

InSCiight

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Issue 06



Expanding the
forensic science toolkit
Origins of everything
Humanising computers
Marine science pioneers

Editorial team:

Rebekah Holmes, Linda Thompson

Feature writer: Pauline Curtis

News writers:

Sabine Kruekel, Judith Poland

Design: Timberlake Studio Ltd

Faculty of Science

Email: scifac@auckland.ac.nz

www.science.auckland.ac.nz/inscight

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

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

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

Contact:

Pauline Curtis: p.curtis@auckland.ac.nz or
Rebekah Holmes: r.holmes@auckland.ac.nz

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On the cover: An artist's impression of the new tower to be erected in the place of the Chemistry Building on the corner of Symonds and Wellesley Streets.

A word from the Dean

This year has seen a huge amount of work to upgrade the Faculty's physical environment.



Professor Grant Guilford, Dean of Science

As described on the facing page, one building project has been completed, another is reaching its final stages, and a third has been approved. This follows the redevelopment of the Leigh Marine Laboratory described in last year's magazine.

The building programme is opening up new opportunities for teaching, research, and our relationships with industry. It is providing spaces that are better suited to modern university activities and will accommodate future growth. And it's creating an environment that is much more welcoming than the imposing pebble-dashed buildings our alumni will recall.

The construction programme embodies the Faculty's work to ensure that it operates at the highest possible standard.

Behind the scenes, for instance, a wide-ranging programme is underway to enhance the creativity, quality, and impact of our research. One of the ways we're doing this is through a focus on multidisciplinary research. The construction work is aiding this, by bringing departments together and creating spaces that facilitate interaction and cross-fertilisation of ideas.

Advances like these are built on a very solid foundation. We're proud of the quality of our research, evidenced by the honours awarded to Professors Marston Conder, Rod Gover, and Margaret Brimble and Drs Nicholas Shears and Quentin Atkinson described in this issue of the magazine.

The breadth of our science is illustrated by the research profiles, which range from studies into the origins of the universe to new forensic science techniques and how to "humanise" computers. And a story about 50 years of marine science shows the impact that our researchers can have.

In the magazine you'll also find examples of our industry links. We have a very productive history of working with industry, and welcome increasing awareness of the links between science and economic growth and investment in applied science. As a comprehensive science faculty we're committed to excellence in both targeted commercial research and curiosity-driven fundamental science.

The Faculty places particular emphasis on high quality teaching and learning. This year we congratulate Professors Michael Walker and Robin Kearns for their outstanding success at the National Tertiary Teaching Excellence Awards. We're also finding ways to further enrich our students' experience.

At undergraduate level, for example, we've implemented a new orientation programme, have adapted Faculty-wide learning outcomes and are in the process of developing an enrichment programme to stretch our highly capable students. For our postgraduate students, the joint graduate schools described in last year's magazine are offering a wider range of research opportunities and increased contact with industry. Our students will also benefit from the improvements in learning, research, and social spaces that the building programme will provide.

The future for the Faculty is very promising indeed, and I look forward to seeing all these initiatives come to fruition.

PROFESSOR GRANT GUILFORD
Dean of Science
The University of Auckland



Artist's impression of the redeveloped Building 301 (left) and Building 303 (Right)

Around the Faculty

Science redevelopment

A major redevelopment will provide state of the art research and teaching facilities for the Faculty of Science and a new entranceway to the University. The project is part of a ten-year campus renewal plan that is bringing the University's facilities up to the highest possible standard.

The existing south podium of the building on the corner of Symonds and Wellesley Streets will be demolished and a new tower erected in its place. The new building will comprise eleven stories and a basement with a total floor area of 23,500 m². Much of the adjacent tower building will also be refurbished, giving a total of almost 38,000 m² of new or refurbished space.



Artist's impression: Students will benefit from large communal spaces and informal areas.

The redevelopment will accommodate most of the faculty's forecast growth in research activities and staff and student numbers over the next ten years, and will provide modern research, teaching and study environments. It will also bring together disciplines that have been widely dispersed across the campus, increasing opportunities for cross-disciplinary collaboration. The Schools of Environment, Psychology and Chemical Sciences will move into the new building.

The redevelopment will provide a welcoming entranceway on one of the University's busiest street corners. From open public spaces on the ground floor the building will transition into formal teaching spaces and then specialised research areas on the upper levels. Students will benefit from large communal spaces, centralised student services, informal areas with access to wireless internet and drop in study spaces.

The work which is due to begin in 2013 and to be completed in 2017 follows the refurbishment of the Science building on the corner of Wellesley and Princes Streets which has been underway since late 2010 and is scheduled for completion at the beginning of 2013.



New, purpose-built teaching and research facilities in the Department of Sport and Exercise Science.

A third Science building project was completed in May 2012: The Department of Sport and Exercise Science, located at the University's Tāmaki Innovation Campus, received a new purpose-built undergraduate teaching laboratory and a suite of research laboratories. The new spaces, which are located in Building 731, brought the department into the Health Innovation sector at Tāmaki Campus alongside the School of Population Health, the Centre for Patient Safety Simulation, Clinical Psychology and the University of Auckland Clinics.

Artist's impression: Formal teaching spaces and specialised research areas will be located on the upper levels.





Visitors to the Marine Discovery Centre can learn about marine life and ecosystems through the interactive displays.

Getting close to marine critters

After its official launch in June 2011, the Marine Discovery Centre at Leigh opened its doors to the public for the first time on Labour Weekend 2011. Despite the poor weather, the centre, which was made possible by a generous gift from the Edith Winstone Blackwell Foundation Trust, enjoyed good visitor numbers over the 2012 summer season and commenced its outreach activity with schools after the busy summer holiday period.

Schools from as far north as the Bay of Islands and as far south as New Plymouth, participated in the centre's activities which include experiencing what marine scientists do, looking at marine ecosystems and discussing the benefits of marine reserves. In March alone more than 1000 children visited the centre.

"The feedback from schools was fantastic and highlighted the value of the visit to their teaching programme," says Rebecca Goffin, the centre manager. "One primary school teacher told us she conducted a survey with her class and the students and parents overwhelmingly said they would love to come again."

The Leigh Discovery Centre continues to refresh displays and add new exhibits, and plans to offer morning information sessions on the plants and animals of the Marine Reserve next summer so a stop to the centre will be on the 'must do' list for visitors to Goat Island Marine Reserve.



Visitors to the Marine Discovery Centre enjoy exploring the touch tank.

University's Cabernet Merlot Franc a five star hit

Goldie Wines has received an excellent five star review for its latest release – the 2010 Goldie Cabernet Merlot Franc. Notable wine reviewer and blogger Raymond Chan reviewed a selection of the Goldie and Island ranges of wines available from the vineyard, which is now under University ownership and serves as a teaching and research facility for the faculty's Wine Science Programme.

He gave particular praise to the 2010 Goldie Cabernet Merlot Franc calling it "elegantly proportioned and very fine-featured with bright, ripe and luscious blackcurrant and blackberry flavours, along with red fruit nuances."

The vineyard's other premium wines under the Goldie label also scored well with the 2010 Goldie Syrah and the 2011 Goldie Chardonnay receiving silver awards.

Wine Science students associate judges at Upper North Island Wine Competition

In its second year the 2011 Upper North Island Wine Competition, organised by the School of Chemical Sciences' Wine Science Programme, attracted 100 entries by 33 winemakers from Northland, Auckland, Waikato and Bay of Plenty. The annual competition aims to give greater recognition of the region and its unique and historic contribution to the New Zealand wine industry. It is also a valuable opportunity for top wine science students to gain experience as associate judges, who do not influence the final outcome but learn by comparing scores and discussing the wines with the judging panel.

Ti Point Vineyard's 2010 Ti Point One Merlot Cabernet franc and Omaha Bay Vineyard's 2009 Pinot gris, both from Matakana, were named the champion red and white wines of the 2011 competition. Gold medals were awarded to six wines, and silver and bronze medals went to 12 and 35 wines, respectively.

Ben Dugdale, winemaker at Karikari Estate and an Upper North Island Wine Competition committee member and judge, said that winemakers from his region see the competition growing in future and strengthening the links between producer and the University. "Having a relationship with the University opens pathways for the producers in terms of knowledge and information as well as giving students valuable options in terms of possible employers or direct feedback in terms of real issues that face the industry."



New postgraduate opportunities in Science

The Faculty of Science has established three new Master of Professional Studies programmes in Food Safety, Mathematics Education and Data Science. The new one-year programmes are aimed at professionals with a first degree and workplace experience who aspire to senior positions within their sector by building on their existing industry knowledge.

For more information about the programmes visit:

www.science.auckland.ac.nz/food-safety

www.science.auckland.ac.nz/math-education

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

Beyond the borders

More than 90 poster presentations and talks by PhD students made the fourth annual Chemical Sciences Research Showcase the largest student research event of its kind in the Faculty of Science calendar. What started as a low-key poster competition four years ago has developed into a one-day forum for postgraduate students to present and discuss their research with the New Zealand Chemistry community, and to network with potential employers. It also provides a unique opportunity for the students to take a look at what their peers are doing.

"Some of the research presented is the direct result of ideas exchanged at last year's showcase, and we encourage our students to search for inspiration beyond the borders of their branch of chemistry," says Gerard Logan who chairs the organising committee. Head of School, Professor Jim Metson, who opened the event together with Vice-Chancellor Professor Stuart McCutcheon, said it was fantastic to see the quality and breadth of work undertaken in the school and the confidence and communication skills of the PhD students who were presenting.

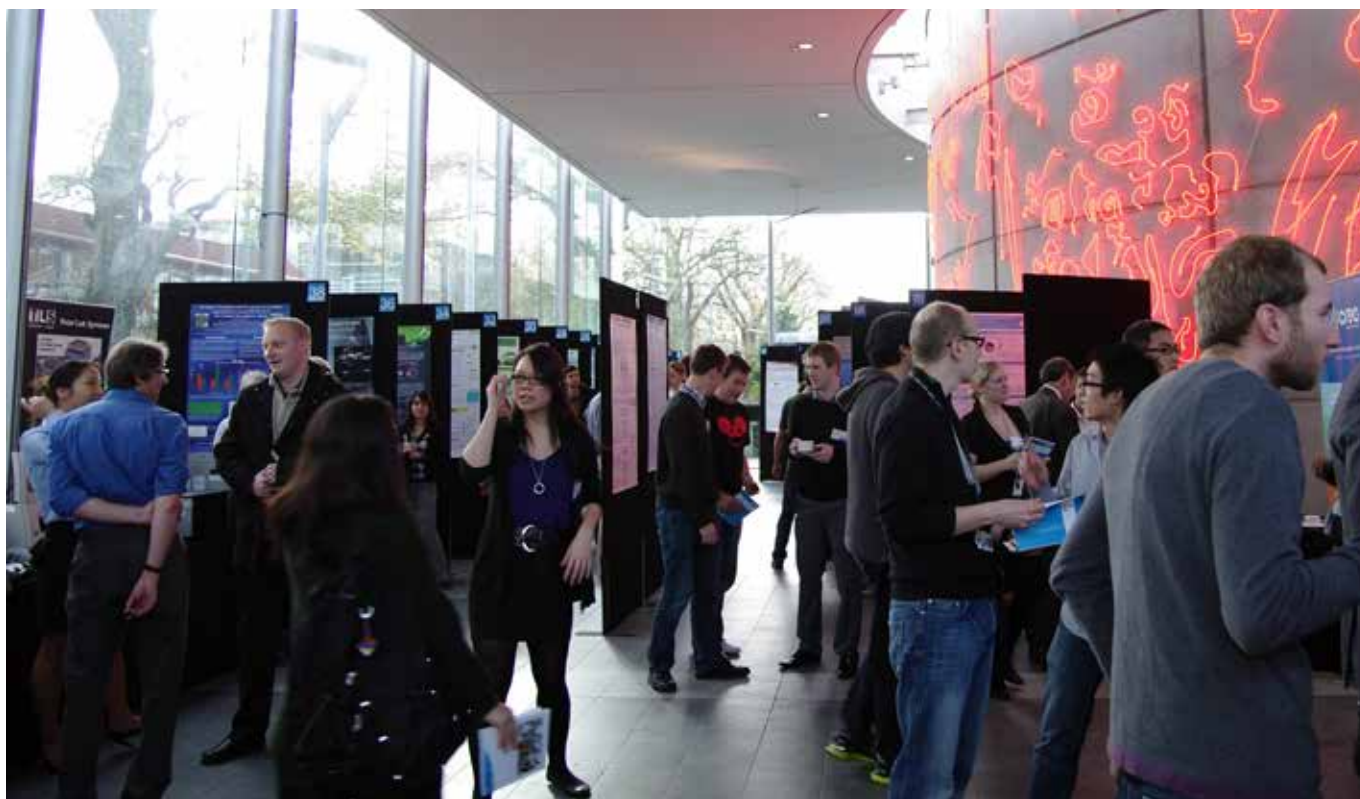
Companies such as Fonterra, Fisher & Paykel Healthcare, Sigma-Aldrich and intellectual property firm Baldwins sponsored prizes for the best poster and oral presentations. Peter Varelis, Senior Research Scientist at Fonterra said that being part of the event was an excellent way "to meet and support the bright talents of tomorrow".



Judging the poster competition was a difficult task, given the quality and breadth of the research presented.



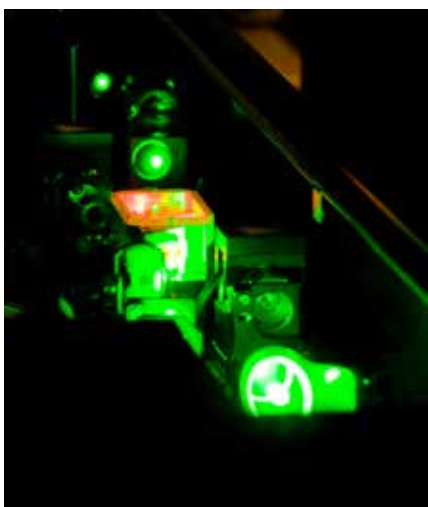
Networking with the New Zealand Chemistry community is just one of the benefits of the Research Showcase.



More than 90 posters were presented in the fourth Annual Chemical Sciences Research Showcase.

Industry partnerships

"Science and innovation are critical to sustainable economic growth, and the creativity and insight our science offers draws many local and global companies to partner with the Faculty," says Dean of Science Professor Grant Guilford. "In working with industry we're committed to both commercially-aware research excellence and maintenance of the independence of thought upon which our scientific creativity and public trust depends." The profiles below illustrate just some of the ways the Faculty partners with industry, across a range of sectors from primary industry to manufacturing.



A high-tech short-pulse laser at the Photon Factory

Making light work

Improving designs for solar harvesting and exploring new designs for GPS chips are just two of the projects underway at the Photon Factory – a test bed for science and innovation opened in 2010. Drawing together chemists, physicists, and engineers, the Photon Factory, led by Dr Cather Simpson, uses high-tech short-laser pulses to manufacture miniature features (as small as 0.001 mm or less) on a wide range of materials. The group has already successfully worked with well-known New Zealand companies like Rakon, Fisher & Paykel and Izon, and a team led by Cather recently won \$7.68 million in Government funding to transfer high-tech research in the field to local companies. In its first industry project, with Next Window, the Photon Factory designed, prototyped and tested a new widget that improves optical touch screen technology, and is now being mass-manufactured in Europe. More recently the Photon Factory established start-up company Engender to commercialise its research on micro-scale devices to sort sperm. The technology offers a much cheaper and less harmful way of sorting sperm for the dairy industry and other agricultural sectors, and has the potential to generate significant revenue.

photonfactory.auckland.ac.nz

Fast-tracking biotechnology

High profile New Zealand businesses like natural health and beauty products company Comvita and leading global dairy co-operative Fonterra (through its research subsidiary ViaLactia Biosciences Ltd) have co-located their research and development divisions in the Institute for Innovation in Biotechnology (IIB). The IIB is a bio-industry cluster based in purpose-built facilities opened by the Prime Minister last year. Through co-location, companies from start-ups to mature businesses are accelerating their innovation programmes by accessing state-of-the-art research facilities and expertise while their intellectual property remains fully protected. They can also engage in collaborative projects with academic researchers and get involved in the Master in Bioscience Enterprise – a training programme that produces business-savvy scientists highly sought after by industry. "We're creating a functional ecosystem where industry and academic staff mix without boundaries," explains Director Professor Joerg Kistler. In addition to its co-location arrangements and enterprise training, the IIB provides international consultancy services and runs regular networking functions and specialist workshops.

www.biotech.co.nz

Optimising aquaculture

The New Zealand aquaculture industry is growing rapidly and has set itself a target of \$1 billion in annual sales by 2025. Associate Professor Andrew Jeffs and his students from the Leigh Marine Laboratory work closely with the seafood industry, on everything from farming rock lobsters to nutrition for sea cucumbers. For instance PhD student Oliver Trottier is studying the impact of parasitic pea crabs on Greenshell™ mussels – farmed native green-lipped mussels. He found that pea crabs cost the industry \$2.16 million each year, by limiting the growth of the mussels they inhabit. Based on detailed studies of the parasite's biology he is now investigating practical ways for mussel farms to lower infection levels. The project began when Oliver approached Greenshell New Zealand with his research proposal and was granted access to their farms. A successful relationship developed and MSc student Jessica Feickert has now won a scholarship to extend the work, through a government scheme that funds research with an impact on industry.

www.marine.auckland.ac.nz/uoa/oliver-trottier



After officially opening the facilities, Prime Minister the Rt Hon John Key tours the IIB with Director Professor Joerg Kistler and University of Auckland Chancellor Mr Roger France

Clearing the air for aluminium

Aluminium is the second largest metals market internationally. Controlling emissions from aluminium production is important for the environment as well as for smelter workers. Professor Jim Metson, Head of Chemical Sciences and Professor Margaret Hyland from the Faculty of Engineering, work with the aluminium industry to ensure that smelter emissions meet tight regulations. They are two of the principal scientists in the university's Light Metals Research Centre (LMRC), a supplier of research and technical support to aluminium smelters around the world. Before alumina goes into a smelter to be reduced to aluminium metal, it is used to "dry scrub" or clean the air coming off the pot lines. Jim and Margaret work with both smelters in improving scrubbing performance and with companies who supply equipment to the alumina refining industry, helping them control the nature of the alumina produced and, as a consequence, its efficiency in dry scrubbing. They played a major role in the upgrade of New Zealand's Tiwai Point smelter, but most of their work is now focused overseas, for instance with a German company supplying equipment to alumina refineries around the world.

www.lightmetals.co.nz

Staff news

New Heads of Department/School Directors



Professor Richard Easter, who joined the University in January 2012 from his former position as an Associate Professor of Physics and Astronomy at Yale University, has been appointed Head of the Department of Physics. Richard holds a Bachelor of Science (Hons) and a PhD in Physics from the University of Canterbury and worked in postdoctoral positions at Waseda University, Brown University and Columbia University before taking up an Assistant Professorship at Yale in 2004. He has

worked in many areas of astrophysics and theoretical cosmology, exploring the origins of the universe and the mechanism responsible for the Big Bang, in particular the astrophysical predictions of models of the very early universe and the cosmological implications of string theory.

Read more about Richard's research in our feature story *The origins of everything* on page 12.



After leading the School of Biological Sciences as acting director for six months **Professor Gillian Lewis** was confirmed as Head of School in August 2011. Gillian earned her undergraduate degree and PhD at the University of Otago and has held academic appointments at the University of Otago, The University of Auckland and Baylor College of Medicine in Texas, as well as working as a visiting lecturer at the University of North Carolina and an environmental scientist at URS New

Zealand Limited. Her work centres around applied freshwater ecology, in particular the microbiology and restoration of degraded water bodies. Over the last ten years Gillian has focused in particular on stream biofilms – sheets of bacteria, fungi and other microorganisms that stick to each other and to surfaces in the environment.

Multiple honours for Mathematician

Internationally renowned mathematician **Professor Marston Conder** is one of four researchers from New Zealand universities to receive a prestigious James Cook Research Fellowship in 2011.

The fellowships, administered by the Royal Society of New Zealand on behalf of the Government, are awarded to researchers who have achieved national and international recognition in their area of scientific research and allow the researchers to undertake concentrated work in their fields of expertise for two years. Marston's research will address many outstanding questions about symmetries of discrete structures, and develop a better understanding of the nature of symmetry. Discrete structures occur in a wide range of fields, including many other branches of mathematics as well as molecular chemistry and the design of computer architectures and efficient distribution networks.

Marston's research expertise in Algebra, and in particular in the study of symmetry, was also recognised by two other prestigious honours: In December 2011 Professor Conder was appointed the first Distinguished Professor of Mathematics by The University of Auckland, only three months after being named the first Maclaurin Lecturer by the New Zealand Mathematical Society and American Mathematical Society. The inaugural lectureship will see him touring the United States and giving lectures in several prestigious universities, as well as a plenary address to the American Mathematics Society.

In September 2012, Marston was also invited to join the inaugural Class of Fellows of the American Mathematical Society. An invitation recognises outstanding contributions to the creation, exposition, advancement, communication and utilisation of mathematics.

New Professors

Five associate professors in the Faculty of Science have been promoted to professor.

Professor Robert Amor (Computer Science) performs research in construction informatics, developing and adapting beneficial computer science techniques for the architectural, engineering and construction industries. Robert's primary research interest is in achieving interoperability between software tools undertaken in collaboration with the University's School of Architecture and Planning and the Civil and Environmental Engineering Department.

Professor Tom Brittain (Biological Sciences) is a specialist in molecular, cellular and developmental biology. His research interests are in physical biochemistry, in particular, the study of the structure and mode of action of metalloproteins and in functional studies which range from fundamental theoretical and physico-chemical characterisation to investigations of actions in vivo and in cell culture.

Professor Kendall Clements (Biological Sciences) works in the area of ecology, evolution and behaviour. His main research focus is the biology of marine herbivorous fish, from ecological work on feeding rates and diet choice to biochemical and physiological studies on metabolism and the function of the digestive system. Kendall also has a research interest in the evolution of reef fish, and has had two Marsden grants to study speciation in triplefin fish, which are abundant and diverse in New Zealand waters.

Professor Georgy Gimel'farb (Computer Science) is a world-known expert in image processing, computer vision and statistical pattern recognition. His main areas of interest include computational binocular stereo, texture modelling, 3D scene description from image and range data, and medical image analysis for computer-aided diagnostics. Georgy has authored or edited four books and published more than 320 refereed publications.

Professor Sally Poppitt (Biological Sciences) holds the Fonterra Chair in Human Nutrition and is the founding director of the University's Human Nutrition Unit. Her research has been focused on the prevention and treatment of conditions arising from poor nutrition including overweight and obesity, metabolic dysregulation and diabetic and cardiovascular risk. She has a particular interest in the mechanisms which underpin appetite regulation and the control of food intake.

In addition, the Faculty is pleased to welcome the following external professorial appointments, who will add enormous value to our research and teaching: **Professors Elwyn Firth** (Sport and Exercise Science), **Bernd Krauskopf** (Mathematics, previously University of Bristol), **Pat Langley** (Computer Science, previously Stanford University), **Hinke Osinga** (Mathematics, previously University of Bristol), **Joel Rothman** (Biological Sciences, previously UC Santa Barbara) and **Margaret Wetherell** (Psychology, previously The Open University).

Professors William Lee and **Roger Pech** from Landcare Research, **Professor Margot Skinner** from Plant and Food Research and **Professors Wendy Nelson** and **Simon Thrush** from NIWA were co-appointed to work in the Faculty's Joint Graduate Schools.

New Fellow of the Royal Society of New Zealand

Department of Mathematics **Professor Rod Gover** has been elected as a Fellow of the Royal Society of New Zealand, a title honouring New Zealand's top researchers for distinction in research or in the advancement of science, technology or the humanities.

Rod is an internationally recognised expert in geometry and its applications to analysis, differential equations and theoretical physics. His research not only tackles fascinating mathematical problems but is of direct relevance to other fields of science and can be used to explain how light behaves as it travels through space, how cells organise themselves into tissues, and to explain the properties of materials used in construction. Rod's latest project in collaboration with a physicist who studies the fundamental physics of the universe looks at questions which arise in string theory and quantum gravity.

New Year Honours and Distinguished Professorship for Margaret Brimble



Professor Margaret Brimble was made a Companion of the New Zealand Order of Merit for services to science during the 2012 Queen's New Year Honours. The order is awarded to those "who in any field of endeavour, have rendered meritorious service to the Crown and the nation or who have become distinguished by their eminence, talents, contributions, or other merits".

Only one month before receiving the honour, Margaret was appointed to the rank of Distinguished Professor, a title that recognises professors who have achieved international eminence of the highest order in their fields of research and study. Her research on bioactive compounds that have been isolated from plants, microbes or marine organisms to be used in medicinal compounds has been recognised with numerous national and international awards, including the 2011 Adrien Albert Award from the Royal Australian Chemical Institute, the 2010 Royal Society of Chemistry UK Natural Products Chemistry Award and a 2007 L'Oréal-UNESCO Women in Science Laureate for Asia-Pacific in Materials Science.

Early career research excellence

Rutherford Discovery Fellowships for New Zealand's top young researchers have been awarded to academic staff members **Dr Nicholas Shears** and **Dr Quentin**

Atkinson and alumnus **Dr David Goldstone**. The fellowships provide ten early-to-mid career researchers from around the country with up to \$200,000 annually for the next five years.



Dr Nicholas Shears is based in the Department of Statistics and undertakes marine research at the Leigh Marine Laboratory. The fellowship supports his work examining the impacts of human activity

on coastal ecosystems, and predicting how these effects are likely to vary with climate change.

Fellow recipient **Dr Quentin Atkinson** from the Department of Psychology is examining how languages and cooperative cultural systems evolve through time, using the same sorts of tools that biologists use to study species evolution.

The two scientists are joined by **Dr David Goldstone**, a structural biologist previously based at the National Institute for Medical Research in the United Kingdom, who has returned to The University of Auckland, where he studied. The fellowship funds his on-going research on key proteins involved in the immune response to retroviruses, a family of pathogens that includes HIV.

Teaching excellence

Staff from the Faculty of Science have scooped two of the 12 National Tertiary Teaching Excellence Awards for 2011 plus the Prime Minister's Supreme Award. The awards are managed and administered by Ako Aotearoa – The National Centre for Tertiary Teaching Excellence. They aim to recognise and celebrate excellence in tertiary teaching.

Professor Michael Walker (School of Biological Sciences) received the Supreme Award for tertiary teaching excellence worth \$10,000 along with a "sustained excellence in teaching in a kaupapa Māori context" award worth \$20,000. Michael is of Te Whakatōhea descent and established the Tuākana Programme more than 20 years ago to improve retention rates for Māori and Pacific science students, particularly in their first academic year. The innovative programme has been so successful that it has been rolled out across all university faculties.

The second sustained excellence in tertiary teaching award, worth \$20,000, went to **Professor Robin Kearns** (School of Environment). Robin has taught Geography at the University since 1990. "He is an internationally recognised researcher," says his citation, "and a dedicated and energetic teacher of learners at every level, covering a very wide range of subjects across human geography,

the environment and public health. He focuses on cultural safety, he mentors and he shares his teaching expertise with others. Robin's goal is to inform, provoke and captivate, although he recognises that teaching is 'an imperfect art'."

Director appointed for New Zealand eScience Infrastructure

Nick Jones has been appointed Director of the New Zealand eScience Infrastructure (NeSI), a nation-wide supercomputer network designed to support cutting-edge research. The co-Director of The University of Auckland's Centre for eResearch comes to the role with extensive experience in e-research, network design, e-learning, and software research and development, as well as governance of collaborative projects across the New Zealand research sector. NeSI along with Professor Mark Gahegan and colleagues from each of the partner institutions.

Launched in June 2011, NeSI provides New Zealand researchers with high-performance computing capabilities and eScience services indispensable to scientists around the world as they tackle increasingly complex and data-intensive research questions. The network brings together new and existing supercomputer facilities and a national team across The University of Auckland, Canterbury University, the University of Otago, NIWA and Landcare Research. NeSI will be built over the next three years with \$48 million co-invested by the Government and partner research organisations.

New Research Director for Ngā Pae o te Māramatanga

Dr Daniel Hikuroa, a leader in the integration of indigenous knowledge and science, has been appointed Research Director of Ngā Pae o te Māramatanga, a Centre of Research Excellence consisting of 16 partner research entities and hosted by The University of Auckland.

The former Community Earth Systems Science Programmes Manager at the Institute of Earth Science and Engineering (IESE) and lecturer at the School of Environment has realised many community based projects ranging from geothermal developments to industrial waste site rehabilitation. As Research Director of Ngā Pae o te Māramatanga, Daniel will continue to investigate the enormous potential that integrating indigenous knowledge and science can yield, both theoretically and practically. His experience will further strengthen the centre's research relevant to Māori communities and reinforce its role as an important vehicle by which New Zealand continues to be a key player in global indigenous research and affairs.



Treasure hunting in Antarctica

Collecting penguin guano (dung) and remains in sub-zero temperatures might not sound like the ideal vacation for most IT professionals but it has been an unforgettable experience for **Yvette Wharton**. The Science IT staff member

travelled to Antarctica in December 2011 as a member of a research team that seeks to find evidence of how Adélie penguins have adapted genetically to a changing climate in Antarctica over the last 40,000 years. Led by **Dr Craig Millar**, Senior Lecturer at the School of Biological Sciences, and experts from Italy and Australia, the team collected bones, egg shells and guano samples from relict and abandoned colonies along a seven-kilometre coastal stretch between Cape Bird and Cape Royds on Ross Island. The bones can be used for DNA analysis and layering of the artefacts and radiocarbon dating then reveal at what point in time the penguins inhabited the area.

The trip last summer was already Yvette's second visit to Ross Island. In 2005 she supported one of Craig's previous research projects that looked at the evolution rates of penguins by collecting and analysing bone and blood samples. Since her graduation from the faculty with a Master of Science in Marine Ecology, Yvette has kept a close connection with the School of Biological Sciences, supporting the BIOSCI 100&100G Antarctica: The Frozen Continent course with online tutorials and course material. Working as a laboratory technician in the school she completed a Graduate Diploma in Information Systems and joined the Science IT team.



Researchers seek to find evidence of how Adélie penguins have adapted genetically to changing climate in Antarctica over the last 40,000 years.

"The interest in science drives me, and the opportunity to work with interesting researchers and to collect teaching material for my tutorials", says Yvette when asked about her personal motives to donate her time to science. "And of course experiences such as meeting Falcon Scott, the grandson of Robert Falcon Scott, on my last trip. That was a highlight".



Faculty of Science Kaiārahi Michael Steedman features on Auckland's waterfront signage.

History meets technology at Auckland Waterfront

There are dozens of stories hidden along the Auckland City waterfront and a new initiative by the Auckland City Council featuring Faculty of Science Kaiārahi **Michael Steedman** allows visitors to discover some of them. The council installed 12 blue signs across the waterfront that present the history, urban design characteristics and Māori heritage of these places. Scanable QR codes on these signs allow visitors to access online videos through their smart phones.

Michael, who provides direction and support to Māori and Pacific students at the Faculty of Science and is a member of the Ngāti Whātua iwi, introduces visitors to the history of Te Wero Island as part of this initiative. The small headland at the entrance of the Viaduct Harbour was named after 'te wero', the traditional challenge that is performed at the beginning of a formal pōwhiri. Scanning the QR code on the sign brings up a video of Michael performing the welcome ceremony.

For the QR Code Journey locations visit www.waterfrontauckland.co.nz/journey



Science Research Fellow scoops top photo

Science Research Fellow Dr Mazdak Radjainia won the first prize in the Wildlife category of New Zealand Geographic magazine's Photographer of the Year 2011 competition. The winning photograph depicts a humpback whale mother assisting her new born baby to stay and breathe at the surface.

Mazdak received a PhD from The University of Auckland in 2010 and currently works as a research fellow at the School of Biological Sciences' electron microscopy group. The hobby photographer was on a spearfishing mission in Niue, which is on the migratory path of humpback whales travelling from their feeding grounds in Antarctica to the tropics for calving and mating, when he spotted the cow and calf.

Student News



Faculty launches new look Orientation

For many students, the first week at university can be bewildering and even intimidating as they try to find their bearings and adapt to a whole new way of learning. On 23 and 24 February 2012, the Faculty of Science introduced a new style Orientation programme designed to welcome and support our new students and provide the opportunity to make friends and meet faculty staff. A two day event was created to teach the basic skills in taking lecture notes, time management and the important balancing of academic and social life. Science students spoke on film about the challenges they have faced at university and how these were overcome, others led guided tours of the faculty and other important parts of the campus, ending at our various schools and departments for an informal welcome and social event. Following the success of this year's venture, the Faculty of Science will continue to ensure that our students feel welcome, secure and supported and make the most of their university experience.

Best Doctoral Thesis Award for Computer Scientist



Dr Joseph Heled, a recent graduate from the Department of Computer Science, is one of only five recipients of the Vice-Chancellor's Prize for Best

Doctoral Thesis in 2011. From a total of 319 doctoral degrees successfully awarded, 19 nominations were received from faculties for the five prizes. The nominations are ranked (among other things) by significance of the thesis in its field, the originality and excellence of the research, and representing exceptional academic and intellectual achievement.

Joseph's thesis focused on Bayesian computational inference of species trees and population sizes. His thesis work is right at the forefront of research in evolutionary bioinformatics and the software methodologies he developed addressed some of the key open questions about analyzing and interpreting the complex evolutionary and population genetic processes that generate multi-individual multi-species genomic data sets. His contribution to the field has already been substantial and many interested observers look forward to following the development of his ideas as his career unfolds.

Joseph is currently employed as a postdoctoral fellow in the Department of Computer Science.

3 minute thesis competition



Kien Ly from the School of Biological Sciences won the 3-Minute Thesis competition 2012 with his PhD thesis presentation *Rise of the planet of the worms:*

towards a cure for Alzheimer's Disease. More than 70 postgraduate students from throughout the University competed in this year's competition where competitors must sum up their entire research in just three minutes using only one PowerPoint slide.

Kien was one of eight finalists who battled it out to be crowned this year's winner in what was an entertaining and animated final. At the sound of a buzzer each competitor raced against the clock to present their ultimate "elevator pitch" on thesis topics ranging from bionic suits and agent based modeling to Alzheimer's and anthraquinones.

Kien was applauded by the judges for his ability to present a serious study with flair, animation and humour. Supervised by Dr Russell Snell he is using a species of microscopic worm called *C. elegans* to understand Alzheimer's disease and his presentation focused on why he chose worms over more traditional model species such as rats and monkeys.

As the 3-Minute Thesis competition winner, Kien will fly to Brisbane to represent The University of Auckland at the trans-Tasman finals hosted by The University of Queensland in October.

Biomedical Science student wins the 2011 Prime Minister's Future Scientist Prize

The Prime Minister's Future Scientist Prize is awarded annually to a secondary school student for their achievements in carrying out a practical and innovative research or technology project. The 2011 prize went to current first-year Biomedical Science student **Nuan-Ting (Nina) Huang**. Nina's success arose from her research into a possible link between mental concentration and the early onset of short-sightedness, a project she began as part of the International Baccalaureate Diploma while a Year 13 Student at Auckland's Diocesan School for Girls. Working with a group of Year 7 students, she investigated how the pupil size of students' eyes changed when they carried out tasks at near and far distances and requiring different levels of concentration, from solving mathematics equations to reading simple sentences. Solving maths problems, orally and on paper, led to pupil size decreasing, which Nina concluded was due to mental concentration inhibiting the contraction of the dilator muscles in the eye. In addition, the eye increased its optical power to focus on the task.



First-year Biomedical Science student, Nina Huang, winner of the 2011 Prime Minister's Future Scientist Prize.

The Future Scientist Prize gave Nina a \$50,000 scholarship to assist with her tertiary studies. The research also won Nina the Genesis Energy Supreme Award in the Royal Society's 2011 Realise the Dream Competition. This provided her a further \$7,000 cash scholarship and an all expenses paid trip to compete in the European Union Young Scientist Competition in Slovakia in September 2012.

Nina has not yet decided in which field she would ultimately like to specialise but she continues to be passionate about research and is enjoying her studies in Biomedical Science.

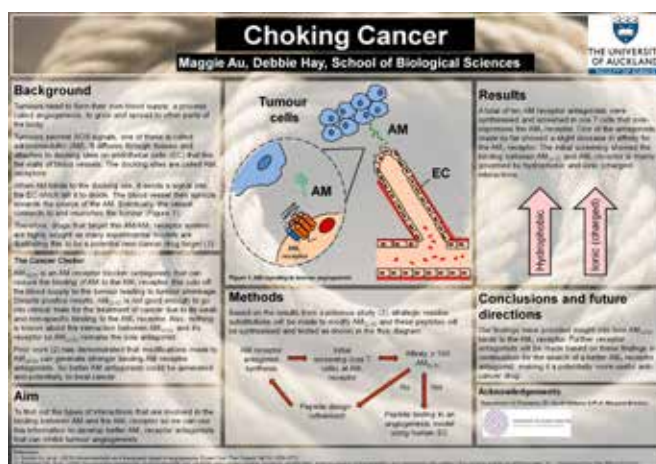
2011 Postgraduate poster competitions

Annual postgraduate poster competitions have once more allowed our students the opportunity to showcase their research.

In the faculty competition, School of Biological Sciences student **Maggie Au** received the first prize for her poster on research into cancer medication. Maggie's research investigates novel ways to block the tumor's ability to grow new blood vessels, allowing it to spread to other parts of the body.

The second prize went to **Kelsey Deane** from the School of Psychology for her poster on measuring the success of a New Zealand-based youth development programme which aims at increasing the academic self-efficacy of students from low decile schools. Kelsey went on to win first prize in the poster section of the University-wide *EXPOSURE Postgraduate Research Exposition* and was also awarded the competition's special prize for her "Contribution to the Advancement of Social Development".

Chemical Sciences student **Karthik Kannappan** was awarded third place in the faculty competition for his poster on the design and efficiency of a novel pump and mixer for microfluidic devices, using the volume change Electrochemically-active Conducting Polymers undergo when switching between oxidised and reduced state.



Biological Sciences student Maggie Au's winning entry in the 2011 Postgraduate Poster Competition.

Also enjoying success at *EXPOSURE* was **Fathima Iftikar**, from the School of Biological Sciences, who was awarded Second Prize in the Oral Presentations section for her presentation *The Heart Warming Impacts Of Climate Change: A Mitochondrial Insight To Heart Failure In Fish*.

Sporting success for Science students

A New Zealand University Blue has been awarded to Faculty of Science student **Toby Scott** for his excellence in orienteering. The awards are recognition of an athlete's achievements in their chosen sport as well as good progress in their academic studies. One of nine recipients from The University of Auckland, Toby is studying for a conjoint degree in Engineering (Honours) and Science with Chemistry as his major.

Meanwhile, three students from the Department of Sport and Exercise Science are making a name for themselves in a variety of sporting challenges.

Toni Keeling, who is studying for a BSc/BE conjoint degree in Sport and Exercise Science and Mechanical Engineering, was the winner of the 2012 Open Female Coast to Coast two-day individual race, crossing the South Island in 14 hours and 20 minutes. The annual challenge which combines running, kayaking and cycling takes competitors over a distance of 243km from Kumara on the West Coast to Sumner in Christchurch on the East Coast. Toni has also successfully competed in multisport events throughout New Zealand and says that her achievements would not have been possible without the support from her supervisor who allowed her to fit her summer research around her training.

In September, **Ana Holt**, along with fellow University of Auckland students **Esthie de Wet** and **Ellyce Stehlin** traveled to Kazan, Russia to take part in the World University Rowing Championships. This was seen as a test event for the 2013 Summer Universiade and the rowing complex in Kazan is described as one of the most advanced in the world. Ana, who is studying for a BSc in Sport and Exercise Science and Physiology, competed with Ellyce in the Lightweight Women's Double Sculls. The pair finished a very commendable 5th in this event. Ana's trip to Kazan was partly funded by a grant from the Vice-Chancellor's Strategic Development Fund. This fund aims to support students in cultural activities and for Ana it proved a huge help in getting to the championships.

Adam Storey, a PhD candidate within the department and a coach for the New Zealand Weightlifting Team, travelled to the 2012 London Olympics Games as coach for weightlifter Richie Patterson. While Richie competed previously at the 2008 Beijing Games, this was Adam's Olympic debut. Competing in the 85kg Men's class, Richie



Toni Keeling, a Sport and Exercise Science and Mechanical Engineering conjoint student, won the 2012 Open Female Coast to Coast individual race.

finished 14th. Previously, Adam had travelled with the New Zealand team to Samoa for the 2012 Oceania and Commonwealth Weightlifting Championships, an event which also served as a Qualification Event for the London Olympics. The New Zealand Men's team was able to secure an Olympic spot and in a tremendous achievement went on to win the overall Men's Team title.

Expanding the forensic science toolkit

PhD students Marie Lecomte and Julia Allwood are developing new forensic techniques to fight crime. Based at The Institute of Environmental Science and Research Limited (ESR), they're amongst the first doctoral students in The University of Auckland's Forensic Science programme working in forensic molecular biology.

Marie is working out how to determine the age of human bruises. "Currently there's no technique to determine how old a bruise is in a living individual," she explains. "A doctor may be called on to give their opinion on how old a bruise is, but that may not be good enough in a court situation."

This creates difficulties in cases of physical abuse when the victim is reluctant, or unable, to tell police what happened. And while doctors can identify patterns of bruising consistent with abuse, they cannot say with certainty when it happened.

To date, researchers have focused on bruise colour as a potential indicator of age but the results aren't always reliable. In part that's because we all perceive colour differently, and even high-tech measurement devices can't cope with changes in skin colour over the body.

Marie is taking an entirely different approach. She's looking for changes in proteins in the skin after bruising. By comparing bruised and undamaged skin she's finding proteins that are present at higher or lower levels than normal at specific times after injury. The ultimate goal is to develop a forensic test for protein "markers" that indicate the elapsed time after bruising.

Since the test may be used with victims of abuse, it's important that it doesn't cause further injury, so Marie uses a method to extract proteins without causing further damage.

She applies a special pump that delivers low frequency ultrasound waves, creating micro-pores in the skin and gently drawing fluid from between the cells. The micro-pores are generated by a temporary change in the top layer of the skin that reverses naturally over a short period of time.

Marie's initial studies, with people who came to the laboratory after accidental bruising, proved unsuccessful because they couldn't give the exact time of injury and there was too much variation in the bruises.

She was therefore granted approval by the University's ethics committee to purposely bruise volunteers. A perhaps surprising number of people have stepped up to have a weight dropped on their arm from a set height, and return over several days to have samples taken.

Marie, whose research is supervised by Dr Douglas Eliot, ESR forensic scientist and Director of the University's Forensic Science programme, and ESR scientist Sue Vintiner, is nearing the end of her PhD.

She has recently pinned down 18 proteins with potentially useful patterns of change, and will soon learn what they are.

One protein that has already been identified shows an unexpected pattern. Haptoglobin, which picks up free haemoglobin so it can be recycled, is found at reduced levels in bruised skin and this seems counterintuitive. Bruises occur where there's blood in the skin and red blood cells that contain haemoglobin break down there, so more haptoglobin might be expected.

Some of the other proteins show a similar pattern and it will be intriguing to find out what their role is. It seems that, in addition to its forensic applications, the work may provide some surprising insights into the molecular changes that occur as bruises develop and heal.

Julia is working on a very different problem – how to use crime scene DNA to identify suspects when there's no match in the National DNA database. "If you can make a link with a standard DNA profile or "fingerprint", that would be the gold standard" she explains. But for cases where there's no such link, Julia is developing a method to predict a person's eye colour, gender, and possibly hair colour from crime scene DNA.

The test will help investigators narrow down their field of suspects. "It's designed to be equivalent to an eye witness account" says Julia, for instance identifying a man with blue eyes. When a suspect is found, a standard DNA profile would still be required.

Identifying suspects based on their physical characteristics raises some interesting ethical questions, like whether it could result in "drag-net" investigations targeting people of a particular ethnicity.

Julia did a lot of research on the issue before beginning her laboratory work. To minimise the risk she has selected genetic markers for eye and hair colour that are indicative of colour alone. They cannot, for instance, be used to infer a person's heritage. "I've gone as far as I can in removing any potential bias," she says.

In the end, "it's a risk, but no greater or lesser than with an eyewitness account." Julia says that if ESR and the police choose to use the test, it would be up to the investigators to ensure it's used appropriately, just like any other investigative tool.

The sequencing of the human genome made the research possible. Julia began by selecting potentially useful genetic markers from large-scale studies investigating their links with physical characteristics. She then tested the markers' associations with those characteristics in a group of New Zealanders.

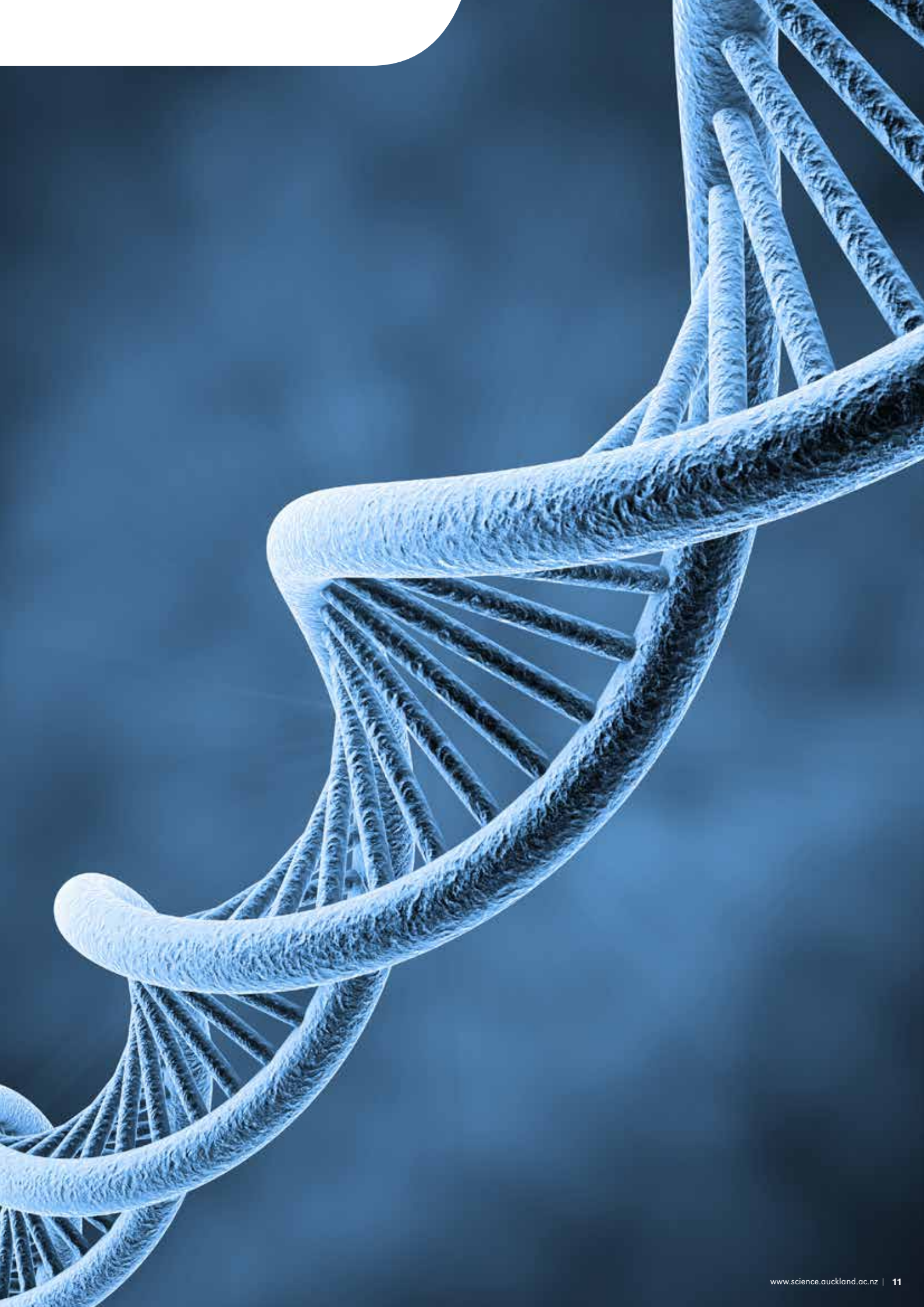
From early consultation with police she knew that markers for eye and hair colour would be useful. She also looked for a new marker of gender since in rare cases a genetic mutation causes the standard test to misidentify males as female. Other physical traits, like height, proved impossible to link to individual genes.

Julia used volunteer DNA to pin down the most useful markers and developed a predictive model based on the results. She successfully identified a new marker of gender that is 100% accurate in her test subjects, and can predict blue or brown eye colour with 94% accuracy.

By chance her volunteer group – which her study protocol stipulated she could not select – had a higher incidence of brown hair than the general population. So while she can accurately predict brown hair, more work needs to be done to confidently predict other hair colours.

Julia points out that if this component of the test were developed further, changes in appearance like balding, greying, and dyeing would need to be taken into account by investigators.

Julia is now into the fourth year of her PhD, supervised by Dr Eliot and Dr SallyAnn Harbison, Senior Science Leader in Forensic Biology at ESR. Julia would like to get the test to the point where ESR and the police can decide whether they'd like to add it to their forensic repertoire.





Origins of everything

“The knowledge we’ve been able to gain about the whole universe, while we sit on this tiny planet, is one of the most profound things the human race has achieved,” says Professor Richard Easther when asked about the role of fundamental science.

As a theoretical physicist and the new Head of Department of Physics, he’s well qualified to comment. Richard is a cosmologist who studies the very early universe, “which is to say the first trillionth of a trillionth of a trillionth of a second,” after the big bang. “This epoch sets the stage for everything that happens as the universe evolves.”

He tests competing theories of the early universe, working out what would happen if a particular theory were true and comparing the predictions with what can be observed today.

“We don’t know the laws of physics that applied immediately after or even during the big bang, but we have some guesses as to what those might be. So we can look at various candidate theories of high energy physics and ask, if this is true, how would the early universe have looked or worked, and what would the universe look like now?”

“We are trying to figure out both the fundamental laws of physics that operate at really high energies and also how the universe began and evolved”

The work provides a means to test some of the deepest ideas in science – at least one of which has entered wider public awareness:

“String theory is often talked about as a potential theory of everything,” Richard says. “It’s the idea that the fundamental building blocks of the universe are little pieces of vibrating string, and that different particles correspond to different vibrational states of the string. It’s not clear whether that’s true, but the theory has been around for a long time.”

One of the only ways to test the validity of the theory may be to look at its cosmological implications. “So at the moment there is a strong push to figure out what the universe would look like if string theory were true. That’s still an open question but the payoff is potentially enormous.” The results would have implications for how we understand everything around us.

The field of modern cosmology emerged around 100 years ago, just after Einstein’s discovery of general relativity, and theories about the very early universe have been debated since that time. “But really, science is

about observations and testing predictions so real progress requires data,” Richard says.

Recent technological advances have meant that the discipline is going from strength to strength. “In the last two decades, cosmology has gone from being primarily a speculative or theoretical endeavour to an empirical science, and we can make a lot of progress that wasn’t possible just a short while ago.”

The emergence of large telescopes and space-based instrumentation such as the Hubble telescope, and the ability to process data with computers mean that for the first time, cosmologists have data that are good enough to really test their models.

In fact, Richard says the data are becoming so good that theoreticians must now provide much more detailed predictions. He is perhaps best known in his field for arguing that it’s necessary to examine the full set of consequences of any model: “You can no longer just look at one part of a theory and ignore the rest.”

Looking ahead, Richard says that the experiments being discussed and built over the next ten to 20 years mean the field will remain active and vibrant well into his students’ lifetimes.

The next big development will be the release of data from the Planck satellite, providing vastly improved measurements of microwave radiation left over from the big bang. And within the next decade the Large Hadron Collider may shed light on one of the biggest mysteries in cosmology – the nature of dark matter.

One of the developments that Richard is particularly excited about is the construction of the Large Synoptic Survey Telescope. The LSST, being built in the United States, will take photographs of the sky every four days providing invaluable information about the universe.

In the longer-term, there are huge opportunities in understanding gravitational waves. “When something moves or explodes it sends out a ripple in space-time that you can measure. There may, in fact, be waves left over from the big bang itself and that’s one of the things I’ve worked on calculating. We’re just getting to the point where we can detect [those waves] directly, and that’s going to have a huge impact on cosmology.”

Advances like these mean that top research institutions around the world are placing

increasing emphasis on cosmology. Richard’s appointment in late 2011 brought the field to The University of Auckland and already he sees opportunities for collaboration with colleagues in physics and statistics.

“Cosmology is a big growth area in science and it’s the kind of cutting-edge research that can be done anywhere in the world, so it’s a good thing for Auckland to be getting into,” he says.

Richard is in the process of transplanting his research from Yale, where he worked for eight years.

One of his areas of interest is inflation. “Just after the big bang there is this idea that the universe undergoes a period of very rapid growth – or inflation – which seems necessary to set things up to look the way they do. The question is what makes that rapid growth happen. One of the things I’m doing is developing techniques for taking astrophysical data and seeing whether we can reconstruct the mechanism of inflation.”

Another area of research is how the chaos and disorder immediately after the big bang transitioned into a relatively “smooth” universe – in other words one in which “at any given time, all points look pretty much the same as each other.”

Richard, who is originally from Hamilton, earned his Honours degree and PhD at Canterbury University before travelling to Japan and then the United States. He says although he enjoyed being at Yale, his family never intended to stay away so long. Having almost resigned themselves to being accidental emigrants, they leapt at the opportunity to return when the position came up at The University of Auckland.



Humanising computers

Imagine your handwritten notes or rough diagrams being transformed, at the click of a button, into digital form. That's the vision of researchers like Dr Beryl Plimmer, an expert in human-computer interaction who specialises in pen-based input.

Using a pen to create free-form notes and diagrams is a more natural way of working than typing on a keyboard or dragging a mouse. "Intuitively we know this because people have whiteboards in their offices, and when they start a discussion they'll jump up and begin writing," says Beryl.

"People can't hold much in short-term memory, so if you're working on a complex design or problem, you have to offload it onto paper or a computer, and work with it there." Numerous studies by Beryl's group and others show that "pretty consistently, people make better progress, and will explore a much wider variety of ideas, if they're working with a pen than with a computer tool."

In part this reflects the speed of recording ideas. "It's much faster to draw on whiteboard than use a drawing tool," Beryl explains. It's also about the constraints a drawing tool or text editor place on how ideas can be expressed. But as well, "and this is more interesting," working with a pen produces a greater level of ambiguity.

"If you hand draw something – often roughly – it's easier to reinterpret it in a different way," even for the person who draws it. "In the design disciplines they talk a lot about externalising ideas, and there's what's called a backtalk loop where you put something on paper and look at it again and then reinterpret it."

"All of these things work better with a hand-drawn artefact than something that's formalised, and neat and tidy."

Beryl's group is exploring how to capture these benefits while working on a computer, using an electronic pen and digital ink. "The point is to allow you to do free-form work so that you're not constrained to tapping keys."

For instance they've created a system for working with hand-drawn diagrams. Handwriting is turned into editable text; components can be moved around without losing their connections to other parts of the diagram; messy hand-drawing can be transformed into tidy shapes; and formal descriptions of the diagram exported for computational purposes.

And amongst other tools they've developed a programme that, at a click of a button, turns a sketch of a web page into html code. By going back and forth between the hand-drawn and formal versions, the user can progress through the stages of design much faster than in one format alone.

In addition to these sketching tools, the team is working on ways to annotate electronic documents, just as we write notes, draw asterisks or underline words on a printed page.

"Studies suggest that when you're reading any sort of document, if you have the ability to annotate it – underlining parts or writing marginalia – which is what's called active reading, then you're much more involved in what you're doing and have a much higher understanding than if you read it like a novel. It's [to do with] your engagement with the document."

Beryl already uses the annotation technology to mark student assignments, and technical advances are now allowing her group to annotate computer programs.

Programs are not the "linear" documents they once were, with a clear start and finish. They're complex networks of interconnected parts that can no longer be printed out and written upon.

The researchers aim to bring back the ability to annotate programs with digital ink. It's a difficult task because the document is "live" and annotations need to stay in the right place when changes are made to the underlying material. But the group already has the core technology working and the next step will be to study how people might use it.

This kind of work opens up the possibility of a truly paperless office – an idea that has been around since computers began to dominate our workplaces. Beryl says that "for a business, going paperless is an economic decision, because paper is so expensive."

"It's also a workflow issue. If you mix digital and paper documents, you always have concurrency problems where one copy isn't the same as the other. If you can keep everything in one format it makes a lot of sense. We also work across time and space in ways that we haven't in times gone by – it's nothing to have people working together on different sides of the world – and going digital means you can share documents easily."

"The hardware that we need has now been invented," Beryl says and the challenge now is to develop "recognisers" to help computers make sense of hand-drawn material. It's a

painstaking process of breaking down and codifying examples of graphs or diagrams drawn by different people, and using artificial intelligence so the computer can learn to identify the components.

"The recognition problems are still hard to solve," says Beryl. "The level of ambiguity in hand drawn stuff is quite high. And along with that you need the computing power to be able to compute it in real time."

"Digital ink recognition is a bit like speech recognition – there's lot of speech recognisers out there but very few people use them on a regular basis because they're still very error prone. I've been told that you need at least 95% accuracy, but I think it needs to be higher before it really becomes a goer. Otherwise, as a user experience, it's just too frustrating."

Recognition problems that are relatively simple for the human brain can be "extraordinarily difficult computationally." Beryl gives the example of her granddaughter who, at 21 months, could distinguish signatures from drawing and create her own. Postdoctoral fellow Rachel Blagojevic is trying to teach computers the same distinction. She began with a Master's thesis and, years later, is "probably the world expert" on what remains a difficult problem.

Challenges like these mean "progress is slow and steady," but Beryl anticipates that interest in pen-based input will grow as the software develops. Already devices like the iPad, using relatively crude taps and swipes, are extremely popular, and writing with a pen offers much finer control. "You don't write or draw with a finger," she points out.

The team's work also has some unexpected applications. They've used their technology to teach visually-impaired teenagers to sign their names. "This is something they have to learn to do, but if you're just using pen and paper they get no feedback and it's very difficult and boring."

The researchers replaced visual feedback with other modalities of touch and sound. Students held a robotic pen that followed the teacher's movements, used a tactile mat that left a raised trace as they wrote, and listened to sounds that tracked their vertical and horizontal pen strokes.

The proof of principal research demonstrated the success of the approach, and "it'll be interesting to see what happens with the ideas," Beryl says. Already other researchers are using the work to explore how to make visual information, like diagrams, accessible to visually impaired people.





Marine science pioneers

In the same week the New Zealand laboratory responsible for the world's first fully-protected marine reserve celebrated fifty years of achievement, news broke that the largest ever chain of marine reserves had been created. The new network protects the Coral Sea, Great Barrier Reef and other high-value areas around Australia from fishing and oil and gas exploration.

"Marine science played a critical role in the [Australian] initiative," said Dean of Science Professor Grant Guilford at the opening, a two-day event that focused on the Leigh Marine Laboratory's contributions to marine science and looked to its future. "So it's an auspicious week for Leigh to celebrate its fiftieth anniversary."

The laboratory is perhaps best known for its association with the Cape Rodney to Okakari Point (Goat Island) Marine Reserve, established in 1975, and what has been learned about the impact of marine reserves. But as the speakers at the anniversary revealed, it has a much wider – and sometimes surprising – scientific reach.

Director Professor John Montgomery described the "eureka" moment when he worked out how shark brains process complex sensory information – a discovery that is now being used in the wiring of robots. Professor Chris Battershill explained how in his field of sponge biology, new chemicals with potent activity against cancer are being identified. Professor Ned Pankhurst spoke about his work on how stress can shut down reproduction in fishes, and the implications for aquaculture.

The presenters, all former staff and students now spread around the world, talked about how Leigh has contributed to their chosen fields.

Several described how they pioneered new techniques in underwater science that are now used around the world – from mapping habitats to taking blood samples from fish. SCUBA was just emerging when the laboratory was established and Leigh's climate and coastal layout were well-suited to diving. Led by scientists like Professor Howard Choat, the laboratory became a champion of subtidal research.

Taxonomist Dennis Gordon – one of the laboratory's first alumni – spoke about the "massive number of species" that had been described by staff and students using the laboratory, including 38 species discovered there.

Professor Mike Kingsford spoke about revolutionary work at Leigh showing that plankton are not helpless drifting creatures, as

once believed, but respond to environmental cues like reef noise to find places to settle. "No other place in New Zealand has the same momentum [in this field]," he said.

Leigh continues to provide valuable information about the effects of marine reserves. For instance, Dr Alison MacDiarmid and Dr Russ Babcock spoke about increases in the size and number of crayfish, snapper and red moki. "Research based at or connected to [Leigh] continues to make a leading contribution to marine conservation both within New Zealand and internationally," said Russ.

The work is by no means straightforward, however. The complexity of the marine environment can make it difficult to tease out the impact of the reserve from natural processes, as illustrated by a debate between speakers, about a switch at Leigh from "urchin barrens" to "fertile kelp meadows".

Changes like these, studied around the world, have been widely attributed to a ban on fishing. According to the paradigm an increase in predators like snapper and crayfish leads to fewer sea urchins, allowing growth of "habitat-rich" kelp forests the urchins would otherwise graze. Although there is a lot of evidence to support this, there is debate about the degree to which it is responsible for the change.

Professor David Schiel explained how natural factors, like storms or sedimentation, can also affect kelp growth. Other speakers described research showing that interactions between species aren't always so dramatic and urchin-rich areas aren't necessarily "barrens". And, since each location is different "we need to beware of broad generalisations regarding the effects of marine reserves," Howard concluded.

While debates like these may continue for some time, they show how many factors must be taken into account in the marine environment and the importance of ongoing research.

Whether it's work on the effects of marine protected areas or the basic biology of sponges, the reserve has been critical to research at Leigh. "It's important to understand organisms in their real environment," said Director, Professor John Montgomery. Unlike laboratory-based colleagues overseas, scientists at Leigh can go out and study what's really happening in the marine environment.

"Having a reserve right on its doorstep which is accessible to research, a lab infrastructure that was more sophisticated at an earlier stage than marine stations elsewhere in the world,

and being champions of underwater science," are all reasons Leigh can make unique scientific contributions, Ned explained.

"Our intentions were self-serving initially," explains founding Director Professor Bill Ballantine when asked about establishing the reserve. "We wanted to be able to protect our experiments because there's no other way to do research in the sea." Even today, most reserves around the world are created for scientific purposes.

"But it quickly became about more than that," Bill adds. He recalls a discussion with a local opponent of the proposed reserve. After more than an hour of heated debate, "he began talking about how it used to be different around Leigh, and he'd like his grandchildren to be able to see what it had been like."

The anniversary was an opportunity to reflect on the pioneering vision of the two scientists who established marine science as a discipline at the university. The passion for marine ecology of the then heads of botany and zoology, Professors Valentine Chapman and John Morton, set the stage for the development, Dennis explained.

Looking forward to the next fifty years, the recent redevelopment of the laboratory "reflects the university's commitment to marine science," said Dean of Science, Professor Grant Guilford. "We expect [the field] to become an increasing focus for New Zealand as we learn to take advantage of the opportunities the marine environment provides and address its challenges."

The redevelopment aims to link the laboratory more closely with its communities, including the thousands of people who visit the reserve each year. Its new Discovery Centre – the venue for the anniversary event – provides information about marine science and the marine environment to school students and the public.

Articles by the speakers, on the contributions of Leigh to their fields, will appear in a special issue of the *New Zealand Journal of Marine and Freshwater Research*.



Alumni News



Professor Charles Alcock, recipient of a 2012 Distinguished Alumni Award.

2012 Distinguished Alumni Awards

Two Faculty of Science alumni were among the six recipients of the 2012 Distinguished Alumni Awards. The annual prizes honour University of Auckland alumni who have made outstanding contributions to their professions, to their communities and to the nation.

Professor Charles Alcock who graduated from The University of Auckland with a BSc Honours degree in Physics in 1973 is the Director of the Harvard-Smithsonian Center for Astrophysics, the world's largest and most diverse centre for the study of the universe. Professor Alcock, whose primary research interests are massive compact halo objects, comets and asteroids, received the US Department of Energy's Ernest O. Lawrence Award for Physics in 1996 and the Beatrice M. Tinsley Award of the American Astronomical Society in 2000. He was elected to the National Academy of Sciences in 2001 and to the American Academy of Arts & Sciences in 2006.

Dr Mark Sagar, the winner of two consecutive Academy Awards, graduated from The University of Auckland in 1996 with a BSc majoring in Physics and Mathematics and a PhD in Engineering. Dr Sagar won a Scientific and Engineering Oscar in 2010 for developing a system used to create the realistic appearance of digital characters in *Spiderman 2* and subsequent films and again, in 2011, for his pioneering facial motion capture solutions used in *King Kong*, *Avatar* and other blockbusters. His PhD research was a landmark study in how to develop an anatomically correct virtual eye and realistic models of biomechanically simulated anatomy.



Dr Mark Sagar, recipient of a 2012 Distinguished Alumni Award.

Fostering human-computer interaction

The University's brand-new Laboratory for Animate Technologies will take computer animation to a new level, creating interactive autonomously animated systems which will help define the next generation of human-computer interaction and facial animation. Based in the Auckland Bioengineering Institute (ABI), the pioneering laboratory has been set up by 2012 Distinguished Alumnus and Oscar-winning bioengineer, **Dr Mark Sagar**.

Industries that may benefit from research and technology created in Mark's lab include those

in which establishing emotional rapport is important such as education, advertising and the entertainment industry.

Mark says his lab will create an experience that will allow visitors to engage with "smart technology" that appears conscious, emotive and thinking. The technology created in his lab will simulate the lifelike qualities and the observable natural reflexes and behaviour of someone engaging with another person. The lab will also develop advanced computer vision techniques to track facial expression and behaviour.

Mathematics alumnus honoured

Department of Mathematics alumnus **Dr Shaun Cooper** is the recipient of the 2011 New Zealand Mathematical Society Research Award. The award recognises Shaun's sustained generation of "significant and original contributions to number theory, particularly in the areas of elliptic functions, theta functions, and modular forms".

Shaun who graduated with an MSc in Mathematics from The University of Auckland before pursuing a PhD at the University of Wisconsin currently holds the position of associate professor at Massey University's Institute for Information and Mathematical Sciences.

Science grads compete at London Olympics

Two alumni from the Faculty of Science competed at the 2012 London Olympics.

Alexis Pritchard who graduated with a Bachelor in Science in Sport and Exercise Science in 2007 wrote her name in the history books as being one of the first two women to represent New Zealand in women's boxing at the Olympics, with the sport being added to the games for the first time. After winning her opening bout in the women's Light division Alexis lost in the quarterfinal against Russian boxer Sofya Ochigava.

Men's Black Sticks defender **Dean Couzins** who received a Bachelor of Science in Sport and Exercise Science in 2006 made his third appearance at the Olympic Games. The Black Sticks missed a spot in the semi-finals after playing one victory, two draws and two losses in the preliminary round but ended their Olympic campaign on a positive note with a 3-1 victory over Argentina in the playoff for ninth place.



Photo: Jae Frew

Queen's Birthday Honour for Nigel Latta

Television star, author and Psychology alumnus Nigel Latta received a 2012 Queen's Birthday honour in recognition of his work.

The clinical and forensic psychologist who is well known for his television programmes including *The Politically Incorrect Parenting Show* and *The Politically Incorrect Guide to Grown-ups*, was made an Officer of the New Zealand Order of Merit for his services to psychology.

Nigel Latta studied clinical psychology at the School of Psychology and graduated with a Master of Philosophy with first-class Honours in Psychology, and a Postgraduate Diploma in Clinical Psychology.

He has since worked with individuals in private practice, written numerous books on parenting and worked as a consultant for a number of organisations including social service agencies, offender treatment programmes, the Department of Corrections, the police and Child, Youth and Family.



Connect with us

We have made it easier for you to stay in touch with us throughout the year by establishing a variety of social media platforms for our faculty and departments, including a Facebook account especially for our Māori and Pacific alumni. Keep in touch with other Science alumni and connect with current students, receive updates on current campus events and public lectures, and read about our latest research featured in media around the world.

For a list of our social media accounts visit www.science.auckland.ac.nz/connect-with-us

Getting involved

If you would like to support the university there are many different ways to contribute, from participating in Women in Science events to donating to the Science Student Support fund through the Faculty's Annual Appeal. All money raised will go towards groundbreaking research and programmes, undergraduate and postgraduate scholarships, lectureships and professorial chairs or infrastructure and development.

For more information please contact

John Taylor

Phone: 09 373 8799

Email: john.taylor@auckland.ac.nz

or visit www.givingtoauckland.org.nz

Alumni events

Upcoming alumni events for your diary include:

- **Tauranga Alumni and Friends Event**
Wednesday, 17 October
- **Shanghai Alumni and Friends Reception**
Monday, 22 October
- **Beijing Alumni and Friends Reception**
Tuesday, 23 October
- **Hong Kong Alumni and Friends Reception**
Thursday, 25 October

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

www.alumni.auckland.ac.nz



Alumni profile

Name: **Nicole Paterson**

Position: **Analyst,
Human Capital
Consulting Team,
Deloitte New Zealand**

Class of: **2012 MSc
Industrial Psychology**

I'm always looking for ways to improve things and that's what I do for a job now. As part of the Human Capital Consulting Practice at Deloitte New Zealand I help companies plan and implement change, focusing on the employee side of their business. In my five months in the role I've already helped organisations modify their culture, prepare their employees for change, and get the most out of their leadership team.

I work on site with my clients and I'm always moving to new companies and projects and meeting new people, which I really enjoy. I like being in a professional services firm, and the business world appeals because it is so varied and there are clear outcomes and rewards for your work.

My MSc in industrial psychology prepared me well for the job. It helped me develop an extra level of maturity and I really grew from the mental and emotional challenge. I also had time to get to know the market and gain relevant work experience. I chose The University of Auckland because of the

prestige and the strength of its postgraduate degrees. My supervisor Dr Helena Cooper Thomas was fantastic – she helped me when needed but also gave me a lot of freedom.

Industrial psychology is the study of the employee-employer relationship and how to improve employee wellbeing and productivity, so I use what I've studied every day – but it's not a prerequisite for the job. While several of us have psychology degrees, members of my team have studied everything from economics to law, engineering, health sciences, and management. What's important is the ability to think critically and analytically, and postgraduate study really develops those skills. We also need to think on our toes, have confidence, and build good relationships with our clients.

I didn't know what consulting was until I went to a Faculty of Science careers evening last year, where I made a contact who suggested consulting at Deloitte. It turned out to be the job I always wanted but didn't know existed.

Community links

Talking Science

Physicist **Professor Richard Easther** (see story on page 12) took his audience on a trip through the universe at his *Talking Science* seminar this May. He spoke about how cosmologists have reconstructed the history of the universe, back to the question of how it all began. The Talking Science seminars, now in their third year, are proving as popular as ever. Richard's talk was the first in a new "Origins" series providing a guided tour from the birth of the universe to the origins of life and beyond.

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

The next Talking Science event is the second in our "Origins" series and it will be on Tuesday 30 October. More details will follow.

Water in sustainable cities

A free public art event to raise awareness of water issues in Auckland City took place at Wynyard Quarter on Auckland's waterfront this year. The interactive event, called *Fluid City*, opened on World Water Day, 22 March. Run by a collective of artists, educators and scientists as part of the University's cross-disciplinary thematic research initiative *Transforming Cities: Innovations for Sustainable Futures*, it presented stories, memories and the science of water in the region. Scientists involved included microbiologist **Dr Clark Ehlers** (Biological Sciences), who manned a Roving Laboratory where people could test samples and examine microbiological life from Auckland waterways, and geographer **Professor Gary Brierley** (Environment) who contributed to a Story-Telling Vessel that played interviews and insights about water and invited people to share their own stories.

www.transformingcities.auckland.ac.nz (see "current research")



Dr Clark Ehlers, Biological Sciences, manned a "roving laboratory" as part of a free public art event.

Lies, damned lies and statistics

Understanding earthquake risk, predicting Super 15 results, and dissecting survey flaws have all been recent topics on Stats Chat. The blog, launched by the Department of Statistics, has just celebrated its first birthday. It aims to improve statistical literacy by scrutinising facts and figures used in the media. "We're aiming to offer insight and boost statistical literacy by providing a space for thoughtful analysis and comment on the statistics making headlines," says Head of Department Professor Chris Triggs. The blog also acts as an archive for the general public, journalists and teachers, and runs a weekly competition for bad, exemplary or fascinating examples of statistics.

www.statschat.org.nz

Computer science commentary

Anything from theoretical mathematics to the latest smartphone app is up for discussion on a new blog by the Department of Computer Science that aims to improve public understanding of computer science. Run by **Dr Ian Watson** with contributions from colleagues and students, the blog comments on topics from artificial intelligence, to driverless cars, and a recent internet banking meltdown and has had a special focus on Alan Turing's legacy in his centenary year (see below).

<http://uoacomputerscience.blogspot.com>

Turing centenary celebration

Alan Turing cracked the German Enigma codes during World War II and is widely acknowledged as the inventor of the computer. The Department of Computer Science took

part in worldwide celebrations of Turing's work on the centenary of his birth in June. Its 2012 Gibbons Lecture Series covered four topics that Turing was involved with – the theory of computing, cryptanalysis, building a practical electronic computer, and artificial intelligence. The Gibbons Lectures, named in memory of Associate Professor Peter Gibbons, aim to share computer science with the wider public.

www.cs.auckland.ac.nz/our_department/Gibbons_Lectures

Exercise is medicine

Physical inactivity is one of the greatest health problems of the 21st century. Although research indicates benefits from exercise in disease prevention and treatment, compliance is poor. The popular 2012 Vice-Chancellor's Lecture Series on the topic *Exercise is Medicine* tackled the issues that confront physical inactivity. The four public lectures, featured speakers from the Department of Sport and Exercise Science and Liggins Institute along with visitors Professor Arthur Kramer from the University of Illinois and Professor Steven N. Blair from the University of South Carolina. The lectures considered the influence of physical activity and exercise on healthy minds and brains, nutrition and exercise, the long term benefits of exercise in pregnancy and early life, and the evidence supporting exercise as medicine.

www.auckland.ac.nz/vclectures

Faculty in the media

The faculty's research is reported by national and international news media. Some of the most popular stories over the last year were: El Niño and La Niña will become more dominant in New Zealand with climate change (Dr Anthony Fowler, Environment); cloud heights have lowered in the last ten years and may reduce global temperatures (Professor Roger Davies, Physics); honey bees reveal how anaesthesia can cause jet-lag (Dr Guy Warman, Biological Sciences); the first survey of New Zealander's experiences with antidepressants is under way (Professor John Read and Dr Kerry Gibson, Psychology); machine harvesting produces higher quality Sauvignon blanc (Associate Professor Paul Kilmartin, Chemical Sciences); the Indo-European language family originated in Anatolia (Dr Quentin Atkinson, Psychology); research reveals why Bryde's whales are vulnerable to ship strike in the Hauraki Gulf (Dr Rochelle Constantine, Biological Sciences); and New Caledonian crows provide the first evidence of "causal reasoning" in a non-human species (Professor Russell Gray and Dr Alex Taylor, Psychology).

www.science.auckland.ac.nz/in-the-media

Contact

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

0800 61 62 63
Phone: +64 9 373 7599 ext 87020
Txt: 5533
Fax: +64 9 373 7431
Email: scifac@auckland.ac.nz
Web: www.science.auckland.ac.nz