InSCight

August 2007 | **Faculty of Science Alumni Magazine** Issue 01

Alumni survey results
Written in the rings
All in the genes
Gordon MacDonald

THE UNIVERSITY OF AUCKLAND
FACULTY OF SCIENCE

A word from the Dean

Welcome! This is the first issue of a new Science Faculty publication prepared for our Alumni and friends. It is designed to provide you with a chance to join in the excitement that science and technology engenders in the modern university.

As science and technology continues to advance at a dizzying pace, it is perhaps timely to reflect on how our own lives have changed over recent years and how the experience of students now enrolled in a science degree differs from our own.

Information Technology has transformed our students' lives and also the modern university. We in Science now have 3400 screens alone. Our University now has a highly organised library and database access system providing online access to almost every publication at high resolution at one's own desk. Students return refined drafts of essays and theses faster than supervisors can read them; lecture material is increasingly presented in an electronic format; and laboratory and field notes are almost always recorded on a laptop.

In the experimental sciences, advances in Photonics, Mass Spectroscopy, Nuclear Magnetic Resonance and other analytical technologies provide undreamt of sensitivity, speed and accuracy. The most intimate details of molecular interactions are routinely determined at high resolution by X-Ray Crystallography; and Magnetic Resonance Imaging provides new insights into the functioning of our bodies. Chemical, biochemical, physical and mathematical methods are applied – more than ever before – by multi-disciplinary teams to cutting-edge research in the Life Sciences, Social Sciences and to research into the earth and marine environments.

I hope you find *inSCIght* interesting and stimulating, and I encourage you to leave it on your coffee table for others to access and enjoy.

PROFESSOR DICK BELLAMY
Dean of Science
The University of Auckland

University research vessel, Hawere, at Goat Island ▶

Around the Faculty

G joins SGES

Geographers and environmental scientists have united with their geology colleagues to create the new School of Geography, Geology and Environmental Science (SGGES).

The merger follows a global move towards multi-disciplinary study and research, and creates more opportunities across all disciplines housed in the new School. The combined power of the new SGGES will provide better resources for students, although teaching will be maintained under the existing subject streams. The consolidation will provide better access to research funding, and expansion of existing (and development of new) research collaborations with organisations such as Landcare and NIWA.

Professor Glenn McGregor, currently Professor of Physical Geography at King's College, London, has been appointed as the Inaugural Director of the School of Geography, Geology and Environmental Science. Professor McGregor is expected to take up his new position in March 2008.

30 years of marine reserves

Thirty years ago, marine scientists from the Faculty joined with government and industry representatives to celebrate the official inauguration of New Zealand's first marine reserve.

The 5km of coastline from Cape Rodney to Okakari Point, was the first marine reserve under the 1971 Marine Reserves Act, and one of the first in the world.

The Leigh Marine Laboratory research team were instrumental in voicing the ideas that eventually led to the reserve legislation. The lab is still a site of research into New Zealand's marine life and the benefits of protected marine areas globally.

All the better to see with

Optometry graduates will now be able to prescribe eye medications along with spectacles and contact lenses.

The next graduating class will be the first with the new qualification, allowing them to apply for therapeutic endorsement of their practising certificate. The accreditation from the Optometry Council of Australia and New Zealand will allow them to prescribe certain medications for eye diseases in New Zealand and some Australian states.

The University is one of only two undergraduate institutions awarded the ocular therapeutics accreditation in Australia and New Zealand.

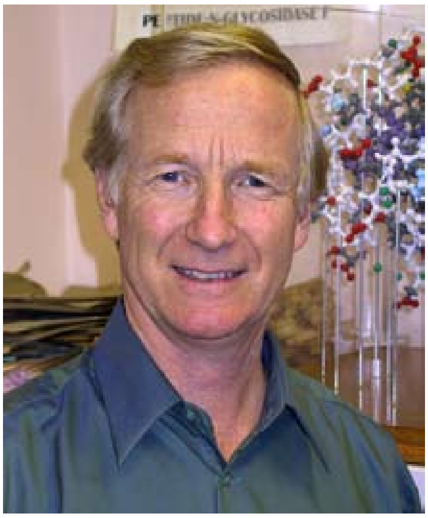
CoRE funding

The Maurice Wilkins Centre for Biomolecular Discovery has been allocated an additional six years funding through the Centres of Research Excellence government funding round.

Research at the Wilkins Centre, one of the original CoREs, builds understanding of human disease, with the aim of developing new drugs, vaccines and diagnostic tools. Current targets include cancer, diabetes, cardiovascular and infectious diseases.

Seven CoREs were awarded funding, including two other Centres hosted by the University – the National Research Centre for Growth and Development, based at the Liggins Institute, and Ngā Pae o te Māramatanga, the National Institute of Research Excellence for Maori Development and Advancement, headed by Professor Michael Walker of the School of Biological Sciences. The University is also a partner in the Allan Wilson Centre for Molecular Ecology and Evolution, and the new Riddet Centre.

People news



Rutherford Medallist, Professor Ted Baker

New Zealand honours Ted Baker

Professor Ted Baker, lecturer and researcher in the School of Biological Sciences, has been awarded the Rutherford Medal, the highest honour for scientists conferred by the Royal Society of New Zealand.

Ted, also Director of the Maurice Wilkins Centre, is a key driver in developing structural biology techniques in New Zealand. His research looks at defining the structure of proteins implicated in disease, particularly cancer and tuberculosis, as a method of developing new drugs targeting these diseases.

Ted received his award at the annual Royal Society dinner at the Auckland Hilton, attended by scientists and affiliates from across New Zealand.

For they are jolly good Fellows

Professors Howard Carmichael and Stephen Kent have been named as Royal Society of New Zealand Fellows.

Howard, a theoretical physicist at the University, studies quantum theory and applications in quantum optics. His new Fellow of the Royal Society of New Zealand status is added to his existing Fellowships of the American Physical Society and the Optical Society of America.

Stephen, Adjunct Professor of the Institute for Innovation in Biotechnology (IIB) and School of Biological Sciences, was named an Honorary Fellow in the 2006 awards. Honorary Fellowships are awarded to scientists with links to New Zealand who live overseas – Stephen is currently a Professor at the University of Chicago.

Computing super brains

Undergraduate computer scientists from the University represented New Zealand at the ACM Programming Contest World Finals in Tokyo, coming third in the Asia Pacific region and 11th overall.

Team CIA, of (then) third-years Robert Bowmaker, Stephen Merriman and Andrew Olsen, won the title of New Zealand Champions, in the South Pacific round of the ACM competition at the end of 2006. Competing against 87 other teams chosen from over 6000 teams who competed at regional level, Team CIA were only beaten by previous world-final winners and came well ahead of competitors from Australia and the USA.

They also successfully defended their title at the New Zealand Programming Contest, becoming the only team in the history of the competition to solve all their problems correctly.

Other stellar programmers from the University include ACM regional runners-up E_FAIL members (Johnathan Rogers, Peter Nelson and Michael Brough); Year Two category winners Team Zygote, (Heather Macbeth, Matthew Gatland and Matthew Steel); and top Year One team in the New Zealand Programming Contest, the Rabid Huskies, (Alistaier Fernandez, Matthew Peterson and Paul Ianovski).

Professor Di McCarthy, CEO Royal Society

Moving on

Dianne McCarthy, Professor of Psychology, Associate Dean of Science, Pro Vice-Chancellor Equal Opportunities and Science Alumna, is moving on to new pastures.

Di has been appointed CEO of the Royal Society of New Zealand, the national scientific body. She started her new job in May.

Di has been at the University for 37 years, starting as a BA student in maths and music. She will be known by many former staff and students, as a classmate, teacher, research colleague or friendly face around campus.

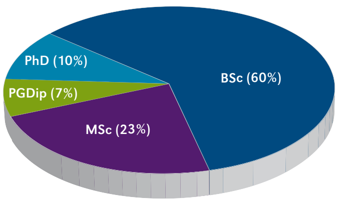
The Faculty wish Di well in her new endeavour.

Science alumni survey results

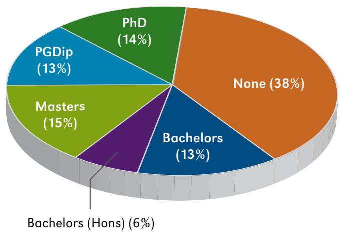
At the end of 2006, the Faculty of Science asked all its alumni to answer a short electronic questionnaire, to determine where their science degrees have taken our graduates.

Seventy-five percent of the 820 respondents said they used their degree regularly or every day, with only 3 percent saying their degree hadn't helped in their career development. The most common career for science graduates is research, with education, management, IT and consultancy coming close behind.

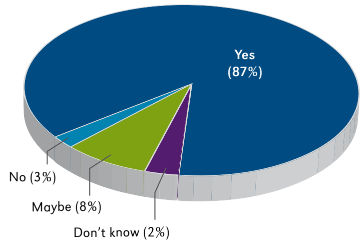
What was the highest science-related qualification you were awarded at The University of Auckland?



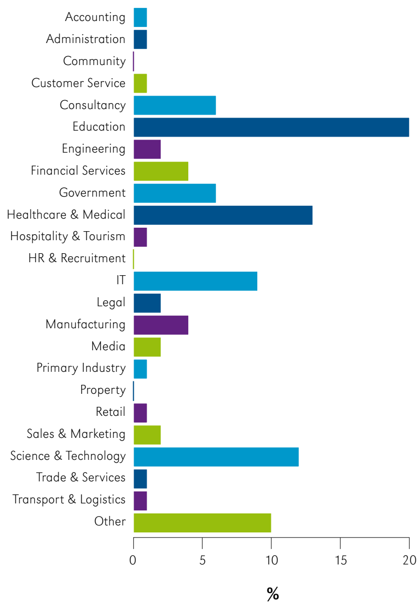
What, if any, other qualifications have you studied for, since gaining your science degree?



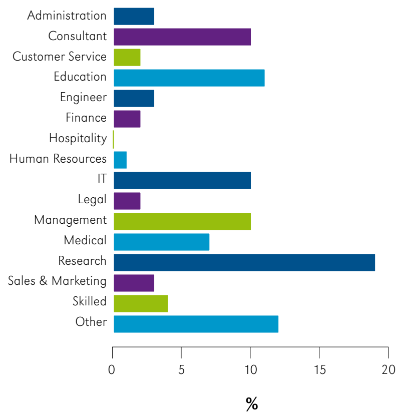
Do you think your University of Auckland degree has helped with your career?



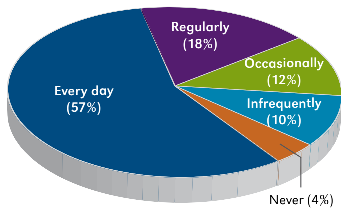
What best describes the main activity of the company you work for?



What best describes your role?



How often do you use science in your role?

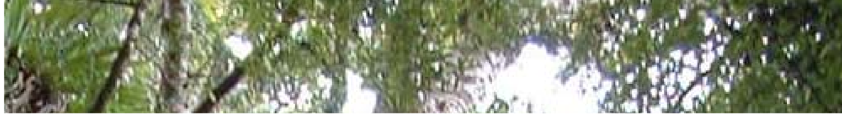


Get in touch

If you are a graduate of the Faculty of Science and have a story to tell, get in touch with us now.

Whether you have received an award, want to inspire graduates with tales of how your degree has helped you make a difference, or just want to get involved again with the Faculty, email Nicole De Pina at n.depina@auckland.ac.nz or Emma Timewell at e.timewell@auckland.ac.nz

Don't forget – this is your magazine, so if there's something you would like to see included, please let us know. If you would prefer to receive *inSCIght* by email, simply send us your email address.



Written in the rings

Tāne Mahuta, New Zealand's tallest kauri tree, has seen a lot of history. In the 1200 years of its life, Tāne Mahuta, the God of the Forest, has stood tall through good weather and bad, watching the seasons change and the temperature rise and fall.

Each year, Tāne Mahuta grows a little, laying down a new ring of growth in its giant trunk. Each year, the ring differs a little in width, depending on what's going on around it – whether the weather has been fair, or if there has been enough water and nutrients – forming a natural calendar of environmental conditions.

From the 1970s, research at the Tree Ring Laboratory has been tracking these historical environmental changes by analysing the rings of kauri trees. By knowing the past behaviour of the planet, the research team hope they will be able to get a view of the future and whether the current climate change is a natural oscillation in the Earth's history, or something more.

Getting the data

The team of scientists in the Tree Ring Lab have sampled over 200 living trees, which typically populate the upper North Island. Core samples, about the same width as a drinking straw and up to a metre long, are taken back to the lab, sandpapered to a high polish and viewed through a microscope at magnifications of around 20 times the normal size.

Each ring ranges from almost non-existent to around 3 millimetres wide. By measuring the exact width of each ring, the scientists can see which years were good for growth, and which were bad, for each individual tree. By combining the results from a number of trees, any idiosyncrasies of individual trees are removed and the general environmental pattern can be reconstructed from today backwards.

This practice has also been duplicated in dead trees, where the chronological pattern can be found but the most recent time point, the year the tree died, is not known. The pattern of growth for the past 400 years is known from analysing the living trees, and these are used to identify corresponding points in the dead trees' lives. From this, the pattern of environmental change can be tracked back further than is possible from living trees alone.

Two main sources provide the dead trees – old buildings and wood preserved in swamps. Kauri was widely used by the Māori, as house timbers, wall panels and for *waka* (canoes). With the Europeans' arrival, major tree-felling exercises began, for use in houses, furniture and Navy masts and spars. Kauri was also used in building dams required for the early timber industry.

The Tree Ring scientists source timber from old houses during reconstruction and demolition, their interest beginning with timber from old houses behind the Human Sciences Building, on the site now housing the Fale Pasifika. Old timber provides information prior to its felling in the late 18th and early 19th centuries which, in some cases, stretches back further than is possible with core samples from live trees.

Other gaps in the history are filled with information from fossilised trees found in swamps. Data from these perfectly preserved trees has given the scientists continuous patterns over nearly 4000 years. Radiocarbon dating gives an approximate age which is then refined using pattern matching. In some cases, trees have been dated to tens of thousands of years old, providing an idea of annual changes in a "floating" time period.

The El Niño Effect

Quite strangely, kauri trees, unlike people, enjoy the El Niño effect. During El Niño years, where temperature fluctuations in the Pacific Ocean cause major environmental effects such as flooding and drought, kauri seem to have their best growing years. By comparing the growth charts of the trees to historical weather records, it has been possible to identify the growth pattern associated with strong El Niño activity.

The scientists have identified a 50- to 80-year cycle in El Niño activity, with one or two El Niño events each decade. Periods of low activity, where the effects are small or far apart, are interspersed with periods of high activity, with many violent changes in the environment. The last major El Niño was seen in 1997-8, and from current predictions we should be entering a period of low activity.

What use is the information?

Being able to track historical climate change at such high resolution should allow scientists to project El Niño activity. By knowing when the next El Niño event is due, measures can be put in place to minimise the impact of its effects.

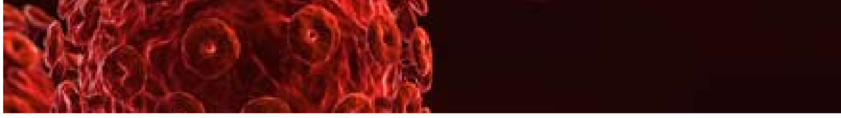
The 20th Century was the most active period of El Niño activity in the past 400 years. This may have been a natural occurrence or somehow related to global warming. By having a historical record of environmental events, scientists can deduce whether current events are unusual when compared to the planet's recent past.

Family (Department):
School of Geography, Geology and Environmental Science

Genus (Group):
Tree Ring Laboratory

Species (Principal Investigators):
Dr Gretel Boswijk (Director), PhD
Dr Anthony Fowler, MA, PhD
Associate Professor John Ogden, MSc PhD DSc

Climate changes can be tracked using ► kauri trees (Agathis australis)



All in the genes

The concept of evolution began with the Ancient Greeks who talked about the succession of animals and plants as Earth developed. Lamarck and Darwin became the forefathers of biological evolutionary concepts in the 19th Century, describing how organisms develop characteristics to survive in new habitats and the theory of natural selection.

In the 21st Century, bioinformatics research at the University is using computer modelling to create software to test evolutionary hypotheses, particularly those based on gene sequence data. The research crosses the Department of Computer Science and the School of Biological Sciences, bringing together the skills of both to understand how viral populations, amongst others, have evolved.

The practical uses

One use of this computer modelling is in the understanding of evolution and population dynamics of viruses such as HIV. HIV evolves at a rapid rate, about a million times faster than its host, humans. In an infected person the population of HIV virus particles will evolve at a rate of about 1 percent per year, meaning in 12 months the virus population evolves about the same amount as humans and chimpanzees took to evolve from the same common ancestor.

For this reason, science has so far failed to create a vaccine against HIV. Two HIV viruses can be as genetically different as humans are to mice, and finding a common vaccine target across all HIV viruses, existing and future, is a huge task.

By studying the genetics of the HIV virus, we can gain some understanding of its evolutionary trajectory. By understanding the past evolutionary history of the virus, we can better predict the future, which may allow us to develop effective vaccines or drugs to target the virus. By using evolutionary models we can take into account this rapid evolution rate, and also identify regions of the viral genome that don't seem to change as much or are in some other way predictable.

In addition, the models have the potential to solve one of the mysteries of HIV and many other human pathogens – when and where were they introduced to the human population? A number of theories exist to describe the introduction of the HIV virus to humans. One of the most publicly debated theories is that of Edward Hooper, author of *The River*, who prescribes that HIV was inadvertently introduced through the use of monkey cells in developing a vaccine against polio in the 1950s. Genetic analysis of today's HIV has shown that even with its rapid evolutionary rate, the virus is too diverse to have been introduced as late as the 1950s, but is more likely to have arisen decades earlier.

The theory

Coalescent theory, formalised in the early 1980s by Kingman, states that all variants of a gene in a population can be traced back to a single common ancestor. In small populations, individuals are related more recently, whereas larger populations have more diversity and the common ancestor shared by two randomly selected individuals will tend to be further back in their family trees. Where a large number of individuals are being studied, the probability increases that at least two of them are closely related. These basic assumptions are at the heart of coalescent theory.

The theory was originally described for the case of stable populations whose populations have not changed much historically. But more recently the theory has been extended to allow for populations that have changed in size through time, such as the growing human population. Recent research, lead by Alexei Drummond at the University, showed how coalescent theory could be used to estimate from gene sequence data how a particular population's size has changed throughout its evolutionary history, even when no initial assumptions of stability or growth can be made.

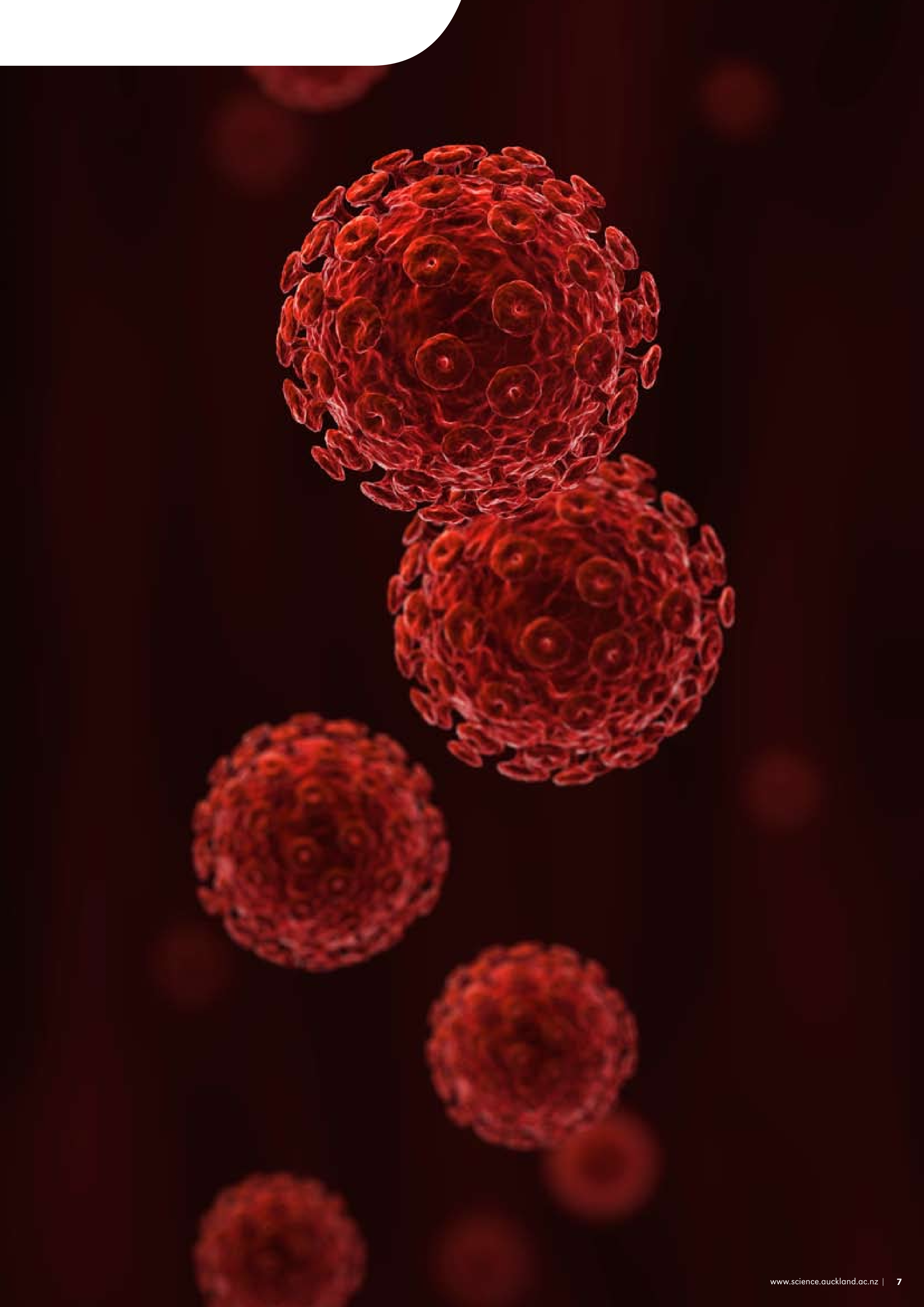
However, the coalescent models currently employed are far from perfect. They still rely on some drastically simplifying assumptions such as random mating and that each individual has an equal chance of producing offspring. In reality, fertility and natural selection are assumed to play a large part in population genetics, and individuals often select partners that are geographically available. Research at the University, driven by Dr Drummond, is looking to extend the statistical models to overcome some of these suppositions.

Family (Department):
Department of Computer Science and School of Biological Sciences

Genus (Group):
Bioinformatics

Species (Principal Investigator):
Dr Alexei Drummond, BSc PhD

Microscopic view of HIV particles ▶



Alumni news

Distinguished Alumnus Terry Collins

Professor Terry Collins was recognised with a University Distinguished Alumni Award at this year's celebratory dinner in February.

Terry is the Thomas Lord Professor of Chemistry at Carnegie Mellon University in Pittsburgh, USA, and founder of the Institute for Green Oxidation Chemistry. He graduated from The University of Auckland with a BSc (1974), MSc (1975) and PhD (1978) in Chemistry.

Green chemistry is the design of chemical products and processes to reduce or eliminate the use and generation of hazardous substances in manufacturing and business. More than 80,000 chemicals are used in industry, and some of them have major effects on the environment or severe toxicological effects. Green chemists, such as Terry, are looking to develop new manufacturing methods which use green alternatives and reduce pollution.

Distinguished Alumni, Professor Terry Collins

A World of Difference

Maree Burns, a psychology graduate, has received a Vodafone NZ Foundation World of Difference award in recognition of her work with youth groups.

Maree, who graduated with a PhD in 2004, works with the Eating Difficulties Education Network (EDEN). The award of a year's salary will allow her to continue her work with teenagers and children who suffer from eating disorders by establishing a counselling service and securing sustainable funding for the charity. She also wants to raise the profile of EDEN and get eating difficulties and disorders recognised on the mental health agenda.

Professor Margaret Brimble, UNESCO Women in Science Laureate

Global recognition for chemist

On a February afternoon in Paris, Margaret Brimble was named a 2007 Laureate at the L'Oreal UNESCO For Women In Science awards.

Margaret, Professor of Organic and Medicinal Chemistry at the University and an alumna, was the first New Zealander to be named a Laureate since the awards began in 1998.

Margaret was the recipient of the Asia-Pacific Laureate, one of only five Laureates presented each year in the global awards. The awards recognise research excellence in women and are overseen by a panel of judges including Nobel Prize winners.

Margaret was recognised for her work in synthesising naturally occurring compounds which can be used in the treatment of human diseases. Research by The Brimble Group focuses on developing potential drugs for pain, epilepsy, hypertension, cancer and stroke.

Stay connected

The 120,000 strong Alumni and Friends organisation of The University of Auckland provides the opportunity for graduates and friends to stay connected with the University and to be part of a life-long network.

On-going opportunities to keep in touch are provided through the bi-annual *Ingenio* magazine and the monthly e-newsletter, *@auckland*. A range of benefits and services is available exclusively to alumni and friends, including invitations to events in New Zealand and overseas. Visit the website at www.alumni.auckland.ac.nz.

Alumni are also invited to join The University of Auckland Society, an active, independent organisation that provides an even closer link with the University through additional networking and benefits. For further information visit www.society.auckland.ac.nz

Gordon MacDonald, R and D Manager, Brainz Instruments and Science Alumnus

Alumni profile

Name: **Gordon MacDonald**

Class of: **1980 (BSc), 1989 (MSc)**

Studied: **Physics**

Lives: **Auckland**

Family Status: **Married with an 18-year-old son**

I transferred within the Tru-Test Group to Brainz Instruments in 2001 as their R&D Manager. Brainz manufactures EEG monitors, the hospital machines which monitor the brain. My job is managing a team of software, electronic and mechanical engineers working on the company's core technology of signal processing of EEG data.

I got interested in signal processing in my first job as a geophysicist. After graduating with my BSc, I went to work for an oil exploration company, as the geophysics field trip in the third year had really turned my head. Over seven years I travelled the world and also grew increasingly interested in signal processing. That's when I decided to study more physics and came back to Auckland.

My masters thesis was in underwater signal processing, with the ultimate goal of extracting a particular type of wave from existing data. Whilst my project was unsuccessful, I learnt a lot about signal processing which I still use in my job today.

I went to work for MAF Fisheries, now NIWA, to employ my hard-earned knowledge in a practical sense – using underwater acoustics to estimate commercial fish populations. After Fisheries, I moved to Tru-Test to work on agricultural technologies that again used signal processing as a base. From there to Brainz.

My background in maths and physics has been a great help throughout my career, particularly when trying to understand technologies, like Brainz's, in a broad multi-disciplinary field. The broad knowledge of fundamental science I gained at the University allows me to learn and adapt to new information and transfer this knowledge from one application to another. My signal processing knowledge is also widely applicable across industries, and is now incredibly helpful in developing the Brainz technology.

My main memories of the University are of the many interesting people I interacted with, both in Science and through extra-curricular activities like the tramping club.

From the teaching side, I particularly remember Associate Professor Manfred Hochstein for his passion in teaching the fundamentals of exploration geophysics. Associate Professor Ron Keam complemented him extremely well on the theoretical side. Their combined efforts gave me an excellent preparation for working in the industry.

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