their own ideas, discuss in a group, write reports and essays and learn how to critique their writing," she says. "It's another shot at heading them in the right direction by developing skills that will make the students marketable."

The Faculty of Science's Associate Dean (Academic), Margaret Goldstone, is Chair of the Faculty Teaching Learning and Innovation Group (FLTIG) that identifies problems the Faculty has with teaching and learning and spearheads solutions.

"Everyone nominated our students' ability to handle academic English as opposed to social English as a major factor in poor writing, reading and communication, as well as an inability to handle information at a level that we would ideally like them to," She says. "FLTIG is centrally involved in helping design an easily implemented strategy to improve Academic English for the Faculty."

He says, "It's a great shame when scientists are the ones that are developing new knowledge and expanding the frontier of knowledge and yet they can't communicate their ideas clearly."

## Calling all Science Scholars

The Faculty of Science presented its Science Scholars Programme at an official launch in September to showcase the new initiative that will engage and develop our best and brightest students.



(Left to right) Dr Nicolette Rattenbury, Glenda Haines, Professor Richard Easter, Professor David Williams and Professor Stuart McCutcheon attend the Science Scholars launch.

Vice-Chancellor Professor Stuart McCutcheon kicked off the event, and congratulated the Science Scholars team for initiating an "exciting programme" that will no doubt influence other faculties to do the same.

The Science Scholars Programme will welcome its first cohort in 2015. As a competitive entry programme, the 100 students to be selected each year will participate in core papers, supported by one-on-one advising by professional and academic staff. The programme places an emphasis on research through small inquiry-based projects, summer residential experiences and larger projects in the final two years.

The Science Scholars team responsible for bringing this initiative to the University of Auckland are: Associate Professor Cather Simpson (Chemical Sciences), Professor Richard Easter (Physics), Professor David Williams (Chemical Sciences), Glenda Haines (Student and Academic Services Manager) and administrator of the Science Scholars Programme, Dr Nicolette Rattenbury.

[www.sciencescholars.auckland.ac.nz](http://www.sciencescholars.auckland.ac.nz)

## Innovative partnership supporting island and ocean conservation

A new partnership, the first of its kind in New Zealand, was launched in August between the University of Auckland and NGO Conservation International (CI). This broad-based partnership will increase marine research, scientific capacity and a common vision for stewardship of our ocean.

Head of the University's Institute of Marine Science, Professor Simon Thrush, said the collaboration with CI would help to highlight major marine conservation issues in the Pacific. "This partnership provides new opportunities for students and staff to engage in research addressing integrative conservation and resource management issues in our region. The opportunity to strengthen our understanding of important conservation issues facing our region is important, and working with CI we will be better placed to train students and engage them in solution-focused research."

The partnership launch was held on the eve of the Third International Conference for Small Island Developing States, held in Samoa the following week. The theme of this conference was sustainable development through genuine and durable partnerships.

# News about our staff

## New Heads of Department



**Professor William Hayward** became the new Head of School of Psychology in January 2014. Originally from Christchurch, Will obtained his BA and MA in Psychology from the University of Canterbury.

He then went to the US, and obtained a PhD from Yale University, before heading back to the Southern Hemisphere to take a lecturing position at the University of Wollongong, Australia. Will has spent the last 14 years in Asia, where he taught at the Chinese University of Hong Kong, and then at the University of Hong Kong, where he was Head of the Department of Psychology. William's primary research interests are in the area of Visual Cognition, which lies at the intersection of perception and memory.

## New Professors



**Professor Mike Pearson** (Biological Sciences) is a plant pathologist with a specific interest in viruses who came to the University of Auckland in 1983. His research involves the study of previously undescribed viral diseases, with a particular emphasis on horticultural crops from New Zealand and the Pacific Islands. This includes detection and characterisation of the causal agents, studying their epidemiology, and developing diagnostic tests, the ultimate objective being the development of practical control measures.

Mike says about his promotion, "it is the recognition by your peers, both nationally and internationally that makes a significant contribution to your field of study and sense of achievement."



**Professor James Wright** (Chemical Sciences) obtained his PhD from the University of Auckland. After working at the Department of Scientific and Industrial Research for a short time and then carrying out

postdoctoral research at Stanford University, he took up a lectureship in the Department of Chemistry at the University in 1984. Since then he has pursued research that has ranged from fundamental chemical studies through to real-life applications. His present research interests include the organometallic chemistry of metallabenzenes, catalysis, macrocyclic chemistry, metallo-pharmaceuticals and Green Chemistry. The Green Chemistry projects include new environmentally benign ways of

bleaching wood pulp for paper production and the efficient removal of pollutants from drinking water. James is currently engaged in the process of establishing a Centre for Green Chemistry in the School of Chemical Sciences.



**Professor Paul Kilmartin** (Chemical Sciences) gained a PhD in the electrochemistry of conducting polymers from the University of Auckland in 1997, and in that year was appointed as a lecturer (50% Food

Science, 50% Analytical Chemistry). He has been closely involved in the development of several academic programmes firstly within Food Science and in research within the Polymer Electronics Research Centre. He then established and directed the Wine Science postgraduate programme from 2003, and guided this to become an internationally-recognised centre in enology research and teaching, with over 120 Wine Science graduates. He is currently an Associate Editor for the journals Food Chemistry and the Australian Journal of Grape and Wine Research.



**Professor Richard Newcomb** (Biological Sciences) divides his time between the Joint Graduate School in Plant & Food Science and Plant & Food Research, a Crown Research Institute (CRI). Richard's

research interests include the use of molecular approaches to understanding chemical sensing evolution. Animals possess a large family of odorant receptors that they use to detect a multitude of odours. By understanding the mechanisms and evolution of this biological chemical sensing system, Paul aims to develop solutions for the food, insect pest control and biosensing industries. He is also interested in using molecular techniques to address issues of the ecology and evolution of New Zealand's unique biota. Richard says, "Being promoted to professor as a fractional appointment with a CRI demonstrates that it is possible to co-exist in both these worlds successfully."



**Professor Jadranka Travas-Sejdic** (Chemical Sciences) obtained her PhD from the University of Auckland after completing her BSc and MSc in Zagreb, Croatia. Her present research interest is in

the field of advanced polymeric materials, particularly those based on conducting polymers, and their application in health and bioelectronics, and polymer electronics devices.

## Prestigious appointment for psychology professor

Professor Russell Gray from the School of Psychology, not only led three days of lectures on the theme of evolutionary approaches to cognition, language and culture as part of the Nijmegen Lectures in the Netherlands earlier this year, he became the co-director of Germany's new Max Planck Society's Institute for the Science of Human History in Jena.

Professor Gray's research has made significant contributions to the fields of linguistics, animal cognition, philosophy of biology and behavioural phylogenetics. He pioneered the application of computational evolutionary methods to questions about linguistic prehistory.

More recently, he used sophisticated Bayesian phylogenetic methods to test hypotheses about the sequence and timing of the peopling of the Pacific. His work with Dr Gavin Hunt on New Caledonian crows has revealed that their remarkable tool manufacturing skills are the product of a lengthy learning period and are underpinned by brains with large associative regions and the ability to make causal inferences.

She works on a number of projects on conducting polymers run in collaboration with the research groups from the School of Chemical Sciences, School of Medicine and Engineering ("Polymer Electronics Research Group"). Jadranka is also the Director of the Polymer Electronics Research Centre and the Principal investigator for the MacDiarmid Institute for Advanced Materials and Nanotechnology.



**Professor Arkadii Slinko** (Mathematics) received his PhD and BSc degrees from the Sobolev Institute of Mathematics and joined the Mathematics department in 1993. His current research

interests are mathematical economics, in particular social choice theory, decision theory and mathematical theories of allocation of discrete resources; cluster analysis and applications; design of experiments and random matrices; mathematics education of gifted students and mathematics competitions.

## New Zealand Geographical Society Awards

University of Auckland geographers have featured prominently in this year's New Zealand Geographical Society Awards with Professor Robin Kearns from the School of Environment named Distinguished New Zealand Geographer of the year.

The award to Professor Kearns recognises his outstanding contribution to geography scholarship both in New Zealand and internationally. He has published widely over the past 27 years including two books, 39 book chapters and more than 130 journal articles. His work focuses on socio-cultural geography and explores the links between culture, health and place.

Specific areas of study in Professor Kearns' work include the capacity of urban design to promote physical activity and social cohesion; the 'downstream' consequences of deinstitutionalisation of mental health care and the transformation of clinic and hospital spaces and their connection to health care consumption.

Other geographers from the School of Environment to receive awards were senior lecturer David Hayward (Distinguished Service Award), PhD candidate Hayley Spark (President's Award, Best Masters Thesis) and Dr Thomas Etherington (President's Award for Best Doctoral Thesis). PhD student Marc Tadaki received a President's Award for Exceptional Services to Geography.

Professor Paul Kench, Head of the School of Environment, congratulated award recipients and said it was a great result.

"These awards recognise research excellence, distinguished service to the discipline and research excellence and highlight the outstanding and enduring contributions our staff are making to geography at the national level," he said.

## Rutherford Discovery Fellowships 2014

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

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

The Faculty of Science congratulates:

- **Dr Francis Collins**, Environment, for research entitled: "Nation and Migration: population mobilities, desires and state practices in 21st century New Zealand."
- **Dr Kim Handley**, currently at the University of Chicago, for research entitled: "Who is eating what in coastal marine sediments? Understanding microbial contributions to coastal marine health, stability and ecosystem functioning."
- **Dr James Russell**, Biological Sciences and Statistics, for research entitled: "Conservation complexity: scaling vertebrate pest control"
- **Dr Alex Taylor**, Psychology, for research entitled: "The signature-testing approach to the evolution of intelligence."

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

## Dean's Awards for Teaching Excellence

The Faculty of Science is very pleased to announce the winners of the Dean's Awards for Teaching Excellence 2013.

- **Dr Margaret Stanley**, (Biological Sciences) for her extraordinary leadership in developing, coordinating and maintaining a successful postgraduate programme and the impact her engagement has on her postgraduates.
- **Dr Judy Paterson**, (Mathematics) for pioneering and leading team-based learning in mathematics, both at the University and internationally.
- **Dr Julia Novak**, (Mathematics) for her leadership and coordination in pivotal math courses and the breadth and depth of her pedagogy.

## MBIE funding recipients

The University of Auckland has received 14 grants totalling more than \$48 million of new funding in the latest funding round announced by the Ministry of Business, Innovation and Employment.

The University's success rate in this round is a significant achievement, amounting to more than one third of the funds allocated nationally in this funding round.

"The success for the University of Auckland in the 2014 round was driven in large part by the support measures put in place and co-ordinated by the Research Office, and supported by UniServices," says the Deputy Vice Chancellor (Research), Distinguished Professor Jane Harding. "We are delighted that so many of our researchers succeeded in a very competitive round."

Highlights of the successful proposals included six successful Smart Ideas grants, six grants in the Targeted Research category, and two in Enabling Technology.

Dean of Science Professor John Hosking says the funding of these grants was an acknowledgement of the world-class research being carried out.

"This funding goes towards highly advanced science research in a wide variety of fields where our scientists are pioneering new technologies and research that will contribute not only to New Zealand's economic growth but to everyday aspects of people's lives", says Professor Hosking.

"I congratulate the researchers who have been successful in this funding round and I am delighted that the very important work being done here at the University has attracted such substantial investment," he says.

Successful projects that were funded in the 2014 science investment round include the Biocide Toolbox led by Professor Ralph Cooney from the School of Chemical Sciences which received \$15.2 million.

The aim is to create greener biocides agents which combine new synthetic and natural agents. The interdisciplinary team on the project includes Scion, the Cawthron Institute and the University of Otago. Commercialisation partners include thirty three companies.

Research on high-density air quality measurement instruments led by Professor David Williams from the School of Chemical Sciences received \$4.89 million while senior lecturer Dr Frederique Vanholsbeeck of the Department of Physics receives \$3.12 million for a food safe project on real-time bacterial counts.

# Hot topics in the media

The Faculty has enjoyed its fair share of media attention so far this year. Highlights have included:

## Deep hole drilled through Rangitoto

During three weeks in February 2014, a team led by Associate Professor Phillip Shane (Environment), drilled a 150m-deep hole through Rangitoto volcano to select samples of the core to be geochemically analysed in order to decipher the volcano's history.

## Sex sneak

A new study offers insights into the giraffe weevil, so-named for the distinctive "rostrum" extending from its head. Conducted by Dr Christina Painting and Dr Greg Holwell (Biological Sciences), research into the giraffe weevil's mating behaviour shows it doesn't always pay to be brave – sneaking sex can be just as effective.

## Smart crow

Dr Alex Taylor (Psychology) knows a smart crow when he sees one. His research integrates theoretical and experimental approaches from both biology and psychology in order to study the intelligence of five species of corvid. The BBC filmed Dr Taylor and his crows at the field site in New Caledonia last year. An excerpt that was uploaded to YouTube went viral, reaching 5,339,871 views (at last count!)



## New Zealand's most damaging invertebrate pest – the wasp

Due to a growing population of wasps in New Zealand, who thrive in the absence of natural predators, Associate Professor Jacqueline Beggs (Biological Sciences) has been called upon to share her knowledge in the media. Professor Beggs' research aims to contribute to our understanding of the ecological consequences of invasive species and to assist in conserving the native biodiversity of New Zealand.

To keep up to date with the latest media highlights from the Faculty of Science, visit [www.science.auckland.ac.nz/in-the-media](http://www.science.auckland.ac.nz/in-the-media)

*Photo: Bob Brown, former PhD student*

# News about our students



Team InfinityTek celebrates their success.

## Top honours for student team

The University of Auckland student team InfinityTek have won top honours in the New Zealand finals of the world's largest and most prestigious, innovative software competition.

The team won the World Citizenship category and were overall winners of the Microsoft Imagine Cup 2014 and represented New Zealand at the World Finals in Russia in July.

InfinityTek won with an app called 'UVsense', a product that uses a custom-developed wristband sensor to monitor UV exposure and wirelessly communicate that data to a Windows 8 smartphone. The goal of the app is to allow people to manage their skin cancer risk – the most common form of cancer in New Zealand.

They also won the World Citizenship category prize of \$6000, producing the app "with the greatest potential to make a positive contribution to the betterment of humanity".

Team members Muthu Chidambaram, Daniel Xu and Ming Cheuk are graduates in Mechatronics Engineering. Daniel Xu and Ming Cheuk are now completing their PhDs with the Auckland Bioengineering Institute, and Jacky Zhen is a BSc (Hons) graduate, now completing a Masters in Computer Science.

## Vice-Chancellor's Best Doctoral Thesis prize

The Vice-Chancellor's Prize for Best Doctoral Thesis has been awarded to two Faculty of Science students.

Victoria McLelland (Psychology) and Rachel Simister (Biological Sciences) were presented with their certificates at the University's "Celebrating Research Excellence" function in May.

Faculties nominated 18 theses, judged on their demonstrable significance, the originality and excellence of the research, exceptional academic and intellectual achievement, and timely completion.

## Faculty of Science Student Association

This semester the Faculty of Science Student Association (FoSSA) welcomed new students at an orientation event held in the Recreation Centre.

Numerous FoSSA events have been held throughout Semester Two such as the joint Mid-Winter Christmas Party stein with the AUASA.



The University of Auckland  
Faculty of Science Students' Association

"It was cool to see FoSSA and AUASA members mixing and mingling with an early Christmas cheer," says public relations executive for FoSSA, Kate Boersen. "Our fifth pub quiz gave participants the chance to show off their scientific and general knowledge. It brought together students from a range of majors in an informal social setting."

FoSSA held a number of drop-in sessions at the Science Student Centre and have helped out and publicised a number of career events to all science students in 2014.

Kate says "we are also super proud of all the Science Spartan teams that competed in the Interfaculty tournaments. Congratulations go to the men's rugby team and the women's basketball team for winning their respective tournaments. Science Spartans finished up 3rd overall. We absolutely love seeing the blue FoSSA t-shirts around campus and are looking forward to next year."

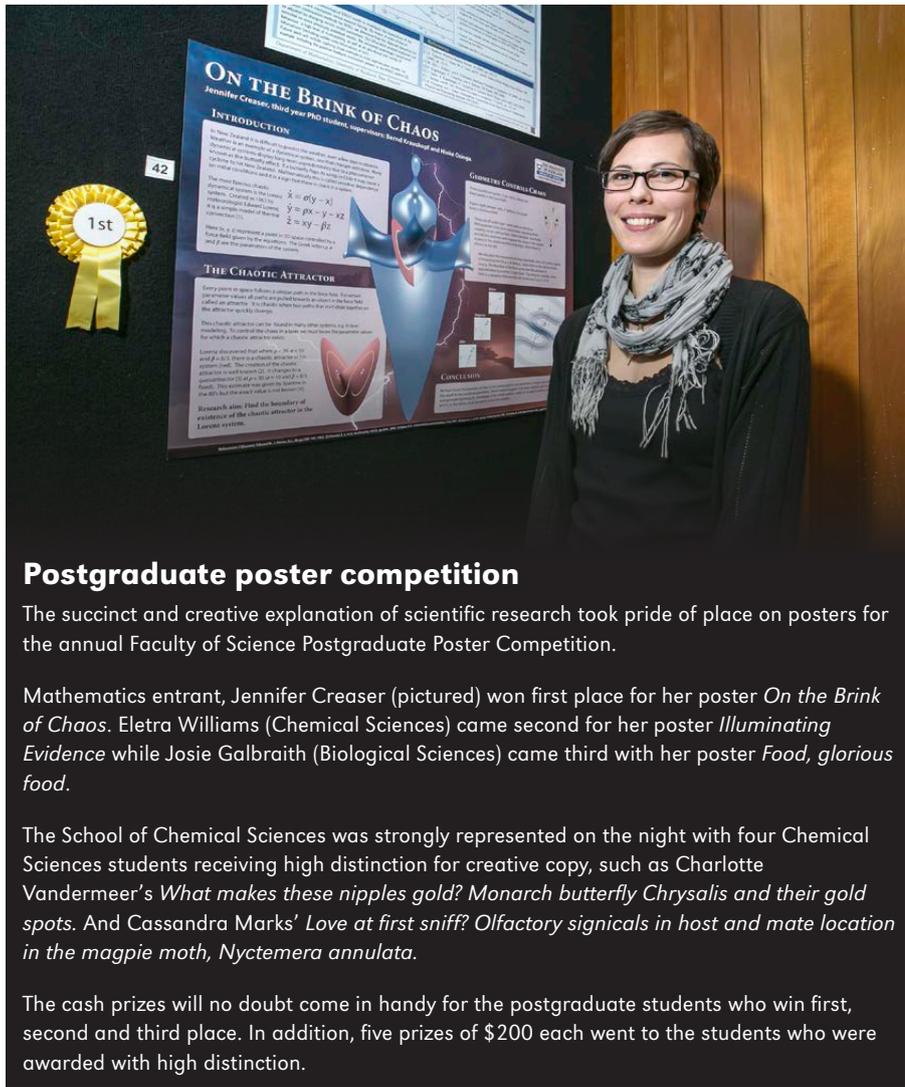


## Winner of Māori Sportsperson of the Year Award

University of Auckland students who excel in sports or arts, or have made a valuable contribution of service or leadership in their community, were celebrated at the 2014 Blues Awards in the beginning of October

Kayla Imrie, who is studying towards a Bachelor of Science with a major in Biological Sciences, won a Blues Award in the sports category as Māori Sportsperson of the Year. Kayla competes in Canoe Sprint and took part in the NZ National Canoe Sprint championships where she placed first in the K2n in both the Open Women's 500m and 200m events. In July this year she represented New Zealand at the Under-23 world championships in Hungary where she competed in in the K4 500, and won the K1 200 C final.

The awards are an acknowledgement of a student's extra-curricular activities while studying at university, and are a University of Auckland tradition that dates back to 1922.



### Postgraduate poster competition

The succinct and creative explanation of scientific research took pride of place on posters for the annual Faculty of Science Postgraduate Poster Competition.

Mathematics entrant, Jennifer Creaser (pictured) won first place for her poster *On the Brink of Chaos*. Eletra Williams (Chemical Sciences) came second for her poster *Illuminating Evidence* while Josie Galbraith (Biological Sciences) came third with her poster *Food, glorious food*.

The School of Chemical Sciences was strongly represented on the night with four Chemical Sciences students receiving high distinction for creative copy, such as Charlotte Vandermeer's *What makes these nipples gold? Monarch butterfly Chrysalis and their gold spots*. And Cassandra Marks' *Love at first sniff? Olfactory signcials in host and mate location in the magpie moth, Nyctemera annulata*.

The cash prizes will no doubt come in handy for the postgraduate students who win first, second and third place. In addition, five prizes of \$200 each went to the students who were awarded with high distinction.

### Basketball finals heat up Interfaculty championship

The Science Spartans defended their title in the Women's Basketball Championship in June.

Women's reigning champs Science dominated the Engineering Eagles with a convincing 89-29 win in a repeat of last year's final.

The finals night wraps up the five-week Inter-Faculty Basketball tournament, sponsored by Beca.

Science student, T.K Pene took home the women's most valued player award.



Deena Franklin

### Science Spartans' rugby reign

The Interfaculty Rugby tournament drew to a close early in October, with the Science Spartans and Education Doggies facing off in the final.

Both undefeated going into the final game, the Spartans managed a convincing 95-24 win over the Doggies.

The Spartans' win makes them the only interfaculty team to reign for three consecutive years in a sports tournament. Science's number 4 Sigmund Widerberg was named Most Valuable Player of the tournament, after consistently strong performances throughout the season.



Science Spartans celebrates their success for the third time in a sports tournament.

### BTech student selected for Tall Ferns

Deena Franklin is in the second year of her Bachelor of Technology, majoring in Biotechnology in the Faculty of Science. Her regional women's basketball team, Harbour Breeze, won the New Zealand national championship, followed by her first call up to national rep team - the Tall Ferns, a week and a half training camp in Christchurch and two weeks of world-class competition in China.

Deena, who is 19 years old and 1.85m tall, comes from the North Shore, and has played basketball since primary school. At University, she has also managed to play in the Inter-Faculty Tournament this year as a member of the Faculty's winning women's basketball team.

Now that the competitive basketball season is over, Deena will be working on some skill areas that her Tall Fern coach wants her to improve, and will be looking forward to eventually playing for the Tall Ferns in the next Commonwealth Games in 2018 to be held on Australia's Gold Coast.

# Forensic Statistics

The steady stream of wrongfully convicted prisoners being released from U.S. jails is a constant reminder of the power of DNA evidence. Many are being freed through the Innocence Project which is dedicated to exonerating people through DNA testing, and Faculty of Science forensic statistician Professor James Curran says that's no surprise given that DNA evidence has "exonerated more people than it's convicted."

Much of James' research time is devoted to refining DNA analysis to make it even more efficient and reliable. His goal is to introduce statistical models that remove the sometimes arbitrary decisions that forensic scientists make. Put simply, if people use the same statistical model then they should come up with the same answer.

"The ideal is to eliminate some of the subjectivity from that process and to cut down on the avenues of attack which question the value of the evidence. That's what using statistical methodology does."

DNA profiling or genetic fingerprinting has come a long way since it was first introduced in New Zealand in the late 1980s. Back then scientists relied on restriction fragment length polymorphism which sometimes took six weeks to get a result. Nowadays, the electropherogram (EPG) produced by an automated DNA sequencing machine can deliver a profile within a couple of hours.

However the EPG data being provided is still open to interpretation depending, among other things, on the height of various 'peaks' in the profile, the heights of the peaks relative to each other - called heterozygous imbalance - and also whether the DNA amplification process has produced a so-called 'stutter'.

One of the most common areas for potential confusion involves rape cases where a number of mixed stains are present and scientists have to determine the levels of DNA coming from each person. Whether decisions are made in an ad hoc way or by using a set of laboratory rules based on certain thresholds can lead to differences of opinion on whether peaks and stutters are real or not. "We're going to take that decision away from analysts. It can be very subjective" says James.

Interpreting DNA evidence generally requires two explanations which means that scientists have to postulate different genetic profiles and attribute a weight or 'likelihood ratio' which James says has a mathematical meaning and also "a nice intuitive meaning" for people.

But rather than having hard and fast rules which lead to a 'yes/no' decision he would

prefer a sliding scale based on a balance of probability of, say, between zero and one. All of which requires statistical models and data analysis.

"We're trying to set things up so that people are doing things in a uniform way so that a lot of the decision processes that DNA analysts used to be involved in are actually removed from them because they don't need to be involved in them."

The current Australasian standard for DNA interpretation is a forensic software programme called STRmix™ which was developed by the Institute of Environmental Science and Research (ESR) and Forensic Science South Australia (FSSA). STRmix™ uses a fully continuous approach for DNA profile interpretation in resolving complex DNA mixtures of up to four individuals. It has the added advantage of running on a user's PC without the need for high-speed computing and can be easily understood and explained in court by DNA analysts.

By performing complex calculations previously performed by hand, James says the software has removed a great deal of fear among forensic scientists about getting things wrong although they are still liable to legal challenges about using technology that they didn't design and allegedly don't understand.

And that's where James believes he can make a difference. Along with his ESR-based PhD student Jo-Anne Bright he is constantly refining the statistics that "inform" the statistical models used in STRmix™. "I know about some more efficient computing and more efficient strategies for sampling and both of those things play a role in the calculations. That's where I'll be making some input."

Computing speed is another critical factor in a world where forensic laboratories are dealing with 'volume crime' and DNA backlogs. With a delivery time of minutes rather than hours, STRmix™ is streets ahead of it's U.S. forensic software competitor True Allele® which can take 24 hours to provide answers - and costs considerably more to operate.

The 'holy grail' may be a system that analyses DNA profiles within 30 seconds, however James says that in terms of high precision and very sensitive evidence types "I'd prefer that people took their time analysing things and not mucking it up and not contaminate stuff and not get the calculations wrong."

Because humans are still involved at the 'front end' in labelling and loading samples there is potential for error, but programmes like STRmix™ have greatly reduced the chances of

making mistakes. "A defence expert is far better off attacking the chain of custody of the evidence than looking for mistakes in the statistics" James says, "If you can show in any way that the evidence is compromised then the rest of the interpretation goes out the window."

While the analysis of trace evidence constitutes only about 12-15 per cent of the forensic case load in New Zealand, it is still of considerable interest. To that end, James is about to start supervising a new PhD research project using Laser Induced Breakdown Spectroscopy (LIBS) which measures the elemental composition of substances like glass, soil or the ink on a ransom note.

In addition to being much cheaper than the conventional Inductively Coupled Plasma Mass Spectrometry (ICP-MS) system, LIBS machines are more compact and can be taken to crime scenes. However little statistical work has been done interpreting the 'curves' and functional data analysis (FDA) from LIBS so the challenge for James is to apply the existing statistical machinery to a new evidence type and use the data to calculate a likelihood ratio. "Both of those steps will be a real step forward in interpretation of the evidence."

Having spent around two decades in forensic research, education and practice James says that the rate of adoption amongst forensic agencies is disappointingly low and that victims of crime "deserve better in terms of asking for a higher standard of science."

While New Zealand rates well by world standards, he says the United States is something of a "black hole" with a massive disparity in forensic analysis ranging from world class to simple calculations that waste a lot of information, "and I think that's very sad for a country that's so technologically advanced."

What's more, he says that "real scientists" should always expect methodologies to change and better ways found to do something in the future. But too often forensic science loses sight of that. "That's what frustrates me immensely, this refusal to change their methodology for fear that cases might be relitigated or that the methods are too complex."

However making the complex simple is all part of the challenge for James and he's grateful for ongoing research contracts from ESR which help to keep New Zealand at the forefront of international trends and developments.

"I think there's really good forensic science and forensic statistics being done in this country. It would be nice to see some public recognition of that and not have to be funded out of internal research budgets of forensic agencies."



# Internet hang up

The possibility that the Internet could “hang up” on us because exponential growth rates threaten its ability to function in real time is somewhat mind boggling - and troubling.

“All we’re relying on is that people will add capacity and intelligence to the network at a rate that’s able to cope with the growth, but we have no guarantee that we’ll win that race” says Dr Ulrich Speidel, senior lecturer in Computer Science.

The increased demand is plain to see, from the massive growth in portable devices, users, and applications to the increasing use of real-time Internet applications such as telephony, video conferencing and remote control which require more and more data to be transmitted at much faster rates than ever before - all of which helps clog the Internet.

“We’re seeing more and more people wanting live video feeds at higher resolutions, so the enormous data we’re pushing through the Internet is increasing by double digit percentages every year.”

Up till now Ulrich says there’s been a balance in terms of the “amount of chaos” created by additional growth and the evolution of the technology, however it’s what’s going on behind the scenes on the Internet superhighways and byways that’s of greatest concern.

His “ah ha” moment came in 2010 when he was at the University of Tokyo and became curious about which way internet traffic flowed from Japan to New Zealand. By sending a ‘traceroute’ (a computer tool for displaying the path and transit delays of data packets across the Internet) he discovered that successive packets would travel in different directions via Hong Kong and Australia or through the United States.

Think of it like taking a bus, he says. The longer the journey, the greater the possibility that you might encounter congestion and delays. It’s the same with data packets which have to travel through an increasing number of routers and gateways. “The question now is, will the additional delay that we need to allow for get worse over time or will it get better?”

While new fibre optic cable and satellite links will help boost capacity, Ulrich says they will also add complexity to the communications network as more Internet service providers enter the market to resell and even bundle upstream capacity to the point where there’s no longer any end-to-end control over the availability of resources. “There are lots of agreements like this in place and the agreements keep changing so it’s very

difficult to predict quite where the traffic will go.”

In order to determine likely trends, Ulrich and PhD student ‘Etuete Cocker have instigated the International Internet Beacon Experiment (IIBEX) - a longitudinal study kick-started with a Faculty of Science Research Development grant.

Over the past two years, a network of 33 measurement stations (beacons) has been assembled in more than a dozen countries ranging from South Africa to Europe, Asia, North America, the Pacific Islands and New Zealand. The beacons exchange synthesized traffic three times a day which mimic a 200 second voice call but actually send numbered packets with timestamps every 20 milliseconds which allows them to be timed and checked for in-order arrival at their destination.

In addition to measuring the number of routers encountered on the journey, the study counts packet loss rates, and the percentage of packets arriving out of sequence. However the main focus is on the average variation of the end-to-end delay known as ‘latency’ or ‘jitter’. “This is the variation that requires us to buffer - like the punctuality of your bus at the far end of the bus route that forces you to take an earlier bus just to ensure that you’re on time.”

The buffer time is essentially the delay in hearing a voice at the other end of a network, and the typical propagation delay which most people will be familiar with between New Zealand and Europe or the United Kingdom is already a noticeable 120 to 180 milliseconds.

Between New Zealand and Japan the baseline delay tends to be 150-200 milliseconds, but there are frequent ‘excursions’ up to 650 milliseconds which would make Skype calls virtually impossible or very awkward because of the wait to get voice across.

Another measure being used is the Mean Opinion Score (MOS) which estimates call quality from end-to-end delay jitter. Five is the highest MOS score, but traffic to Switzerland for example has occasionally dropped below the accepted baseline of 3.5 to 4 which would not be acceptable for business transactions. “While a lot of the time we’ve got acceptable service levels, we do get relatively frequent drops below that” says Ulrich.

IIBEX also has many beacons in the Pacific Islands because of the region’s close links with New Zealand and the lack of fibre connectivity which has created a serious problem getting Internet traffic in and out through often slow and overloaded satellite technology.

In mid-2013, the MOS scores between Tonga and New Zealand were predictably very low which made VOIP communication virtually impossible. However when Tonga was connected to Fiji by fibre optic cable in August 2013 the scores shot up. Nevertheless, there have been frequent drops back to zero which Ulrich attributes to local effects on the old “dirt track” leading to the international data superhighway.

“This is a good news story in the sense that we can tell that the quality’s really getting better, but it’s only really getting better when the local network isn’t badly overloaded.”

The delays also have major implications for real time traffic, such as the remote operation of underwater vehicles in the oil industry or even robotic surgery which could involve life and death situations. “There are lots of reasons why we want the Internet to be real-time capable but because it was never designed to be there’s no guarantee it will have that forever.”

So what does this mean for New Zealand? Well, for migrants like Ulrich and ‘Etuete there’s the ongoing frustration of having to communicate with relatives back home via a potentially inferior Skype or VOIP service.

And there’s a commercial angle too. New Zealand’s geographical location and the availability of cheap bandwidth has fostered a lucrative cottage industry in contact centres serving the United States, Europe and the U.K. But Ulrich questions whether this is sustainable if call quality deteriorated and calls took longer to complete. “It could become more expensive for the provider here to service their clients and the business model would go down the drain eventually.”

While IIBEX has the support of some of the world’s top universities such as MIT and the University of Tokyo, the project has also had to overcome numerous challenges ranging from equipment failures to configuration issues - and taking up too much precious bandwidth in a couple of locations.

Managing the project has also eaten substantially into the time of PhD student ‘Etuete Cocker and another challenge will be to keep IIBEX ticking over when ‘Etuete moves on. In the meantime, it’s a matter of constantly monitoring what’s proving to be a variable and unstable global communications network. “If we see things clogging up everywhere” says Ulrich, “we’d hopefully be able to sound an alarm and say the Internet is in the process of trying to seize up.”





# Green Chemistry could tackle 'big' problems

The availability of fresh potable water is predicted to become a big international issue, and while New Zealand has a bountiful supply of drinking water there is no reason for complacency.

Our major cities may be well served, but Professor James Wright at the School of Chemical Sciences says smaller rural communities often don't have access to sophisticated water treatment facilities and they are more prone to contamination from the agri-chemicals used in farming practices. It's an area where James believes that more studies would be very useful and he believes that Green Chemistry research may well provide future solutions.

"If you're looking at the philosophy of Green Chemistry it's very much about tackling sustainability problems that impact on our entire civilisation. For example Green Chemistry can make important contributions in areas such as sustainable energy production, the elimination of pollution at source, the provision of clean water, and the sustainable production of commodities."

The main research focus in James' group has been on the development of 'benign' (non-toxic) catalysts that will enable "oxygen-based" oxidants - such as relatively inexpensive and sustainable hydrogen peroxide - to be efficiently used in the oxidative destruction of potentially harmful or unwanted organic molecules. Potential end uses include the remediation of effluent streams contaminated with harmful organics and the purification of drinking water that might contain common organics such as pesticides, active pharmaceutical ingredients and suspected endocrine disruptors.

Bio-remediation, oxidations ponds, membrane filtration, treatment with ozone and adsorption onto charcoal are but a few of the water purification solutions currently being utilised, but these can be expensive and do not always remove all contaminants. The aim of Green Chemistry research in this area is to develop simple, sustainable and cost-effective ways to treat these problems.

To that end, one highly promising School of Chemical Sciences project is about to take a significant next step with the registration of a provisional patent for a non-toxic, non-contaminating catalytic oxidation system that could be used to treat bulk water supplies. James is understandably reluctant to discuss

the finer details, however the new purification system originates from experiments that have shown an iron-based TAML® catalyst (TAML stands for tetra-amido macrocyclic ligand) working with hydrogen peroxide can selectively oxidise and remove recalcitrant contaminants in bulk water used for drinking.

"It's a very benign system which comes back to the principles of Green Chemistry," he says. "We can treat bulk water using the catalytic oxidation system without contaminating it either with the catalyst or the oxidising agent. That is, we think, a big jump forward."

Funded by UniServices, the provisional patent will allow further discussions with potential industrial partners such as water purification companies. "Ideally we would want to engage a big company that has all of the necessary resources to develop this to market in collaboration with us. This would allow us to continue on with our research and further develop the product."

The use of a TAML® catalyst is no coincidence. They were first produced by University of Auckland alumnus Professor Terry Collins and his group at Carnegie Mellon University in Pittsburgh and their use in New Zealand is based on a three-way international partnership between the University of Auckland (UniServices), Scion and Carnegie Mellon University (GreenOx Limited).

The collaboration has enabled Terry's catalyst work to be extended, and James says that the catalysts developed in Auckland "have a number of quite different features - different properties - some much better than the original ones." The research has also produced a new way of using oxidation catalysts that's very different from anything else.

Interestingly, both Terry and James completed their PhDs within 2 years of each other and share a passion for Green Chemistry - a term coined in 1991 by Paul Anastas, the former Science Advisor to the U.S. Environmental Protection Agency and now Director of the Centre for Green Chemistry at Yale University.

Indeed, James says that Terry has "championed Green Chemistry tirelessly since its inception" and has been behind many of the "big pushes", the latest being to increase recognition of endocrine disruption in many parts of our food chain.

Chemicals from birth control pills are proving difficult and costly to eliminate from wastewater which then carries into natural waterways where they are known to 'feminise' male fish and amphibians. Despite the conventional wisdom about toxic compounds that 'the dose makes the poison', James says that endocrine disrupting compounds are effective in parts per billion and often have a non-linear dose response curve. "It's something that everybody needs to become more familiar with and more concerned about."

One of the key challenges is to selectively destroy very dilute contaminant molecules by oxidation and the School of Chemistry is collaborating with the School of Engineering on programmes that will use catalysts to oxidatively remove problematic compounds like the synthetic estrogen 17 $\alpha$ -ethynylestradiol (EE2) in waste water streams.

Developing new and more cost-effective catalysts is another challenge, as evidenced by the relative failure (to date) of Green Chemistry to make an impact on the huge global pulp and paper industry which traditionally uses chlorine-dioxide to bleach wood pulp for paper. The chlorine dioxide treatment creates very small amounts of highly toxic organo-chlorines, and while it is possible to bleach using green oxidation catalysts mixed with hydrogen peroxide it's not as efficient.

"Industry has absolutely no desire to take up something on the basis that it is a greener solution if it's not quite as good as what they're currently using and it's going to cost them more" says James.

Similarly, scientists have shown that it is possible to bleach the effluent that discolours the Tarawera River (known to environmentalists as the 'black drain') downstream from the Kawerau mill in the Bay of Plenty. This would allow light back in so the natural bio systems could flourish. However, because this would come at a cost and the mill owners have the necessary consents to keep discharging, James says that there is currently "no real imperative" to pick the treatment process up.

Given the low pulp and paper industry margins, James concedes that there has to be a compelling reason for uptake and his hope is that the development of new and cheaper catalysts will revive interest. The biggest challenge "is in the chemistry" which has already taken decades of hard work to get



this point. "It's very difficult, but we're still working on it."

Accepting that green solutions are not always absolutely perfect goes with the territory. "The inherent challenge is to keep heading towards that ultimate goal of absolute sustainability" says James, "but often we have to accept that we're making incremental steps in that direction."

Attracting funding for Green Chemistry is yet another challenge and the University of Auckland is grateful for the generosity of Dr Beate Schuler, the respected international business woman and philanthropist, who has now donated toward two doctoral scholarships in Green Chemistry. Known as the Beate Schuler Doctoral Scholarships in Green Chemistry they are each valued at up to \$30,000/year.

Professor Wright is also keen to establish a dedicated Green Chemistry Centre at the University of Auckland which would raise the profile of Green Chemistry, attract more talented graduate students and assist with funding.

Rather than offering just the two present courses, the Centre would enable a whole programme on Green Chemistry to be taught and provide leadership in research and educational activities within the public and private sectors - as well as fostering collaboration across many disciplines.

Above all, James says the ultimate goal is "to tackle the big problems, problems that are challenging the very existence of our civilisation."

# Brain fatigue

Drinking coffee or taking substances that alter the balance of brain chemicals could help concussion victims on the road to recovery thanks to some new and promising research at the Department of Sport and Exercise Science and Centre for Brain Research. It might sound simple, however the science is anything but according to the Director of the Exercise Neurometabolism Laboratory, Dr Nick Gant.

"It's about learning why and how the brain fatigues so that we can develop ways of measuring it and restoring your chemical balance that's disrupted by fatigue or after a brain injury."

Prolonged physical exertion results in reduced neural drive from the motor cortex - a mechanism known as 'central fatigue' - however little is known about this phenomenon and the research being conducted under Nick's supervision by PhD student Charlotte Connell is challenging conventional wisdom around the measurement of brain fatigue by using exercise as a model.

In the past scientists have induced skeletal muscle fatigue to tease out performance loss relative to the lack of neural drive from the brain. However Nick says this is a problematic way of doing it because you are using the same fatigued muscle and fatigued movement areas of the brain that were involved in the exercise.

Because the oculomotor system which moves the eye muscles is totally independent of the skeletal motor system, and does not get fatigued during exercise, it was decided to measure eye movement speed using high frequency infra-red cameras which can detect the tiniest movement.

After testing the eye movements of a dozen healthy people before and after they had completed a three hour cycling exercise it was discovered that eye movements were slower and fell short of where they should be landing when presented with an item of interest. This might explain, as Nick puts it, why the brain doesn't even see the car that hits you when you are knackered!

"We speculated for the first time that there is a global or ubiquitous fatigue within the brain that can transfer from one system to another, and we had a unique way of measuring it."

The evidence is even more compelling and remarkable says Nick because the research demonstrates that the reduction in the velocity of saccadic or rapid eye movements cannot be accounted for by changes in visual perception or attention, and is not due to reduced glucose availability after exercise.

For a global change like that to occur Nick says it has to be a widespread disruption in the neurotransmitters - the so-called catecholamines such as dopamine and noradrenaline - that slow everything down in the brain when you deplete them. "We said it's not the fuel which is the sugar, or the fire it's burning which is the oxygen, it's these specific chemicals that transmit signals."

All of which led to another interesting phase in the research. Given caffeine's known ability to increase dopamine and noradrenaline production, a further study was conducted where another group of cyclists took the equivalent of two cups of strong coffee halfway during the three hour test to explore the extent to which the neural control of eye movements is influenced by a manipulation of central neurotransmission.

The results were compelling. Exercise-induced fatigue significantly decreased eye movement velocity by 7.9% in the placebo trial, whilst velocity increased by 10.9% for those in the caffeine trial. "Remarkably, impairments in eye movements are completely reversed when we administer a moderate dose of caffeine" says Nick.

This study is the first to show that caffeine alters human vision and the results show that caffeine has powerful and wide-reaching effects on the human brain. Slow eye movements could delay the brain's ability to recognise and react to important changes in your field of vision. A moderate dose of caffeine will prevent this and may enhance performance by increasing the speed that the visual system can operate. Having caffeinated drinks during exercise also has the added benefit of heightening alertness and making exercise feel easier.

While Nick says it would be "a nice public message" if we could reverse these effects by caffeine and potentially help those people who suffer from fatigue, the reality is that the more people become habituated to coffee the less effective it becomes. To maximise the impact, his advice is to remove caffeine from the diet so that the brain becomes more sensitive to its action "and then you only need a small amount to generate a big affect."

The focus of current and ongoing research is into the use of drugs such as Edronax, Zyban and Ritalin - which selectively target neurotransmitters - to help determine which brain chemicals are most important and vulnerable to fatigue. Not that Nick is looking to help sports people perform better or cheat.

"These drugs are banned in sport and against the spirit of fair play, but we are using them in a different way - to understand the mechanisms

of fatigue, not to test or endorse strategies for people to get ahead of the competition."

One potential goal is to help patients suffering from mild traumatic brain injury or concussion - a problem that afflicts many young Kiwi males - who experience terrible amounts of fatigue and whose only current treatment is physical and cognitive rest. Drugs or other types of supplements might help overcome fatigue and Nick says "if we can reduce the levels of fatigue you may get more of the rehab you need to do done."

However because the brain is a hard organ to study Nick says that recovery from concussion is a guessing game at the moment. "Clinicians do not have a good robust way of detecting when the person's ready to go back, so it's all about manipulating that period that they stand them down."

Looking ahead, Nick hopes that the research will lead to the development of an index to monitor fatigue in an objectively quantifiable way instead of using quite subjective psychological tests. If a baseline could be established as part of a routine medical examination at the start of a person's career, perhaps as part of an occupational safety obligation, "a WOF for the player" he says, then future changes could be more accurately monitored during injury and rehabilitation.

Rather than use expensive and cumbersome infrared technology, Nick also says that the ultimate goal would be to develop a more simplistic and perhaps portable technique, such as a camera within a tablet or smart phone, to measure eye movements. "Maybe Google glasses could detect how fatigued you were or something like that, that's the pipedream."

Not surprisingly there has already been some commercial interest in the testing regime from the food industry in terms of what products might have an effect on fatigue. However all of Charlotte's research to date has been funded through University of Auckland scholarships with specific support from the Tuakana Contestable Fund because of her Māori heritage.

"Charlotte is a real role model" says Nick. "She goes down to the post graduate sessions and speaks about her work and encourages young kids to come through."

And while much of the research is still subject to intellectual property restrictions and peer review, the aim is to publish this year. In 2015, Nick says "we'll be looking to weaponise our strategies and equipment" - in other words move from basic scientific experiments to clinical trials.



# Alumni news

## Chemical Sciences centenary celebration

In 2015, the School of Chemical Sciences will celebrate the 100th anniversary of the formation of the Department of Chemistry at the University of Auckland. The centenary will be marked by a special two day event aimed at alumni, staff, students, and guests. Included in the programme will be the Research Showcase, highlighting the research of the postgraduate students; lectures by Professor Robert Grubbs (CalTech), a Nobel laureate in Chemistry and Professor Russell Egdell (Oxford) on Henry Moseley, a renowned chemist killed at Gallipoli and the opportunities to visit University vineyard on Waiheke Island or tour the campus laboratories. A celebration gala black-tie dinner will be held in the University Marquee.

For more information and to register for this celebratory event visit

[www.scs-centenary.auckland.ac.nz](http://www.scs-centenary.auckland.ac.nz)

## Tuākana programme to celebrate 25 years

2015 will see the Tuākana Programme celebrate 25 years. Established in the School of Biological Sciences by Professor Michael Walker in 1990, Tuākana is a mentoring programme designed to help Māori and Pacific students reach their full potential via workshops, study groups and sessions with tutors and mentors. Alumni of the Tuākana Programme can be found in industries such as aquaculture, fisheries and tourism; iwi authorities; agencies of territorial authorities and Government; environmental and resource management consultancies in New Zealand and the Pacific; medicine and health; and in education, museums and academia. The 25th Anniversary Celebration to be held in 2015 aims through a variety of events and fora to showcase some of the success stories from the Tuākana Programme over the years with profiles of alumni, students and staff. It is hoped to establish a Tuākana in Science Alumni group as a way of connecting current and future students to our alumni so as to continue the practices and goals of Tuākana in the workplace.

## Getting involved

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

The generosity of our alumni and friends help us to ensure that our science students have the opportunity to realise their academic potential. The money that we raise from donations funds groundbreaking research and programmes, undergraduate and postgraduate scholarships, lectureships and professorial chairs, and the development of our facilities.

For more information on how you could support the Faculty of Science, please contact:

**Kiri-Ann Olney, Faculty of Science Development Manager**

Phone: 09 923 6973

Email: [k.olney@auckland.ac.nz](mailto:k.olney@auckland.ac.nz)

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



## Alumni events

Upcoming alumni events for your diary include:

### November 2014 to December 2014

November 27	O'Rorke Hall 65th Reunion*
December 2	Society AGM/Christmas function*

### January 2015 to May 2015

March 12	Conversations on stage with Distinguished Alumni*
March 13	Distinguished Alumni Awards Dinner*
March 25	Tauranga Alumni and Friends Lunch
April 20	Shanghai Alumni and Friends Reception
April 22	Beijing Alumni and Friends Reception
April 23	Hong Kong Alumni and Friends Reception
May 7	Graduation Concerto Competition*

\*Auckland based events

## Don't miss out on an invite to network

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



# Alumni profile

Name: **Michael Beaven**  
Position: **Respiratory Physiologist**  
Class of: **2013, BSc(Hons)**

"I had an interest in sports and science throughout my high school years, which lead me into my studies at the University of Auckland. I undertook a Bachelor of Science Double Major in Sport and Exercise Science and Physiology. In my fourth year I took on a postgraduate Honours Degree; BSc. (Hons.) in Sport and Exercise Science, gaining First Class Honours.

"On completion of my dissertation I hit the work force in pursuit of a number of different positions, namely as a physiologist in the cardiac or respiratory areas. In August 2013 I was taken in by Dr. Kevin Ellyett as a respiratory physiologist and am now comfortably enrolled in a two-year training programme to become a certified Physiologist.

"My day entails a large quantity of pulmonary function tests for a vast variety of individuals, ranging from chronic obstructive lung diseases, transplant assessments, diving instructors, air force cadets, fire service volunteers, and many more. No day is the same, and every patient I have has a new story to tell. So as well as getting my academic fix by thinking about the physiology of all these pulmonary function tests, I also get clinical experience and good patient interaction on a day to day basis.

# Community Links



## Dietetic clinic

The University of Auckland Clinics' newest service, the Nutrition and Dietetic Clinic offers a range of professional and affordable nutrition services to the community. Based at the Tāmaki Innovation Campus, the clinic aims to deliver a client-centred service and provides students of the new MHS in Nutrition and Dietetics programme invaluable clinical experience.

Operating since May, the evidence-based nutrition and dietetic service is closely supervised by highly experienced New Zealand Registered Dietitians. It provides clients who are referred to the clinic by their GP, a chance to tackle issues such as pre-diabetes and children who are fussy eaters.

[www.clinics.auckland.ac.nz/nutrition-dietetic-clinic](http://www.clinics.auckland.ac.nz/nutrition-dietetic-clinic)

## Science Futures Evening

Science Futures Evening is a free annual event for Year 12 and Year 13 students. Over 200 students from around the North Island came with their teachers and parents to the Fisher and Paykel Appliances Auditorium to explore the many different kinds of science-based careers that they might consider. The evening featured a range of role model speakers who have chosen inspiring – and sometimes surprising – careers paths after completing their Science studies. This year featured representatives from Fonterra, Auckland Council, The Centre for Brain Research, Datacom, Vista Solutions, James and Wells Intellectual Property, EverEdge IP, New Zealand Trade and Enterprise and the Faculty of Science Department of Mathematics. Keynote talks were given by the President of the International Association for Ecology and the CEO of Chiasma, a student-led non-profit organisation that fosters connections between science and business. A key message was the great diversity of career options that a Science degree can lead to.

## New mussels to purify our waters

Dr Brendon Dunphy (Biological Sciences), featured in the media in August for his part working alongside local iwi and volunteers to help clean up pollution and increase fish stocks by distributing two tonnes of mussels in Ōkahu Bay. Each mussel can filter up to 350 litres a day, taking chemical and metal residues out of the water. The aim of the regeneration project is to lay the new mussel beds to purify the water and bring back the fish. The beds will be monitored and regularly tested for toxins and will have a positive impact on habitat structure so animal life can settle and increase the levels of productivity in the environment.



## Seismometers in Schools

The New Zealand Seismometers in Schools programme, called "Ru" after the Māori God of earthquakes and volcanoes, is the brainchild of Dr Kasper van Wijk (Physics) and Dr Ludmila Adam (Environment).

The worldwide programme provides schools with a seismometer, computer, software and full support to study the earth's interior to help develop student's interest in the study of the sciences. The project receives broad support both externally via the Foundation of the Society of Exploration Geophysicists, as well as internally with Science IT in particular.

Dr van Wijk and Dr Adam have installed dozens of stations in the USA and have developed the programme in eight schools as part of New Zealand's Ru network.

Dr van Wijk is happy with the preliminary results: "Every school we have visited so far has been thrilled with the addition of a seismometer to their classroom, and all of them have recorded real earthquakes within days of the installation!"

[Read more about Ru at ru.auckland.ac.nz](http://ru.auckland.ac.nz)



## Summer open days and Alumni Day at Goat Island Marine Discovery Centre

The Goat Island Marine Discovery Centre provided fun family days out at its two open days last summer.

On Boxing Day, a sausage sizzle, coffee cart and even Sponge Bob Squarepants were on hand to welcome visitors to the Centre. Patrons were treated to face painting and a half price entry fee with a golf cart on hand to ferry people up the hill from the beach. It proved to be so successful that the Discovery Centre, which has different opening times throughout the year, had another family day on Auckland Anniversary Day to make the most of summer and increase public awareness of the Centre, its interactive displays, touch tank and its wealth of information about the marine environment.

The Alumni Day held at the end of March proved to be a special day for Alumni Society members and donors. The invitation only event welcomed people to the centre where a marquee was erected for the occasion. Music played and lunch was available alongside special tours of the research centre. Speakers, including Professor John Montgomery (Marine Science), Dr Rochelle Constantine (Biological Sciences) and students spoke about their research.

## World Science Day

As part of the 2014 World Science Festival, the Department of Physics organised a live stream of the talk Ripples from the Big Bang: Listening to the Beginning of Time. The discussion, widely touted as ‘bringing together the world’s most respected pioneers in cosmological theory and observation to explore the state of the art in the ongoing quest to understand the beginning of the universe,’ brought an enthusiastic audience to the Fisher and Paykel Appliances Auditorium on a mid-winter Saturday morning. Professor Richard Easter (Physics) was on hand at the end of the stream to answer questions from the audience.



## Learn how to learn

Dr Catherine Mohr gave an aspirational talk aimed toward school students, undergraduates, their parents and teachers, while visiting the University in October. An attentive audience listened to Dr Mohr as she spoke about her career ascension based on the organic chemistry she has made throughout her life while studying Chemistry, Mechanical Engineering and Medicine. As a result, Dr Mohr has enjoyed a successful career merging her professional and personal interests. She called on the audience to “Learn how to learn” and demonstrated that new skills no matter how divergent they seem at the time can cross pollinate and contribute toward a yet unknown stellar career.

Dr Mohr also delivered a public lecture about surgical robots and the advent of minimally invasive surgical practise.



**Faculty of Science**  
The University of Auckland  
Private Bag 92019  
Auckland 1142  
New Zealand

[www.science.auckland.ac.nz](http://www.science.auckland.ac.nz)