MASSEY RESEARCH

Once more with feeling
Designing for emotion

Coming into the fold
The domesticated deer

Songlines
Listening to bellbirds

Research, Scholarship and Creativity

October
2006
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Plus: Chewing it over • Molecules through the looking glass • Children and fairness

Massey University

Why fundamental research makes sense

What is the purpose of university research? The research carried out by universities is so various and the benefits so many that the question is difficult to answer easily or succinctly. Which isn't to say that some haven't tried. One carefully-worded Canadian definition I came upon recently gave the purpose of university research as being, first, to increase our collective understanding of all facets of matter, life and experience, and, second, to apply this understanding in ways that lead to increased prosperity and a better quality of life[1].

To put it in other words, the business of a university is *first of all* curiosity-driven, fundamental research and *then* its application.

Why is the order so important? Because a commitment to fundamental research is one of the defining characteristics of a university, a university's reason for being. It is a statement that bears repeating from time to time.

In the past fifteen years, as the world's economies have become increasingly globalised and knowledge-based, governments have taken notice. They can see that the success of nations depends on their ability to cultivate and employ their intellectual assets to best effect. Viewed through this lens, a university becomes one input among others, a utility for creating an educated and hence more productive workforce and for addressing the environmental, social and economic issues of the day.

If the wine industry needs a competitive advantage, a university can be funded to develop hardier grape vines. If the demographic composition of the population is changing and help is needed to inform regional planning, a university study is commissioned.

I support applied research like this, but then my advocacy is hardly necessary. Applied research has a good fit with the way the world works: it can be carried out within time spans with which businesses and governments are comfortable, it is relatively easily costed and its aims are pragmatic and achievable. It will find the funding it needs.

'Fundamental', 'basic', or 'curiosity-driven' research – choose your terms – is often none of these things. If intention is the measure, then basic research is undertaken to acquire new knowledge of the underlying foundations of phenomena without regard to any particular application. Fundamental research frequently ventures into realms where results are uncertain and success is unpredictable. It can be expensive, with the best research often coming from multidisciplinary teams using sophisticated equipment. It may take many years. Risky, unpredictable, long term, expensive – you can see why fundamental research does not endear itself to the market.

So why persist? One reason is that the pay-offs when they come – and often they are serendipitous – can have such extraordinary, far-reaching and novel applications and implications. Fundamental research in biochemistry gave us the structure of DNA. Today DNA sequencing is routinely used in genetic screening for birth defects, in criminal forensics and in a legion of other applications. Fundamental research in atomic physics gave us the laser, a device now ubiquitous in consumer electronics, computing and communications. The stock of knowledge added to by fundamental research benefits not just private enterprise but society generally.

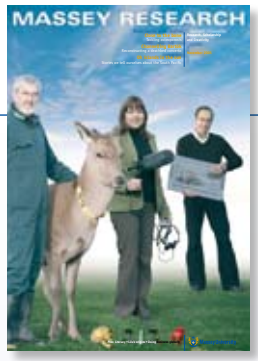
Another reason is that by undertaking fundamental research we create better universities. The opportunity to pursue fundamental research is one of the incentives that persuades our best and brightest to choose university careers over other, often better-paid, options. Their teaching is informed by their research. Their postgraduate students will take with them into industry – or society more generally – the technical and problem-solving skills that fundamental research is uniquely suited to providing. In short, by funding good fundamental research we build good universities, good universities do a better job of knowledge transfer, and a more knowledgeable society should be a happier and more prosperous one.

Of course, there is an extent to which the distinction between fundamental and applied research is purely artificial. Applied research can have implications at a fundamental level. Fundamental research may produce immediate applications. Is Professor Barry Scott's research into the relationship between fungi and grasses they inhabit applied or fundamental? Either box can be ticked. On the one hand his research may well lead to improved pastures, on the other, it is serendipitously telling us fundamental truths about the role of superoxides – currently demonised as harmful respiration by-product and little else – in regulating cell growth.

What matters – or ought to matter – should be less the label 'applied' or 'fundamental' than the quality of research being undertaken. One hopes that funding bodies will take note.

Judith Kinnear
Vice-Chancellor

[1] Association of Universities and Colleges of Canada, *Momentum: the 2005 report on university research and knowledge transfer*



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Playing well with others

Welcome to the third issue of *Massey Research*, one of our flagship publications. Here, once again, you will find profiles of a number of Massey's researchers and the work they are doing.

Yet any publication that focuses on individuals is, in a sense, misrepresenting the nature of much of the research that goes on within universities today – research which more than ever is a collaborative, multidisciplinary enterprise taking place within and between universities, tertiary institutions, Crown Research Institutes, government and private enterprise.

One reason for this trend away from the individual and towards the network or the team is that some of the most fertile territories for research, development – and, for that matter, commercialisation – demand multidisciplinary approaches. Take, for example, the robotic jaw being developed on Massey's Palmerston North and Auckland campuses. To develop a jaw that is a simulacrum of our own jaws and can be used to measure the characteristics of food requires a command of mechatronics, physiology, dentistry, and food technology. Hence, although the development of the jaw is being spearheaded by Massey mechatronics and food technology researchers, other expertise at Otago and Auckland Universities is also integral.

Another reason for collaborative research is economic: in the interests of New Zealand's advancement it makes more sense to share expensive capital items than to duplicate them.

One of the most tangible acknowledgements of the worth of collaborative research has come in the form of the creation of various centres and partnerships. A short walk away from my office on the Palmerston North campus two of the most recent centres are taking shape. One is the Hopkirk Institute, a $16 million state-of-the-art research and teaching facility, which will bring together the expertise of scientists from Massey's Institute of Veterinary Animal and Biomedical Sciences (IVABS) and AgResearch; the other, a $1.5 million microscopy research centre, which will be used by research groups throughout the Manawatu region. Both will open in early 2007.

What is more, if I were to take the two-hour drive down to the Wellington campus I would find a third new research centre, the joint Centre for Disaster Research, established this year as a partnership between Massey and GNS Science to better prepare New Zealand against natural disasters.

But the developments I most anticipate are those connected with the two Partnerships for Excellence. One of these, the $22 million "Agricultural and Life Sciences Partnership", is integrating the research and education capabilities of Massey and Lincoln universities; the other, the $5 million "Towards a Future-Focused New Zealand Equine Industry Partnership", will employ education and research to help the equine industry reach its full economic potential.

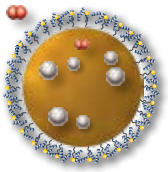
Since these partnerships were announced in 2005, their planning and development has continued apace. The next year should be momentous, and I look forward to bringing you news of them in the next issue of this publication.

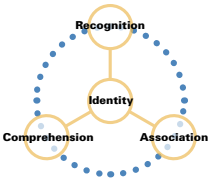
Nigel Long
Assistant Vice-Chancellor - Research

MASSEY RESEARCH

HERE & NOW

FEATURES





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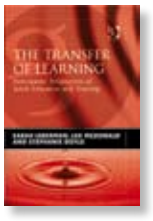
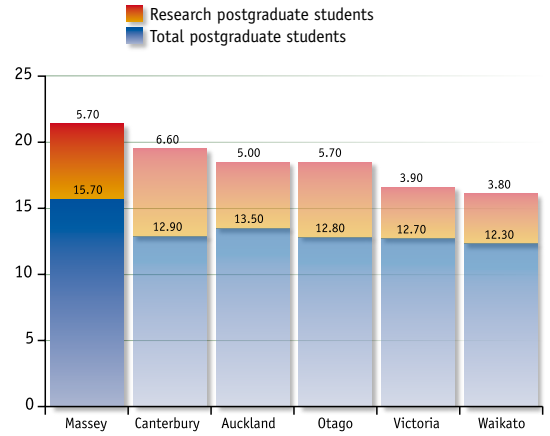


To learn more about Massey research and to view earlier issues of this publication visit http://masseynews.massey.ac.nz

An exceptional postgraduate research experience

Postgraduate student numbers are burgeoning at Massey. In 2005 more than 21 percent of Massey's student population were postgraduates, a proportion higher than that of any other New Zealand university. In the proportion of research degree students to total equivalent-full-time students (EFTS), Massey falls second only to the University of Canterbury.



Postgraduate students as a percentage of total students (EFTS) for 2005

A research powerhouse

Massey's lineage as an agricultural college can still be seen in the University's eminence in biosciences, but Massey has become much more.

Currently the University has more than 700 research-active staff. They include acknowledged world experts in fields as disparate as sleep/wake research, the 'handedness' of molecules, and the Bartók Viola Concerto.

The Performance Based Research Funding exercise conducted by the Government in 2003 identified Massey as having strengths in a number of domains:

- applied biological sciences
- veterinary and large-animal science
- accounting and finance
- communications, and journalism and media studies
- design
- management, human resources and industrial relations
- Māori knowledge and development
- social sciences, social policy and social work
- visual arts and crafts.

The University also hosts a span of human health research expertise, including nursing, rehabilitation therapies, public health, and burgeoning new areas such as sport and exercise science.

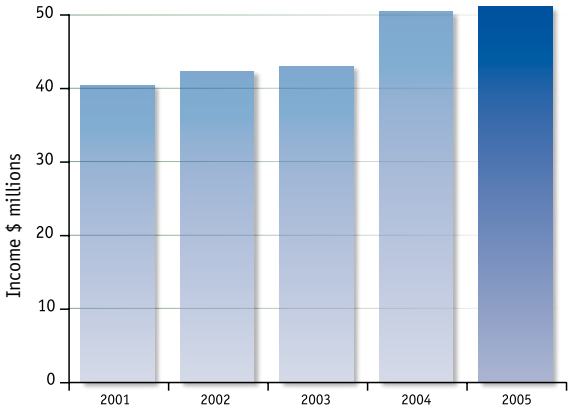
The University's strength in research – alongside strength in teaching and its international reputation – is one of the reasons the 2005 *Times Higher Education Supplement* World University Rankings has again placed Massey in the world's top 200 universities.

Building a research infrastructure

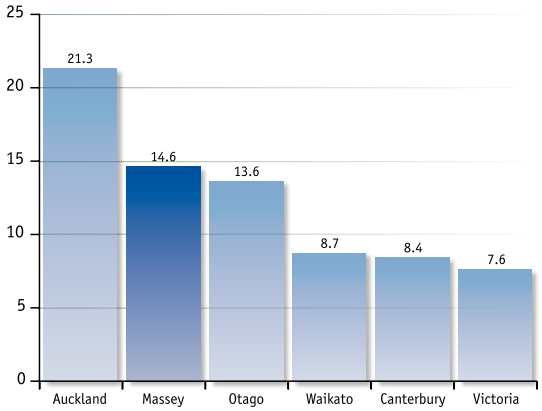
The University is committed to providing its researchers with an environment in which scholarship and creativity can flourish. This includes professional development programmes, generous leave provisions, a system of rewards and recognition, opportunities for promotion and, at the postgraduate level, a range of scholarships. It also includes investing in the equipment and infrastructure that make advanced scientific research possible. The Massey community is currently looking forward to the opening of the Hopkirk Institute and of the Manawatu Microscopy and Imaging Centre, both scheduled for early 2007.

A magnet for research investment

The research funding attracted by medical research – an expensive and well-funded activity – skews the totals for research funding across the universities. If this funding is excluded, however, Massey can be seen to attract more research and contract income from external sources than any other New Zealand university. External sponsors invested $51.5 million in Massey's researchers in 2005.



Total research and contract income awarded



External research income as percentage of total turnover for 2005

The Graduate Research School

The Graduate Research School was established in February 2004. Currently it is responsible for doctoral degrees (in philosophy, business and administration, clinical psychology, and education), and scholarships, both undergraduate and postgraduate. It is also to assume responsibility for research masters degrees. The School provides information and administrative services for doctoral degrees and scholarships.

The Dean of Graduate Research is the Chair of the Doctoral Research Committee, and the of Scholarships Committee, and has an advocacy role for graduate research within the University.

Consortium wins contract for new tertiary teaching centre

New Zealand's first Centre for Tertiary Teaching Excellence is to be set up at Massey as part of a $20 million government initiative to boost the quality of teaching in all branches of the post-school education sector.

A Massey-led consortium won the contract to establish the centre and run it for five years.

The consortium includes AUT University, the University of Canterbury, Christchurch College of Education, the Universal College of Learning, and Manukau Institute of Technology. It was selected ahead of a consortium led by Victoria University.

The centre will focus on supporting the development of teaching expertise across the tertiary sector. Based at Massey's Wellington campus, it will have regional hubs in Auckland, Christchurch and Palmerston North.

The decision to award the contract to the Massey consortium was announced on 16 August by the Minister for Tertiary Education Dr Michael Cullen.

Dr Cullen said it would assist tertiary education organisations and educators to deliver the best possible learning outcomes for students.

"The centre will also support and challenge tertiary education organisations to enhance the effectiveness of teaching and learning practices.

"This will undoubtedly have a positive impact on the quality of teaching and will result in students achieving their full potential."

The centre will

- establish benchmarks to improve teaching practice.
- support the development of subject expertise in tertiary teaching.
- research, identify and share effective teaching and learning practices.
- explore the need for professional standards including entry requirements to the tertiary teaching profession.
- administer the Tertiary Teaching Excellence awards.

"Encouraging excellence in teaching will reinforce our reforms of the tertiary sector funding framework as we strive to lift quality across the sector," Dr Cullen said.

"High quality teachers producing high quality, work-ready students where the economy needs them most, is vital for economic transformation."

Gordon Suddaby, Director of Massey's Training and Development Unit, who is leading the project for Massey, says the centre will have a strongly collaborative approach. Its establishment board includes representatives from wananga, polytechnics, private training establishments and other tertiary education providers.

He says about half the $4 million annual budget will be spent on projects, while some of the money will be spent on research, and monitoring and evaluation of effective teaching.

The centre will have a director, and that appointment will be one of the first tasks of the establishment group, while each of the hubs will have just over one full-time equivalent staff member.

Centre functions will include building the teaching capabilities of all tertiary institutions, providing advice to the tertiary education sector and government agencies.

"It could be simple things but it could be more intensive, something like how to address student issues or Industry Training Organisations might want to do surveys to establish what are the needs of particular industries," Mr Suddaby says. "It's a really exciting initiative. I see it as an opportunity to provide the support and some direction and coherence to the sector that hasn't always been there."

Australia has a similar organisation called the Carrick Institute, while Britain's Higher Education Academy has a much bigger brief that crosses into what the Tertiary Education Commission does here. "We will build our model ourselves," says Mr Suddaby.

That process started a fortnight ago, with the centre establishment group holding its first meeting in Wellington. Massey Vice-Chancellor Professor Judith Kinnear congratulated the group on the successful bid.

Professor Kinnear says it is important that the centre be relevant, linked to practitioners and outcome-driven but, at the same time, research-informed.

"This is a far-sighted initiative by the Government that overseas experience suggests will quickly reap rewards for New Zealand across all spheres of tertiary education."

She had called on her own contacts among staff involved in the Carrick Institute and the Higher Education Academy to help to support the bid and says the centre will utilise those links in future, including for collaborative research.

Mr Suddaby is delighted that Massey gave such strong support to the project, with Professor Kinnear taking an active role, including in the selection interviews conducted by the Tertiary Education Commission.

He says it was good to work collegially with such a wide range of partners and acknowledged particularly the contribution of Alison Holmes from Canterbury and Associate Professor Neil Haigh from AUT.

"All the collaborative partners and their vice-chancellors have been very supportive. In our bid we tried to make it practitioner-driven and practitioner-based. The people involved in it were all involved in staff development activities.

"The establishment group is now looking forward to developing a wide range of collaborative engagements with the whole sector to realise the vision of best learning outcomes for all students."

Professor Tom Prebble from Massey has been given the role of interim director and project manager.

UCOL CEO Paul McElroy with Massey's Gordon Suddaby, and Professor Tom Prebble.

Disaster research centre established

A new research centre established by the University and GNS Science aims to better prepare New Zealand to cope with natural disasters.

Based at the School of Psychology on the Wellington campus, the joint Centre for Disaster Research concentrates the skills of psychologists, sociologists, planners, geologists, risk assessors, Māori researchers, and economists from both organisations.

A function to celebrate the establishment of the centre was held at the institute's Lower Hutt office last week with Research, Science and Technology Minister Steve Maharey witnessing the signing of an agreement.

Mr Maharey says the new centre would put New Zealand at the leading edge of hazards research.

"New Zealand is vulnerable to natural hazards, so it is essential our research and science community has a strong focus in this area."

Institute chief executive Dr Alex Malahoff says New Zealand's vulnerability to natural hazards was the main reason for setting up the centre.

"It will help to ensure that there is improved uptake of GNS Science's natural hazards research so it is integrated with Massey's work on preparedness and reaction to disasters," Dr Malahoff says.

"Recent events in Indonesia and New Orleans provide strong evidence for the relevance of bringing a focus to this area where the physical and social sciences intersect."

Dr Malahoff says New Zealand had been spared the pain of a significant mass casualty natural disaster since the 1931 Hawke's Bay earthquake, resulting in a degree of complacency and incomplete understanding of the devastation of natural hazards.

Research, Science and Technology Minister Steve Maharey, GNS Science chairman Con Anastasiou, Vice-Chancellor Professor Judith Kinnear and GNS Science chief executive Dr Alex Malahoff.

The Pro Vice-Chancellor of the University's College of Humanities and Social Sciences, Professor Barrie Macdonald, says the centre will concentrate the expertise of both organisations.

"This is a valuable partnership that will draw on the University's established strengths in earth sciences, planning for mitigating the effects of natural disasters, and the building of resilient communities."

Professor Macdonald says the benefits of the centre include improved support for risk reduction activities, and a better understanding of how to recover from natural disasters.

Centre staff will work with a range of agencies to improve New Zealand's capabilities to respond to natural disasters. They will focus on research, postgraduate teaching and commercial consultancy.

Hopkirk Institute takes shape

Substantial progress has been made in constructing the quarters for the Hopkirk Institute, which will be based on the Palmerston North campus. The Institute, to be launched in early 2007, will bring together research scientists from the Crown Research Institute AgResearch and Massey's Institute of Veterinary, Animal and Biomedical Sciences. Professor Grant Guilford, head of IVABS, says the collaborative venture, created under the terms of a memorandum of understanding, creates a team of animal health researchers of a size and expertise to rival that found anywhere in the world.

AgResearch CEO Andy West says the main focus of the Institute will be on infectious diseases endemic to New Zealand. Its work will focus on diseases that threaten the productivity of the pastoral sector, animal welfare, sustainability of farming systems, food safety and market access for animal products.

Manawatu Microscopy and Imaging Centre to open in 2007

Massey's Palmerston North campus is in the process of setting up a new $1.5 million Manawatu Microscopy and Imaging Centre. The facility will be available for staff and students at Massey, neighbouring CRIs, and other research institutes and hospitals in the greater Manawatu region.

The centre will be based around two new state-of-the-art machines: a confocal microscope, which allows precisely focused 3D images of structures such as chromosomes; and an environmental scanning electron microscope (ESEM), which allows detailed examination of non-treated, live tissue. The centre will also include new computer-based imaging equipment, and will house a transmission electron microscope (TEM), which is currently located at HortResearch.

The initiative is funded by a grant from the Tertiary Education Commission's Innovation Development Fund. "It's really a big boost for us," says one of the project leaders, Professor Barry Scott.

The facility will be located in the current undergraduate laboratory on Level 1, Science Tower D. The ground floor was chosen, says Professor Scott, because of the obvious difficulty in getting such large pieces of equipment upstairs, and also because of the convenience of access.

The project is a collaborative effort: the funding was applied for by Professor Professor Scott and Michael Peters; Professor Jeremy Hyams is coordinating the establishment and opening of the centre and the opening symposium; and Dr Al Rowland, Dr Barbara Ambrose, and Doug Hopcroft are also involved.

An architect's plan has been developed, and the microscopes will be ordered shortly. The official opening of the centre is scheduled for Wednesday 18 April 2007.

Professor Yusuf Chisti stands alongside two newly commissioned bioreactors. The bioreactors and their PC2-level containment facility complement recently-acquired equipment for recovering biological products. Professor Chisti is researching the use of biocatalysts – biotech microorganisms, animal and plant cells, enzymes, and subcellular components – to produce novel bioactive substances, vaccines, potential therapeutics, diagnostic antibodies and other high-value products.

Building research capability in the social sciences

The next generation of social scientists is now being fostered by the network charged with building the country's research capability in the social sciences.

The Building Research Capability in Social Sciences network is a collaborative venture between universities. Formed two years ago with an $8 million grant from the Tertiary Education Commission, the Massey-hosted network is already having an impact according to the chairman of its management group, Professor Paul Spoonley.

An access grid has been established at each university and all of the Massey campuses, with technology to enable easy discussion and the exchange of information between members.

The grids combine audio and video conference software and can link multiple sites for meetings and conversations.

"It means we can talk from wherever we are, exchange ideas and hear from experts in the field internationally or nationally," says Professor Spoonley.

At the same time, the network has been active in developing the skills of graduate and early career researchers.

"An important challenge is to replace an ageing workforce in the universities and to make sure that new research leaders are being upskilled. There are new people with new ideas who are the next generation of social scientists. It's important to make sure they are contributing to the economic and social well-being of the country. To make sure this happens successfully, new paradigms and methods are required."

From Massey, Professors Robyn Munford, Chris Cunningham, Sally Casswell, Paul Spoonley and Dr Tim McCreanor have all contributed to establishing the network and its first full year of operation.

Members of the management team, from left: (back) Dr Tim McCreanor (Massey), Dr Nick Lewis (Auckland) Dr Charles Waldegrave (Family Social Policy Centre), Professor Richard Bedford (Waikato) Professor Richard Le Heron (Auckland) Professor Chris Cunningham (Massey), Professor Paul Spoonley (Massey); (front) Professor Janis Paterson (AUT), Professor Geoff Kearsley (Otago), Professor David Thorns (Canterbury), Professor Jenny Neale (Victoria) Professor Robyn Munford (Massey).

Design Junction project wins TEC funding

A research project that will build the design capability of small firms in Wellington has been awarded $383,470.

Associate Professor Claire Massey, Director of the SME Research Centre, says the project will develop a new approach to fostering links between organisations that have design knowledge and expertise.

It will include those involved in economic development, business development, training and education of the owners of small firms, and design experts.

The project team includes Dr Martin Perry from the College of Business, and from the College of Creative Arts, Dr Anders Warell, Amanda Bill, and Professor Duncan Joiner. Also involved are Charles Finny, Wellington Regional Chamber of Commerce; Batch Hales, NZIM; and Paul Mather, WelTec. Design Junction is one of 12 projects funded from the Tertiary Education Commission's Growth and Innovation Pilot Initiative. This funding promotes the sharing of knowledge and expertise between the education and industry sectors.

$1 million grant for liquor advertising research

A three-year study to assess the impact of alcohol advertising on young New Zealanders is about to get under way, following a grant of just over $1 million from the Health Research Council to the University's Centre for Social and Health Outcomes Research and Evaluation.

The study will involve 2000 teenagers from the Auckland region, and will include European, Māori, Asian and Pacific Island pupils from city and country secondary schools.

The centre's quantitative team leader, Taisia Huckle, says the longitudinal study will focus on 13-year-olds and follow their development through to age 15.

The impact of alcohol advertising will be measured alongside other factors such as peer group pressure, parental influence, availability of alcohol and socioeconomic influences.

Centre researchers will also talk to alcohol marketing and advertising representatives for an up-to-date appraisal of market approaches and attitudes.

"We hope to collect some really good data and to have some solid findings that will help policy makers and health advisers make good decisions for our young people," Ms Huckle says.

2006 Marsden grants

Dr Leon Huynen, from the Allan Wilson Centre for Molecular Ecology and Evolution, will uncover lost secrets of Māori cloaks and kete. Māori cloaks, or kākahu, have a long history, and stunning examples exist in museums in New Zealand and around the world. Unfortunately, a lot of the information relating to their origins has been lost, meaning we do not always know when or where they were made, or what materials were used. Dr Huynen and his team will extract and analyse DNA from feathers, skins and plant fibres from cloaks and kete. This will allow them to identify the variety of birds, plants and other animals used, and determine if these have changed through time or varied across the country. The results will also provide information on the preferences and choices made by Māori artisans. For example, were their design and material choices governed by what was available locally, or did they trade feathers, skins and fibre? This project will draw on the DNA database of New Zealand birds to match cloak materials to species and to specific geographic populations. The research will contribute to the cultural value of these important taonga, by allowing their stories to be told once again. Dr Huynen and his team will work with the support of Te Rōpū Rāranga Whatū o Aotearoa, the New Zealand Māori weavers group.

Professor Peter Schwerdtfeger, from the Institute of Fundamental Sciences, is aiming to solve one of the fundamental scientific puzzles of our time: why, when many biological molecules exist in two forms which are mirror images of each other, does nature use only one form of each? What has led to this choice? For example, why is it that our bodies can digest only right handed sugar molecules, and why are most of the amino acids that make up our proteins left handed? The answer might be the amount of energy needed to create the right handed and left handed forms, with nature choosing the easiest one. Any energy differences will be tiny, but it may be possible to measure them, if scientists choose the right molecules to examine. Applying advanced computational methods, and making use of the forces that determine the evolution of stars – the weak and electromagnetic forces – Professor Schwerdtfeger will identify the best molecules to study this interesting question. He will collaborate with European researchers, who will help with the calculations and carry out measurements.
Professor Schwerdtfeger is profiled on pages 26 to 31

Dr Jan Schmid, from the Institute of Molecular BioSciences, together with **Dr Barbara Holland** from the Allan Wilson Centre for Molecular Ecology and Evolution, and Associate Professor Richard Cannon from the University of Otago, will mate strains of the fungus *Candida albicans* to see if sex gives it a survival advantage. *Candida* only reproduces sexually very rarely; it usually just divides in two. It is thought that being able to switch to sexual reproduction could give the species an advantage in certain situations, perhaps allowing it to generate new combinations of genes that make it better at infecting people and more resistant to antifungal drugs, for example. After mating strains, Dr Schmid will test whether the offspring are better at surviving than their parents. If they are more hardy, then occasional sex could indeed be giving the fungus an advantage. But if the parents are better at surviving than the offspring, then *Candida* cannot be getting an obvious survival advantage from reproducing in this way, and perhaps sex is a dying art for this species. The study will investigate a fundamental belief: the superiority of sex over reproducing by dividing in two. It could also help in designing treatment for medical conditions caused by *Candida*, by developing an understanding of how the fungus evolves.

Dr Adriane Rini, from the School of History, Philosophy and Politics, along with Professor Max Cresswell from The University of Auckland, will produce the first major book-length study of a phenomenon in philosophy known as the 'world-time parallel'. *What could have happened but never did* doesn't seem as real as *what did happen*. However, just as what did happen, but is not happening now, happened *at another time*, something that could have happened, but never did, can be thought of as happening in *another possible world*. The two philosophers will argue that, whatever the reality, there is an analogy between *possible worlds* (and the associated modal matters like necessity and possibility) and *other times* (past, present, and future). This analogy between modality and time will be explored using formal logic.

Professor Ian Evans, from the School of Psychology, and his team will find out how teachers can best facilitate the development of children's 'emotional intelligence' – a measure of our ability to understand and manage our feelings, as well as other people's. Families play a role in developing this skill, but can teachers also help? Three studies are planned. First, the researchers will work with groups of teachers identified as having a warm, sensitive teaching style, to find out more about what they do in their classrooms. Second, they will use positive examples of teacher-student interactions to create teaching modules on interactive DVD, which will form the basis of a professional teacher development programme. Finally, the team will look at the effect this programme has on children. Does it benefit them – and if so, how? Does children's ability to understand their feelings improve? Does it have positive effects on their interactions with their peers? Can an effect on bullying and behaviour difficulties be measured? Overall, the research has the potential to inform schools about how they can contribute to the development of children's emotional intelligence, leading to improved classroom behaviour and peer relationships.
Professor Evans is profiled on pages 50 to 53

Dr Evelyn Sattlegger, from the Institute of Molecular BioSciences, and her collaborators from Germany and the USA, will study the function of an enzyme, GCN2, and the protein, GCN1, which activates it. Together, these two allow our cells to know when they are lacking in amino acids, and to cope with the problem. Amino acids are particularly important physiologically because, as constituents of proteins, they execute almost all biological functions. Therefore, knowing how cells detect and regulate levels of them would be very useful. Dr Sattlegger will determine how GCN2 and GCN1 function in molecular detail, carrying out a variety of genetic and biochemical analyses. In addition to its role in amino acid regulation, GCN2 also plays several specialised but crucial roles in mammals, ranging from behaviour regulation and memory formation, to viral defence and immunological processes. Therefore, this study could have wide ranging implications for understanding human health and for disease prevention.

Fast Start Funding Recipients 2006

Dr Patrick Dulin, from the School of Psychology, will investigate why older people who enjoy helping others experience health benefits. Many studies have indicated that helping others, by volunteering and providing support, enhances longevity and improves mental health among older adults, but it is still unclear why this is the case. One possibility is that it may stimulate healthy physiological responses, such as lowering blood pressure and stress hormones and making it easier to recover from stress. It may even be the case that providing help to others is more health-promoting for the elderly than receiving support. In this study, Dr Dulin will expose older participants (over 65) to a stressful situation, followed by the opportunity to provide help to a needy other while their emotional and physiological functioning is monitored. This will be contrasted with a control condition in which there is no opportunity to help somebody else. Identifying factors that help individuals to age positively is one of social science's greatest challenges in this century.

Dr Armaz Aschrafi, from the Institute of Molecular BioSciences, will study how protein synthesis at the connection points (synapses) of neurons is regulated. This may lead to new insights into how we learn and remember. Localised protein synthesis at synapses is essential for proper connections to be formed between neurons, and if it is not regulated correctly, this can lead to difficulties in learning and memory. An example is Fragile X syndrome, which leads to autism-like behaviours and to difficulties in learning speech. Protein synthesis is a multi-step process, controlled by a number of different regulator proteins, such as the mRNA-binding proteins. Dr Aschrafi will examine two members of this family of regulator proteins, known as RBM3 and CIRP. Previously, he has shown that over-expression of RBM3 in neurons enhances protein synthesis. Now, he will determine the extent to which RBM3 and CIRP influence protein synthesis at specific steps. This will give new insights into the steps involved in protein synthesis in synapses. Ultimately, the research should lead to an increased understanding of the basic processes that underlie memory formation.

Dr Shane Telfer, from the Institute of Fundamental Sciences, will investigate a new class of catalytically active materials, created using recent advances in nanotechnology. A catalyst is a substance that increases the rate of a chemical reaction without itself being changed in the process. Catalysis is important for both fundamental science and practical applications; for example, catalytic processes are central to solar energy conversion, the action of enzymes, and pollution control in motor vehicles. Recently, materials chemists have been developing ways to arrange individual molecules into precisely ordered arrays, producing new 'nano-structured' materials that are more finely engineered than anything ever made before. These have a huge variety of current and potential applications. Dr Telfer's aim is to integrate this technology with the field of catalysis, designing and fabricating a completely new class of catalytically active materials. In previous work, they have devised a strategy by which active catalytic sites may be embedded within nano-structured materials, and these sites may be programmed to catalyse a wide variety of chemical reactions. Dr Telfer will now investigate these materials in more detail, producing important basic knowledge which may lead to valuable practical applications such as cleaner, greener industrial processes.

Dr Sarah Ross, from the School of English and Media Studies, will study political poetry written by Englishwomen in the 17th century, examining female poets' engagements in the politics of the time. This was a tumultuous era in England, with discontent, civil war, and restoration. In the past decade, knowledge of women's writing in early modern England (1500-1700) has expanded a great deal, as a large number of new texts authored by women have been recovered from British and American archives. However, many of the newly-discovered texts have not yet been analysed. The politics of early modern women's writing has become an increasing area of critical discussion and debate in feminist and historical research, covering domestic, religious, court and state concerns. Research to date says manuscript before 1640 focuses on the domestic, religious and court side, whereas manuscript after the 1640s engages in high state politics. Dr Ross will show, however, that the newly-discovered political poetry modifies this division, and that examining all the types of politics together, no matter what the time period, can lead to a better understanding of the multiple and diverse politicised voices of women in 17th century England.

Dr Nikki Hessell, from the Department of Communication and Journalism, will study the parliamentary reporting carried out by two well-known literary authors: novelist Charles Dickens and dictionary compiler Samuel Johnson. Parliamentary reporting may seem a long way from literature, but several well-known literary authors were involved in this activity during their career. Both Dickens and Johnson produced reports that were not only well-written, but also marketable and appropriate. Johnson worked at a time when parliamentary reporting was still technically illegal, and compiled his reports from other journalists' notes, inventing pseudonyms for politicians to avoid prosecution. A century later, Dickens was part of the well-organised, legal, parliamentary press corps that prided itself on accurately capturing politicians' speeches. Dr Hessell will show how the pair wrote their reports and what made them successful. The project is part of a wider study that will also investigate the parliamentary reporting of Samuel Taylor Coleridge and New Zealand author Robin Hyde.

Sales jobs linked to bladder cancer risk

New research adds to evidence that people who work in sales, particularly women, may have a higher risk of bladder cancer.

Studies have found higher bladder cancer rates among people in various occupations, including hairdressers, textile workers, truck drivers and workers in the rubber, leather and chemical industries. In most cases it is thought that long-term chemical exposures are to blame.

Several studies over the past 20 years have also found sales workers to be at higher-than-average risk of bladder cancer.

For their study, Dr Andrea Mannetje and Dr Neil Pearce of Massey's Centre for Public Health Research analysed 18 studies on occupation and bladder cancer risk.

They found that when other factors were considered – including smoking, a major risk for bladder cancer – women in sales occupations had an 18 percent higher risk of developing the disease than those in other jobs.

For men, there was no clear overall association between sales jobs and bladder cancer. There was, however, some suggestion that men in car sales had an elevated risk, the researchers report in the *American Journal of Industrial Medicine*.

"It is not yet clear that there is a cause-and-effect relationship between sales jobs and bladder cancer," says Dr Mannetje.

"This review of the literature only shows that there is a small increase in bladder cancer risk for female sales workers," she says. The reason, she adds, is unknown, and it is possible that these are chance findings.

One hypothesis, Dr Mannetje says, is that sales workers have less time for bathroom breaks and take in less fluid throughout the day, which might affect their cancer risk because the bladder has a longer contact with potentially cancer-promoting substances in the urine.

However this is speculation, says Dr Mannetje. Neither bathroom habits nor fluid intake have been shown to affect bladder cancer risk, though some animal research suggests they may. It is also unclear whether sales workers visit the bathroom less frequently or drink less fluid than other workers.

Regardless of whether there is a cause-and-effect relationship, Dr Mannetje says, the best way for people to reduce their risk of bladder cancer is to avoid smoking.

The full study can be downloaded from http://masseynews.massey.ac.nz/2006/Press_Releases/bladder-cancer.pdf

More evidence that 'light' smokes fool the smoker

A new survey confirms that many smokers are fooling themselves about the benefits of so-called light cigarettes.

788 people from South Australia and New South Wales were interviewed by telephone.

The survey, conducted by Professor Janet Hoek from Massey and Associate Professor Rachel Kennedy and Jeremy Tustin from the University of South Australia, coincided with both countries' ratification of the World Health Organisation Framework Convention on Tobacco Control, which calls on signatories to review the descriptors used on cigarette packets.

In Australia several tobacco companies have voluntarily undertaken to eliminate the use of the words "light" and "mild" on cigarette packets. Australian regulators have argued that these words imply health benefits the products do not deliver, and so may mislead and deceive smokers.

Professor Hoek says the new survey shows that a substantial proportion of respondents, both smokers and non-smokers, were confused about what the term "light" meant. However, smokers of light cigarettes were much more likely to associate incorrect attributes with them, including the delivery of less tar.

Professor Hoek says although the findings are preliminary, they have important policy implications. They highlight misconceptions among all groups, especially those at greatest risk of being harmed by confusion.

The report says the tobacco industry has indicated it intends to replace "light" and "mild" with terms such as "fresh", "'fine" and "smooth".

Professor Hoek says there is an urgent need for more research, particularly into the attributes smokers might associate with these new terms. "There is little point in replacing one misleading term with another."

A paper outlining the research findings won a Best in Track award at the recent Australian and New Zealand Marketing Academy conference.

A Centre for Research in Analogue and Very Large-Scale Integration (VSLI) microsystem design has opened at the Auckland campus. It is headed by Dr Rezaul Hasan (pictured) and includes co-researchers Dr Tom Moir and Dr Fakhrul Alam. Dr Hasan has a doctorate in Integrated Circuit Design and VLSI Design from the University of California in Los Angeles and 20 years' experience of work and research in the microchip technology industry. Dr Hasan is currently designing a component for ultrawideband wireless communication, which he hopes will be patented for commercial use.

Riddet Centre researcher Dr Jason Hindmarsh stands alongside an MRI machine which he and Institute of Fundamental Sciences researcher Robin Dykstra have re-commissioned. The machine will be used to track how the composition of a mix of milk and probiotic bacteria changes as it is dried and rehydrated.

HortResearch originally purchased the hollow, horizontal bore superconducting micro-imaging magnet to measure fruit.

Dr Hindmarsh says that unlike the nuclear magnetic resonance machines installed in the same laboratory suite, the MRI machine gives spatial resolution.

It shows how an object is physically distributed and, in the case of milk drying, the speeds at which the components of lactose, fats, and water are redistributed.

The project is a collaboration between the Institute, the Riddet Centre, the MacDiarmid Institute and Bruker New Zealand to make MRI micro-imaging available to researchers.

The biochemistry behind tuberculosis

The latest breakthrough in the fight against tuberculosis (Tb) has come from PhD student Celia Webby (pictured). Working in the Institute of Fundamental Sciences, Ms Webby has solved the atomic structure of an enzyme that the Tb bacterium needs to survive. This may pave the way for new antibiotics to fight the disease.

Ms Webby is under the supervision of Associate Professor Emily Parker and Professor Ted Baker, director of the Centre for Molecular Biodiscovery at the University of Auckland. The centre has several projects under way to determine the protein structure of the Tb bacterium, Mycobacterium tuberculosis, but researchers were having difficulty characterising the particular bacterial enzyme known as DAH7PS.

In order to study and describe the atomic structure of an enzyme (a type of protein), it must first be made soluble. Ms Webby had had previous success in making proteins soluble in order to purify and cultivate them in the laboratory for characterisation.

"It's difficult to work on a protein that is not soluble because it needs to be soluble to be able to purify, characterise and grow crystals with. The Tb protein is grown in and isolated from *Eschericha coli* as this is a lot safer than working with the Tb bacterium," Ms Webby says.

"Once we know what an enzyme looks like, and how it works, we can target it. What's really exciting is that this particular enzyme is not produced in humans, making it an ideal target for anti-Tb drugs."

She says the DAH7PS enzyme is significant to the development of antibiotics as it is essential for the virulence or spread of the bacterium that causes the disease. Professor Baker says Ms Webby's success has helped Tb researchers understand the evolution of the enzyme, providing valuable insights into how it works and potentially how its activity could be blocked.

"The current antibiotics used to treat Tb have been around for a long time. We need more effective therapies to combat the disease and to tackle resistant strains which have developed over the years," Professor Baker says.

Scott Walker, a PhD student in the same laboratory with Ms Webby and under the supervision of Dr Parker, is working on the chemistry of inhibitors (substances that bind to the chemically-active sites on proteins and enzymes to inhibit their activity). This recent breakthrough will allow him to take a closer look at the Tb enzyme.

Last year Mr Walker was a runner-up in the biotechnology section at the MacDiarmid Young Scientist of the Year awards, for his PhD project on the development of new classes of antibiotics. He specifically targets bacteria using chemical compounds he has designed to act as inhibitors. These inhibitors have the potential to disable the activity of bacteria that have become resistant to antibiotics, which is one of the largest problems in modern medicine.

Tuberculosis, an airborne infection that mainly affects the lungs, is classified as a "world health emergency" by the World Health Organisation. Globally, it is the most deadly and widespread major infectious disease, claiming the lives of two to three million people a year.

New Zealand has one of the highest rates of Tb in the developed world, twice that of Australia. About 400 new cases are reported each year with the highest number in Auckland, followed by Manukau City and Wellington.

Study finds double standard in attitude to women's drinking

New research has confirmed the so-called "feminisation of binge drinking" – a trend that has seen increasing numbers of women drinking large quantities of alcohol in social situations, in line with their modern status as independent individuals who can earn as much or more than their male counterparts.

And the research, by psychologist Dr Antonia Lyons, has also revealed that while men and women have a growing acceptance of such behaviour among their friends, they have completely different and contradictory attitudes towards excessive drinking by strangers, depending on whether it is a man or a woman they see getting drunk.

The double standards lead both men and women to label other drinkers with terms like "disgusting", "embarrassing", and "slutty" if they are women, while publicly drunken men who are strangers are more likely to be regarded by both sexes as amusing or "a joke".

Neither men nor women displayed these prejudices when judging their own friends. Heavy drinking was regarded as a pleasant and enjoyable leisure activity, with the only negative consequences being things like hangovers, reckless behaviour and the financial cost. Little apparent regard was paid to the consequences for personal health.

Going out and getting pissed: Young adults, drinking and gender identity was a qualitative study intended to explore young adults' understandings of drinking and the meanings they give to it, Dr Lyons says.

It involved middle class 20-to-30-year-olds from a range of occupations, about half of whom were university-educated. The 32 participants, 16 men and 16 women, were split into groups of friends ranging in size from three to five. One group of friends was all women; the other groups were mixed.

"I was interested in exploring gender relations and gender identities and in how women particularly create their identities around this relatively new public drinking behaviour.

"In a way I was reassured that within their groups both women and men saw women going out and drinking with friends positively, as something that developed friendships and socialising, which is a real shift in terms of our culture.

"But I was totally surprised by the negative stereotypes of other women's drinking out in public, which reinforces more traditional views on women as always being in control and caring for themselves and others.

"The study findings suggest that excessive drinking among young adults contributes to the continual creation of identities, and gender identities particularly. The finding that unknown women's drinking is seen as deviant and breaking moral codes reinforces traditional versions of femininity."

Dr Lyons, whose study was funded by the Royal Society of New Zealand Marsden Fast-Start Fund, believes the findings may have implications for public health efforts to reduce young adults' drinking behaviour.

Download the full report from http://masseynews.massey.ac.nz/2006/Massey_News/issue-16/stories/women-drinking.pdf

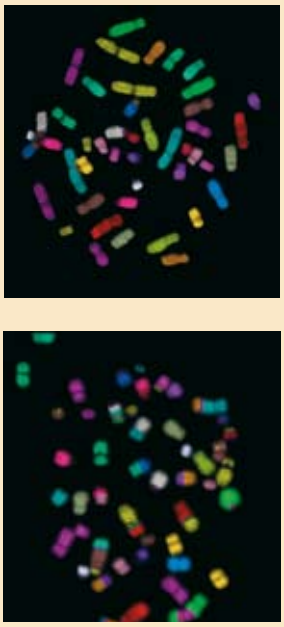
Genetic differences revealed in nuclear test veterans

A small but significant level of genetic effects in New Zealand nuclear test veterans has been found in a study by Massey molecular scientists led by Dr Al Rowland.

In April this year the Nuclear Test Veterans Association released the results of a study conducted by Dr Rowland using the SCE assay[1]. It involved the analysis of the chromosomes of Navy veterans who took part in Operation Grapple in 1957 and 1958, where the British Government tested a series of atomic devices at Christmas Island and Malden Island, now part of Kiribati. 551 New Zealand naval men on two frigates, the Pukaki and Rotoiti, witnessed nine nuclear detonations. Towards the end of this testing programme, the New Zealand frigates were placed progressively closer to the detonations. During the last four tests, the Pukaki was placed 28, 35, 35 and 20 nautical miles from ground zero, respectively.

The results of the nuclear test veterans study showed a small but significant increase in the level of SCE frequencies in New Zealand nuclear test veterans, suggesting that these men may have incurred genetic damage. As with the Vietnam veterans study (see below), factors such as age, cigarette smoking and alcohol were accounted for when comparing the nuclear test veterans sample with a matched control group.

Dr Rowland's research group is continuing to study the New Zealand nuclear test veterans, as part of a larger Government funded programme, applying a range of different genetic tests. These include the Micronucleus assay and G2 assay for efficiency of DNA repair mechanisms, the COMET assay for levels of DNA degradation, and mFISH (multicolour Fluorescent In Situ Hybridization) for chromosome aberrations such as translocations, dicentrics and deletions. The results of this larger study will be released later in 2006.



Karyotypes of a dividing human peripheral blood lymphocyte labelled using the technique called mFISH (multicolour Flourescent In Situ Hybrization). Each pair of chromosomes in the human genome is labelled with a specific coloured probe. The cell at top is normal and shows no aberrations. The cell below shows shifts of colours between different chromosomes. These shifts in genetic material between chromosomes are called translocations. They are an indication of genetic damage.

Vietnam veterans may have incurred genetic damage

A significant difference between the DNA of veterans who served in Vietnam and those who did not has been found in a study by Massey molecular scientists.

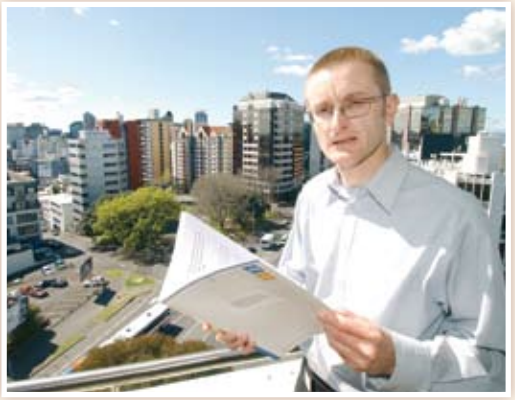
The study was conducted by Master's student Louise Edwards under the supervision of Dr Al Rowland (pictured), and the results of a genetic analysis are now in the hands of the veterans.

Ms Edwards and Dr Rowland, from the Institute of Molecular BioSciences, studied the rate of "sister chromatid exchange" (SCE)[1] in peripheral blood lymphocyte cells. A comparatively higher level of sister chromatid exchange was seen in the servicemen who went to Vietnam.

Dr Rowland says the sample is statistically small; only 24 veterans and 23 controls. Nonetheless the results are highly significant and warrant further investigation. Control participants were also studied for comparison and were closely matched to the veterans in order to remove the input of possible confounding factors such as cigarette smoking and alcohol consumption, which may impact upon the interpretation of the results. The control subjects were all ex-military men of the same age and with a similar lifestyle, medical history and occupational history, but with one important difference – they did not serve in Vietnam. Selection of matched controls for comparison was a very important part of the study. A comparison of the SCE frequencies between the veterans and the controls showed a highly significant difference. Half of the veterans had a higher SCE frequency than the highest control. Taking the major confounding factors into account, the results would suggest that the veterans were most likely exposed to some harmful substance as a result of their service in Vietnam. This exposure could have the potential to cause genetic damage.

1. The sister chromatid exchange (SCE) assay is a bioindicator test that analyses breakages in dividing chromosomes. The higher the SCE rate, the greater the risk of genetic damage, based on the premise that elevated SCE frequencies are known to be caused by clastogenic activity (a clastogen is any substance which is known to damage DNA).

Party pills survey fuels debate



Research on legal party pill use in New Zealand by the University's Centre for Social and Health Outcomes Research and Evaluation has been cited by both proponents and opponents of the pills to back their arguments.

Opponents want the pills either outlawed or their sales further restricted. Proponents argue the pills are a safer alternative to illicit drugs, such as speed and ecstasy.

The pills' main active ingredients are benzylpiperazine (BZP), which has an effect similar to amphetamine, and triflourophenylmethylpiperazine (TFMPP), which has an effect similar to ecstasy.

Since June last year BZP has been classified as a class D drug under the Misuse of Drugs Act, restricting its sale to those 18 and older and prohibiting advertising in mainstream news media of products containing it.

The pills have been sold under a variety of names for more than a decade but have become increasingly popular in the past six years.

The aims of the taxpayer-funded survey were to identify levels and patterns of use and demographics of users, their use of other drugs, any harm or problems associated with use, to gauge availability, and explore the role of party pills both as a possible gateway into illicit drug use and as a possible alternative to or gateway out of using illicit drugs.

A random survey of 2010 people aged 13 – 45 years was conducted in February and March this year.

It found that one in five had tried legal party pills and two in five (40 percent) of 18 to 29-year-olds. Men were more likely to have tried them than women (24 percent, compared with 17 percent) and Māori were more likely to have tried them than non-Māori (26 percent compared with 19 percent).

Study leader Dr Chris Wilkins says he is surprised at the number of people who have taken or are taking party pills. Based on previous research on amphetamine use, he expected a figure closer to 5 percent.

The 13 to 45 age group is one most drug surveys concentrate on, Dr Wilkins says.

He is also surprised at the degree to which many users are unaware of the manufacturer's instructions about recommended doses and substances that should not be mixed with party pills.

The fact that pro- and anti-party pill camps cited the survey to back their position was "in some ways a measure of the success of the study and the data we collected", Dr Wilkins says. "It demonstrates how balanced the research was. Some findings, like the level of use, surprised regulators while others supported somewhat what the [party pill] manufacturers are saying."

He says if legal party pills are creating a bigger pool of people who go on to try illicit drugs that otherwise wouldn't "that's actually quite a big deal. It could contribute greatly to illegal drug use in New Zealand, and that's something we're going to investigate further."

Dr Wilkins thinks a possible alternative to making party pills illegal would be to introduce more regulation relating to warning labels and the type of outlet that sell them, as well as enforcing the age restriction more strictly.

"You don't have to go straight in and make them illegal. There's lots of things you can do like limiting the sales points, not selling them from premises that sell alcohol, having mandatory health warnings, or banning advertising completely."

The survey found of the 80 percent who had never taken legal party pills, 72 percent said they "did not like them", 20 percent said they were not in their social scene, 16 percent said it was for health reasons and 5 percent said they had never heard of them.

When asked whether they had taken the pills in the past year, the percentage of users dropped to 15 percent, or one in seven, and one in 22, just under 5 percent, had taken party pills in the previous month.

Of those who had ever taken party pills, 61 percent said they had stopped taking them in the past year, 8 percent said they were taking more pills than before, 15 percent said they were using fewer and 16 percent said they were taking the same quantities of pills in the past year as previously.

The most common reason given for taking fewer party pills was the "hangover" or "come down" (32 percent), with 30 percent saying they no longer partied as much and 15 percent citing health reasons.

Of those who had stopped taking party pills, just over half said they either did not like them or had been "just experimenting" and 27 percent said they stopped because of the "hangover" or after effect.

Those taking more party pills said they did so because they enjoyed the effect (32 percent), they were partying longer (23 percent) or it was "part of the scene" (15 percent).

Rates of use showed nearly half (46 percent) of those who had taken party pills in the previous year did so on no more than two occasions, 27 percent had taken them on three to five occasions, 11 percent had taken them approximately monthly and 6 percent had taken them weekly or more.

On average men had taken party pills more than twice as often as women, and made up virtually all those who reported taking pills on 50 or more occasions in the previous year.

Most users reported taking one or two pills at a time, in line with common directions from manufacturers, but when asked what was the greatest number of party pills they had taken on one occasion, 42 percent said they had taken four or more, 20 percent said six or more and 11 percent said eight or more.

The mean number of pills taken on a typical occasion was 2.6, with

men taking more at 2.8 compared with 2.2 for women.

Virtually every respondent (99 percent) said they typically swallowed party pills, with two reporting they snorted the powder and claiming to typically inject it.

Asked whether they had driven a motor vehicle under the influence of party pills, 67 percent said no, 18 percent said they hardly ever drove and 12 percent said they had done some driving.

Although party pill manufacturers generally recommend they not be consumed with alcohol, 91 percent said they had drunk alcohol in conjunction with pill consumption and of those 33 percent said they drank more alcohol than normal, 40 percent said they drank less and 28 percent said they drank the same.

Other substances used in conjunction with party pills were tobacco (40 percent of respondents) cannabis (22 percent), and "recovery pills" (9 percent). So-called recovery pills are often sold by the same retailers who sell party pills, and about 15 percent reported taking them.

The most common illicit drug consumed in conjunction with legal party pills was ecstasy (MDMA), taken by 5 percent, followed by magic mushrooms (2 percent) and amphetamines (1 percent).

The survey found that those who used legal party pills had much higher levels of illicit drug use than the wider population, with 61 percent having used cannabis compared with 20 percent of the general population aged from 13 to 45, and 21 percent having used ecstasy compared with 3 percent.

Asked about the role legal party pills played in their illicit drug use, 33 percent said they had recently stopped taking illicit drugs, 28 percent said they took party pills only when they could not obtain illicit drugs and 45 percent said they took party pills as an alternative to illicit drugs.

Of those surveyed who had taken both party pills and illicit drugs at any time, half said they had stopped taking both and there was no relationship between their taking of party pills and illicit drugs.

Of the half who indicated there was a relationship, 14 percent said they started out using legal party pills but now mostly used illegal drugs, 43 percent said they continued to use both and their illegal drug use was not affected by party pills, and 44 percent said they previously took illegal drugs but now mostly took party pills.

The characteristics of party pills users most reported liking were extra energy (53 percent), the high/euphoria (45 percent), the fact they are legal (23 percent), cheap (21 percent), and easy to buy (20 percent).

Asked what they disliked most about them, 51 percent said the hangover or come-down, 20 percent said inability to sleep and 18 percent disliked the purchase price.

The most common physical problems reported by users were poor appetite (41 percent), hot/cold flushes (31 percent), perspiring heavily (23 percent) and stomach pains or nausea (22 percent).

The most common psychological problems reported were trouble sleeping (50 percent), loss of energy (18 percent), strange thoughts (16 percent) and mood swings (15 percent).

The survey found one in 45 users (2 percent) were classed as dependent on party pills, 74 percent had no dependency, and 92 percent had little or no dependency. 88 percent said they never felt their use of was out of control, 97 percent said the prospect of missing a dose of party pills never worried them, and 98 percent said they would have no difficulty stopping taking party pills and could do so without assistance.

Assessing New Zealand's illicit drug market

Observed dispassionately, the illicit drug market is just that, another market, and a large and profitable one. Here, as in any market, supply and demand have their sway. Here too, innovation, integration, product development and marketing techniques are brought to bear.

But the illicit drug market is also different. For one thing, because the product is illicit it becomes easier to use coercion to gain advantage. For another, whereas in licit markets market information flows freely, in an illicit market information that flows too freely gets people arrested. And the people those in the market least want their information to flow to are the authorities.

Hence the introduction of the Illicit Drug Monitoring System (IDMS).

Set up and run by SHORE (the Centre for Social and Health Outcomes, Research and Evaluation) under the direction of Dr Chris Wilkins, the IDMS sets out to provide timely information on trends in illicit drug use and drug-related harm in New Zealand. It is broken into three modules, each focusing on a specific drug type: methamphetamines, hallucinogens and cannabis. Each module consists of interviews with frequent drug users; interviews with key experts such as drug treatment workers, pharmacists and night club door staff; and reference to secondary sources on drug use.

The first version of the IDMS was conducted from April to August 2005. Among its key findings were:

- cannabis and methamphetamine are the drug types the largest proportion of frequent drug users consider to be 'very easy' to obtain
- methamphetamine was reported to be well established in the marketplace, highly available and innovatively marketed
- the price of ecstasy has fallen, with the drug perceived by participants to be less hazardous to health and safer to purchase than methamphetamine
- cannabis was considered to be widely available, but the price has remained stable and the number of users constant
- cocaine, ketamine and GHB are not widely available.

What is likely to happen in New Zealand's illicit drug market? Over half of the frequent drug users interviewed considered the regular use of methamphetamine an 'extreme health risk', but whether this perception will translate into a decline in demand is uncertain. Dr Wilkins speculates that in the short term the number of methamphetamine users will stabilise, but will have larger associated costs as the number of existing users who are dependent climbs.

Ecstasy, because it is perceived to be less of a health risk (although the evidence of behavioural and cognitive damage is mounting) and less risky to purchase, may be the drug that goes on to exhibit the most persistent growth in the long term.

One finding that may have broader implications is the significant level of use of legal party pills by frequent drug users. For frequent cannabis users this stood at 62 percent for party pills and 36 percent for nitrous oxide; similar levels of use were reported by other frequent drug users. Do these substances promote or facilitate the use of hard drugs, or, as their advocates have it, provide a 'safe' alternative to hard drugs and criminality? Dr Wilkins is currently conducting a survey into legal party pill use which will help inform debate.

The IDMS findings are available at the National Drug Policy website, www.ndp.govt.nz, and the SHORE website, www.shore.ac.nz.

Prison literacy programme will connect families

Children will join their fathers in Wanganui Prison as part of a Massey family literacy and learning project – that may be extended other prisons throughout the country if successful.

Adult literacy researcher Dr Franco Vaccarino, from of the Department of Communication and Journalism, says children will visit the prison to spend one-on-one time reading books with their fathers.

"We are encouraging reading between parent and child. We want the father and child to bond through sharing books and other literacy activities."

Overseas research has shown that inmates who spend more time with their families have much better post-release success, he says.

"Children will spend quality time with the parent that they wouldn't normally get, and learn at the same time."

A family learning programme is currently being run at a local primary school, and a similar programme is due to start at the prison in September or October. The University's project team and the Corrections Department are working out a schedule for the visits.

The programme had never been done before in New Zealand, but would be developed if it proved successful, Dr Vaccarino says.

The programme will be offered to Year 1 and 2 pupils who have fathers in prison.

Dr Vaccarino, who has prior experience working in prisons, will run workshops for fathers on how to share books and literacy activities with their children.

"The children will each choose a book to share with their fathers, and fathers will also select a book for the half-hour sessions," he says.

Dr Vaccarino will observe the sessions and collect feedback from fathers, children and prison staff.

"Individuals who are in prison are not just inmates – they are still parents," he says. "When a child's parent is incarcerated, that child's life is turned upside down. It is difficult to ascertain exactly what the effects on children are, but what is certain is that it can be traumatic and have lifelong effects. Visiting a parent in prison is important, as it can calm children's fears. They see that Dad is all right and that he still loves them."

Dr Vaccarino says results from the prison family literacy and learning programme will be available early next year.

The family literacy and learning programmes are part of the larger Literacy and Employment Project, running in Wanganui since 2004. The University and the Wanganui District Library are partners in the project. The larger project's objectives are to examine the learning needs of adults and look at learning and employment barriers they face. The Foundation for Research, Science and Technology funded the $2 million research project. It is led by Associate Professor Frank Sligo of the Department of Communication and Journalism.

Rising house costs leads to more renters

Surveys by the University's Real Estate Analysis Unit appear to confirm a growing shift from home ownership to rental accommodation.

The residential rental market quarterly survey for June 2006 shows an increasing rental population, based on tenancy bonds recorded by the Department of Building and Housing.

Year to year figures show that the numbers of tenancy bonds lodged with department have increased 50 percent since 1995 to more than 150,000 last year.

Professor Bob Hargreaves, who prepared the survey, says the results of the five-yearly Census, due out later this year, will provide the most reliable data on the percentage of households renting and those owning. He says an ongoing decline in home ownership is most likely to be revealed.

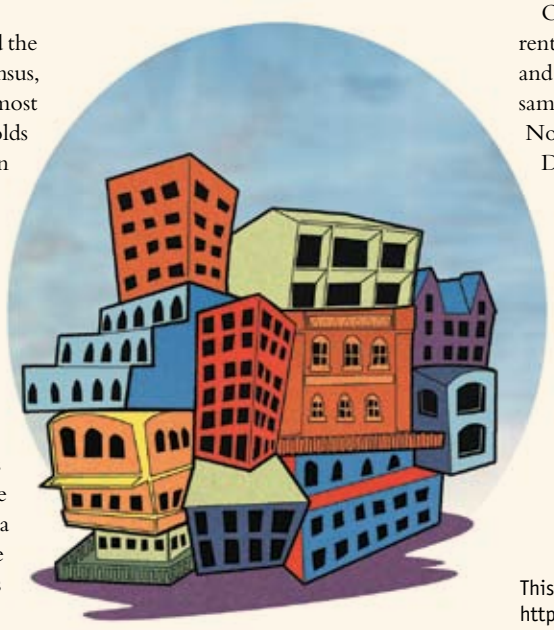
That decline is already showing up in statistics in the unit's rental market survey for the June quarter.

"In the absence of hard data from the Census, there is a clear trend emerging in the bond centre data," Professor Hargreaves says.

"The statistics show rental tenancies increasing at a faster rate than the rate of growth in the population. From a policy perspective this trend, likely to be confirmed by the Census, has implications for home ownership."

The release of the rental figures follows a report based on research by AC Neilsen showing a drop in home ownership of 12 percent in the 12 months to March 2006. It also follows the announcement of a new government advice service on home ownership, highlighting concern about falling rates.

Professor Hargreaves says a further interesting issue is future changes in the affordability of renting compared with owning.



The Real Estate Unit's latest survey uses figures from the recent Massey University Home Affordability Index to make a comparison with rental affordability, based on the median national recent rental divided into average wages. It shows that since mid 2004 renting has become relatively more affordable.

Over the past quarter the median national rent remained unchanged at $260 a week and was up only $10 or 4 percent on the same period in 2005. Rents in the large North Island cities were relatively static. Dunedin and Christchurch showed gains and small increases were recorded in some North Island cities.

Professor Hargreaves says that overall the figures show that rents are still flat lining. But he says there will be keen interest in where they go from here, driven by demand, as home ownership levels fall, and by variables such as net migration.

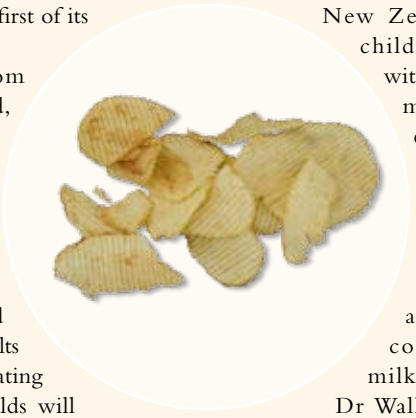
This and other reports can be found at: http://property-group.massey.ac.nz.

Preschool diet of concern

Children as young as three are establishing bad eating habits that are likely to last for the rest of their lives, a study of preschoolers' eating habits suggests.

The same study shows boys are less likely to eat their vegetables than girls and that difference emerges in the very young, setting many children up for a lifetime battle with obesity and other diet-related health problems.

Academics from Massey, Auckland and Victoria universities have produced the longitudinal study, the first of its kind in New Zealand.



Dr Clare Wall, from the Institute of Food, Nutrition and Human Health, says the children, all aged three-and-a-half when the initial survey was done, will be followed through to adulthood by the researchers. Results of a survey of their eating habits as seven-year-olds will be available within a year.

The first study, published in the *New Zealand Medical Journal,* found preschoolers are being fed too many muesli bars, chips and soft drinks and not enough bread, fruit and vegetables.

Just over a quarter of the sample ate the recommended two or more servings of fruit a day, and only around half ate the recommended two or more servings of vegetables.

Only 7 percent ate enough breads, cereals, rice and pasta. Dr Wall says this is of concern because "these foods are high in energy and are a significant contributor of dietary folate and iron for children".

Twelve percent of the children ate treats such as muesli bars and potato chips, which tend to be high in sugar and fat, three or more times daily.

On the brighter side, 88 percent ate meat, fish, eggs or chicken at least daily, with chicken the most frequently consumed, and 86 percent consumed dairy products or milk at least twice daily, in line with Health Ministry recommendations.

Nearly two-thirds of the children drank milk daily, a higher proportion than New Zealand school-aged children and consistent with other findings that milk consumption decreases with age.

Preschool boys were less likely to eat vegetables at recommended levels than girls and were also less likely to consume reduced-fat milk and low-fat milk.

Dr Wall says these gender differences in dietary patterns are similar to those found in New Zealand adults.

The researchers described the results as a grim prognosis, given that existing research suggests a lifetime's eating habits are established in childhood.

Dr Wall also stresses that the 600 children studied were of a higher than average socioeconomic status.

"That means the results of the study are almost certainly conservative: the proportion of children in the general population eating fruit, vegetables, breads, and cereals at recommended levels is likely to be lower than reported in this study."

New Zealand families truly global

A new study reports that around one in five people living in New Zealand were not born here and around 20 percent of people born here are believed to be living overseas.

The study, *Families et Whānau sans Frontières – New Zealand and Trans-national Family Obligation*, was carried out by a team of Massey researchers, led by Dr Niel Lunt at the University's Albany-based School of Social and Cultural Studies. It was commissioned by the Families Commission Blue Skies Fund, which provides grants for innovative research on family issues.

The study shows how the ethnicity of New Zealand's population has changed over the years, with a growing number of migrants from Asia, the Middle East, sub Saharan Africa and more New Zealand-born people with a Pacific heritage. It is estimated that in a little over 15 years there will be a million people living in New Zealand who are of Pacific or Asian ethnicity.

Dr Lunt says there is a need for social policy to address the many issues faced by transnational families.

Download the report from http://www.nzfamilies.org.nz

Cuckoos in the nest

The grey warbler, or rironiro, is New Zealand's smallest bird by weight, just 6.5 grams at maturity. The shining cuckoo, or pipiwharauroa, winters in the tropics, returning to lay a single egg in the nest of a grey warbler. Fostered by the warblers, this particular cuckoo in the nest will grow to 25g, about the same as a sparrow, evicting any other chicks or eggs in the nest along the way.

Michael Anderson, a PhD student at the Institute of Natural Resources' Auckland-based Ecology and Conservation Group is studying the grey warbler at Tawharanui Regional Park, an open sanctuary east of Warkworth. He will analyse the bird's song patterns and, as part of the wider evolutionary project, he will also study the relationship known as brood parasitism between the warbler and the shining cuckoo in association with Dr Mark Hauber of the University of Auckland.

The song dialect research is funded by a Marsden Grant awarded to Dr Brunton of Massey's Auckland campus and the brood parasitism research is funded by a fast-start Marsden Grant awarded to Dr Hauber of Auckland University. Mr Anderson's funding is from a Top Achievers Scholarship awarded by the Tertiary Education Committee as part of the Bright Futures Scheme.

Attitudes to working mothers entrenched

Most New Zealanders approve of married women working full-time but that approval drops dramatically when women have children.

The New Zealand end of an international survey on men, women and work shows that attitudes to women and paid work depend critically on whether they have children and how old their children are.

Eighty-three percent of respondents approve of married women working full-time before they have children but only 2 percent approve of full-time work when women have children under school age.

Approval is higher (30 percent) for mothers of young children working part-time and increases to 14 percent for women working full-time after the youngest child starts school.

A substantial number – 40 percent – believe a preschool child is likely to suffer if the mother works and the same number believe family life suffers when a mother has a part-time job.

The survey, by the Department of Marketing, traversed attitudes to job satisfaction, job security, working conditions and to men and women and work. It is part of the International Social Survey programme, which involves leading academics in 40 countries in annual surveys on economic and policy issues, in seven-year cycles.

The New Zealand survey was taken last year. Lead researcher Professor Phil Gendall says it reveals mixed attitudes on gender issues, particularly working mothers. "Despite the attitudes expressed above, 50 percent still believed that a working mother can establish just as warm and secure a relationship with her children as a mother who does not work, and 46 percent believe working is the best way for a woman to be an independent person.

"Interestingly, a significant proportion (37 percent) agrees that being a housewife is just as fulfilling as working for pay. This suggests many do not consider paid work to be the defining characteristic of a woman's role in the family."

The survey shows that in the home, traditional gender roles are changing slowly. "In most households, women still do most of the housework, cooking, shopping and caring for sick children, while men do most of the repairs, putting out the rubbish and maintaining the car. Just under 50 percent of respondents agreed that men should do a larger share of housework and childcare.

"However, in more than a third of households, couples are likely to share responsibility for looking after elderly parents, doing the gardening and shopping for groceries."

Professor Gendall says in terms of attitudes to women and work overall, New Zealand is in a group of "modern" countries that includes Australia, the Netherlands, Canada, Sweden, Norway and the US. This group contrasts strongly with what can be called "traditional" countries that include Bulgaria, Hungary, Italy, Poland, Russia and the Philippines.

The survey reveals that most New Zealanders care less about what they are paid than whether their jobs are satisfying and interesting. However, it also shows that 85 percent of New Zealanders "sometimes, often or always" experience exhaustion when they come home from work.

"This is partly attributable to the fact that half of the respondents sometimes do hard physical work but stress at work also appears to be a major contributing factor," says Professor Gendall.

All the same, most New Zealanders (80 percent) are satisfied with their jobs and proud of the work they do and the firms and organisations they work for. A substantial number (65 percent) said they were willing to work harder than required to help their firms succeed.

"Workplace relationships are generally good and most have some flexibility in how their daily work is organised and when they start and stop. Job security is not a major worry."

Professor Gendall says by far the most important characteristic of a job is that it is interesting.

"Ninety-seven percent regarded this as important compared with 70 percent who cited high income. The opportunity to work independently, to help other people and be useful to society also rates highly."

Insulin resistance in Māori and Aborigines studied

A group of young Māori men have taken part in a Massey-led study aimed at understanding the predisposition for insulin resistance.

The research is a collaboration between Massey and Sydney University, where the School of Indigenous Health Studies is working with a group of young Aboriginal men in a parallel study.

Parts of the study were undertaken at Sydney's Faculty of Health Sciences, where a cohort of 24 fit young Māori men were tested for aerobic fitness and body composition.

The study is part of a joint initiative between Massey's Research Centre for Māori Health and Development, Te Pūmanawa Hauora and the Institute of Food, Nutrition and Human Health in the College of Sciences.

Te Pūmanawa Hauora director, Professor Chris Cunningham (Ngāti Raukawa, Toa Rangatira) says that like Australian Aborigines, Māori develop type-two diabetes at rates much higher than the Pākehā population.

The study participants had their muscle triglyceride levels measured using magnetic resonance spectroscopy at a radiology laboratory in Liverpool, Sydney.

This test is a non-invasive means of determining muscle triglyceride content, a factor that has been linked to the prediabetic condition insulin resistance.

Professor Cunningham says that while the physiology behind the predisposition to insulin resistance may or may not be different in Māori and Aborigines, the collaboration is an opportunity for Massey health researchers to assist in the understanding of the condition and possible interventions.

In addition, the collaboration will focus on the training of indigenous researchers on both sides of the Tasman.

The two universities recently signed an agreement to engage in collaborative research, teaching and the training of indigenous scholars.

Professor Cunningham and Dr Stephen Stannard, from the Institute of Food, Nutrition and Human Health, undertook the initial feasibility study, which was funded by the Health Research Council.

It enabled a project to be designed that integrated Māori research methodologies with studies about muscle physiology.

The successful completion of the feasibility study has led to the development of an assessment laboratory at Te Pūmanawa Hauora in Wellington.

The relationship between the two universities was assisted by the Vice-Chancellor, Professor Judith Kinnear, a former Dean of the Faculty of Health Sciences at Sydney University.

Tank traps

Rainwater – at least as collected from roofwater systems – may not deserve its reputation for purity, Stan Abbott, a senior lecturer in Microbiology and Communicable Diseases has found.

Massey researchers tested 450 private roof water samples from the lower North Island last year and found more than 30 percent showed evidence of heavy faecal contamination.

"I'm utterly amazed at the number of roof water supplies that fail – and fail badly – the New Zealand drinking water standards," says Mr Abbott.

The contamination can come from a variety of sources.

"Studies of rainwater supply systems have found tanks with holes that let in pathogens as well as larger invaders such as mice, rats, possums, frogs and even birds.

"Even a passing seagull defecating on a roof can raise the level of faecal coliforms in water to potentially dangerous levels and pass on other pathogens."

About 380,000 New Zealanders use roof rainwater all year round and more are likely to do so. Families are moving to lifestyle blocks in rural areas not served by municipal town supplies, roof collection systems are being installed on new homes to avoid water charges, and many people claim to prefer the taste of untreated rainwater to that of town supply.

The risks of catching something from the tap rise during the summer, months when many New Zealanders migrate to that bach, crib, holiday house or campground.

Why, then, aren't more of us falling ill?

Well, some of us probably are, but stoically writing off an episode of illness as just one of those things. Or if we do go end up at the doctor's a contaminated water supply may not be fingered as the culprit.

Cruellest of all may be the punishment inflicted on our guests. Having been exposed to the particular pathogens before, we may have some resistance but visitors – particularly overseas visitors – may not be so lucky.

"So it might be five to 10 days after they leave your house or bach that your guests contract campylobacteriosis, giardiasis, cryptosporidiosis or salmonellosis and they then put it down to something else, such as food poisoning, rather than water-borne disease," says Mr Abbott.

If you do rely on roofwater, Mr Abbott recommends a well-designed collection system combined with a programme of water testing and basic maintenance.

Maintenance

To maintain a safe water supply:

- keep the roof catchments clean and clear of moss, lichen, leaves and other debris, and trim any overhanging trees.
- inspect and clean the gutters, tank inlets and screens every three to four months
- inspect the tanks annually and, if any contamination is apparent, disinfect the supply and clean the tank.
- have the water tested periodically and filter, disinfect or boil drinking water if you are unsure of its quality. Council environmental health officers and public health service health protection officers can recommend local testing laboratories.

Design

A well designed roofwater system will have certain features:

- a clean, impervious roof made from non-toxic material (no lead flashings or lead-based paints)
- a first foul flush device which intercepts and diverts away the initial flow of contaminated water after heavy rain
- wire or nylon mesh screens covering all tank inlets
- a light-proof tank (light can encourage algae leading to bacterial growth)
- tank taps or draw-off pipes that are at least 100 mm above the tank floor or, alternatively, a floating-arm draw-off valve
- a tank floor that slopes towards the sump and washout pipe
- a well-covered manhole for easy access and inspection.

MacDiarmid Young Scientist of the Year awards

Damien Fleetwood, winner of the Adding Value to Nature category A PhD student in the Institute of Molecular BioSciences (Palmerston North), Mr Fleetwood is based at crown research institute AgResearch.

Mr Fleetwood is exploring how fungi and grass combine to poison grazing animals. It focuses on the interaction between grass and a fungus it hosts (the Epichloë endophyte) in a relationship Mr Fleetwood describes as a double-edged sword.

"Grass infected with the endophyte is protected from many insect pests but at the same time many strains produce toxic chemicals, including one called ergovaline, that are designed to stop the grass being eaten because they are toxic to grazing stock," he says.

Animals that eat endophyte-infected grass producing ergovaline suffer effects ranging from poor weight gain to gangrene and death, at a potential cost of millions of dollars to the agricultural industries each year.

Mr Fleetwood's work has helped identify a cluster of six genes that are responsible for producing the toxic chemical ergovaline and built up new knowledge about how they work and when the genes are switched on and off.

"Ultimately this will help us maximise the good agricultural effects of endophytes and minimise the bad ones," he says.

Hayley Lawrence commended in the Understanding Planet Earth category A PhD student in the Allan Wilson Centre for Molecular Ecology and Evolution at the Auckland campus, Ms Lawrence is developing techniques to help locate the burrows of the Chatham Island taiko, one of the world's most endangered seabirds.

It is estimated that there are between 120 and 140 birds remaining, with only 14 breeding pairs on the Chatham Islands.

Ms Lawrence's research on the behaviour and interactions of the rare bird in the wild involves the use of taiko (magenta petrel) blood samples that will provide genetic identification for each bird.

These genetic identifiers will help researchers track birds to the family nest in underground burrows. When nests are found, improved trapping and poisoning of predators can be carried out to protect the critically endangered species.

A predator proof fence has already been built around an area on the Chatham Islands to create a safe breeding ground for taiko.

Ms Lawrence says she hopes her project will also improve conservation efforts to establish a new colony. Her research is supported by the Department of Conservation.

Penguins and icebergs

For the Adelie penguins of the Antarctic there really is no place like home. Each year they return to the colonies of their birth to breed and raise chicks of their own. They are philopatric – lovers of their own territory.

It takes a calamity to stop them returning, but Antarctica can supply just that. Every so often mega-icebergs break away from the Antarctic ice shelf, blocking the normal migration routes to some colonies. It has been estimated that over the past 10,000 years around 20 mega-icebergs have broken from the Ross Ice Shelf every 1,000 years.

One effect has been the periodic mixing of genetic material between penguin colonies, suggests a recent paper in *PNAS* (the Proceedings of the National Academy of Sciences of the United States of America).

For some years one of the paper's authors, evolutionary biologist Professor David Lambert, who is based at the Allan Wilson Centre for Molecular Ecology on Massey's Auckland campus, has been investigating the ancient genetic material extracted from the bones held in the layer cake of frozen guano, egg fragments, feathers, sand, gravel and pebbles beneath penguin colonies.

In a recent study Professor Lambert and his collaborators compared the frequency of particular alleles (sequences of nucleotides on a DNA molecule) between a modern population of penguins at a rookery on Inexpressible Island and its ancient (approximately 6,000 years before the present) counterpart.

They found significant changes – changes more dramatic than might be expected from mutation or genetic drift (chance-driven fluctuations in the frequency of the appearance of a gene) alone. Mega-icebergs, they suggest, probably account for the difference.

The role of mega-icebergs in mixing penguin populations is supported by observations made during the 2001 grounding of a 180km iceberg, which blocked the usual route home for Cape Royds banded penguins. Diverted by the iceberg, the Cape Royds penguins began showing up at the Cape Bird rookery en route to their own.

Seven years and still trading

In recent times it has been a Cassandra-like article of faith that small businesses are precarious enterprises. Volatility, "a great foundation of massive continuous failure", has been seen as the natural state of affairs.

In response, many private and public agencies have directed their efforts towards helping small businesses to survive, rather than promoting best practice and strategies that promote growth.

But are things really that bad? Perhaps not.

In 2004 David Tweed and Dr Judy McGregor revisited 1,511 small to medium enterprises (SMEs) that were the subject of a randomised nationwide study of SMEs conducted by Massey in 1997. The number remaining in business? At least 1,173 – or 77.6 percent.

The figure would have been much lower had Mr Tweed and Dr McGregor not used a number of different methods in combination to check whether firms were still in existence. They searched the internet, used the phone book, conducted a phone survey using the last known number, checked the company register, and sent out two paper-based surveys: the first a personalised survey sent to the business address, the second a more general survey addressed to "The owner/manager".

Each successive method captured more surviving businesses - and even now there may be businesses that have escaped the net.

What defines failure anyway? Some data collection methods have assumed that a change of ownership or geographical location somehow constitutes failure, or that a profitable business closed for health or personal reasons has 'failed'.

Mr Tweed and Dr McGregor's paper calls into question the validity of many of the publicly available statistics. It also raises wider issues for the focus of research, policy and interventions. Rather than concentrating on the incidence of failure, the authors suggest, we should look at the 'stayers' and how they achieve longevity.

Going downhill fast

Sports scientist Matt Brodie wants to know the fastest way to ski down a mountain. The 29-year-old, now in his second year of a PhD at the Institute of Food, Nutrition and Human Health, was awarded the Emerging Scientist prize at the 2005 Sports and Exercise Scientists New Zealand conference for his pioneering work on analysing the motion of downhill skiers.

Motion analysis is used by coaches to optimise athletic performance.

"The traditional method of motion analysis is to video an athlete in action in a laboratory. This is possible for, say, a runner on a treadmill or a cyclist on a stationary bike, but impossible for a skier," says Mr Brodie.

"My solution is to use Fusion Motion Capture, a new mobile system developed at the University combining a GPS unit, sensors worn on the skier's limbs, and pressure-sensitive boot insoles. The sensors directly measure limb acceleration, which allows me to determine the forces that drive the skier's motion."

Mr Brodie's PhD supervisor, biomechanics lecturer Dr Alan Walmsley, says the research is a world first. "Nobody has attempted to directly measure what makes a skier good, and how we can help make them better. Mr Brodie has worked out how to take a motion analysis lab into the field. It's a significant advance."

"Downhill skiing involves so many variables," says Mr Brodie. "There's snow conditions, ski design, what wax you use, technique, weight and body position. I want to find out what the most important variables are, so coaches and skiers can figure out how to go faster."

Before commencing his PhD he spent eight consecutive winters in Japan and New Zealand, working as a ski and snowboard instructor.

"One year I had more than 200 days on snow," he says. "After meeting Slovenian and Japanese coaches and world-class skiers I got interested in figuring out the fastest way down the mountain. We are trying to overcome coaches' and athletes' preoccupation with the way a performance appears (called kinematic obsession by some scientists) because just looking fast may not mean you will actually ski faster."

Mt Taranaki overdue for eruption

Presiding over the surrounding bush and lush pastures, Mt Taranaki, with its symmetrical form, is New Zealand's most picture-perfect volcano. But the volcano, which has shown little or no sign of activity for two centuries, turns out to have a troubled past: in the past 9,000 years the mountain has erupted at least every 90 years on average, with one eruption every 500 years being major.

If this record is any sort of guide, Taranaki ought to be regarded as much as a threat as it is an icon.

Mt Taranaki's tempestuous history is recorded in a series of sediment cores which Massey vulcanologist Dr Shane Cronin has taken from Lake Umutekai, five kilometres east of New Plymouth and about 25 kilometres north-east of the volcano. The cores hold almost 100 ash layers in a matrix of organic sediments. The layers range from just millimetres in thickness, representing eruptions similar in scale to those of Mt Ruapehu in 1995-1996 to layers several-centimetres thick, representing major eruptions akin to the cataclysmic eruption of Mt Tarawera in 1886.

What is more, because the lake's location favours the capture of ashfalls borne by south-westerly winds, the sediment cores taken from it are probably a partial and incomplete record.

Taranaki's last major eruption dates back to 1655. The minor eruptions have often occurred in swarms, with the mountain erupting semi-continuously over a period of years. The present cone on Taranaki is likely to have formed during the last swarm of small eruptions (these are dated at around 1755 but may have been followed by further eruption in the early 1800s).

The findings are a wake-up call, says Dr Cronin, whose work in assembling Taranaki's volcanic history will be used to produce a probability models which will help authorities and businesses plan for the eruptions.

"These events have been as frequent as large-scale floods in many rivers of New Zealand and future activity from this volcano may pose a more immediate threat to the North Island that previously realised."

If there were to be a major eruption, the consequences would be severe says Cronin. "It would undoubtedly cause substantial disruption to much of the North Island, cutting power supplies, damaging transmission lines, water supplies and stormwater."

The ash cloud would disrupt all main North Island airline flight paths and the prevailing south-westerly wind would push the cloud over Auckland, closing the country's largest international airport. On farms the ash would damage pastures, crops and orchards and block the air filters on milking shed cooling plants.

Taranaki is monitored by six seismometers owned by the Taranaki Regional Council and managed by GeoNet, part of the Institute of Geological and Nuclear Sciences.

The monitoring should give at least six days' and possibly as much as a few months' warning of an eruption.

The analysis of Taranaki's pattern of vulcanism is part of a programme of assessing North Island volcanic risk. The research programme is funded by the Public Good Science Fund of the New Zealand Foundation for Science and Technology.

Predicting Ruapehu's lahar path

Christmas Eve, 1953. Beneath the Whangaehu Glacier the waters of the crater lake of Mt Ruapehu find an outlet and surge down the Whangaehu River, carrying a terrible burden of ice, ash, boulders and debris. At Tangiwai, the railway bridge fails. Later that night a crowded holiday-night express train on its way from Wellington to Auckland will plunge into the river. Of the 285 people on board, 151 will die.

Mt Ruapehu hosts one of the most active volcanic crater lakes in the world, and the Whangaehu River, which drains the lake, has carried more than 45 lahars (flash floods involving volcanic debris) since the Tangiwai disaster. And another lahar is imminent; the lake is full once more. This time, however, the event is anticipated.

In preparation, scientists from GNS Science and Massey have conducted an aerial survey of the path of the predicted lahar. The survey used a LiDAR (light detection and ranging) mapping system, which uses digital laser technology to take up to 83,000 measurements of the land surface per second with sub-metre accuracy. Combined with high-resolution digital photography, the method produces a highly accurate 3D snapshot of the land surface.

GNS Science has commissioned the survey as part of a broader research plan designed to capture maximum scientific value from the event.

GNS Science's lead scientist for the project, Dr Vern Manville, says LiDAR offered the most cost-effective method of producing a highly accurate 3D map of the upper Whangaehu River. "Comparison of the results of this survey with a duplicate mission flown immediately after the lahar happens will allow us to work out what changes it made to the river bed."

Vulcanologist Dr Shane Cronin and his team from Massey are using the survey results to make a 3D topographic numerical model of the lahar channel. "This is a unique opportunity to capture the secrets of a life-sized lahar," Dr Cronin says. "The more we can learn about this event, the better prepared we will be for such events in the future."

GNS Science and Massey are also planning to instal an array of monitoring instruments at key locations along the lahar's path to measure its properties as it flows past.

Vibration treatment is being hailed not only as a way to get fit faster but also as a means of rapid recovery from sore muscles and other soft tissue injuries. Now its reputation is being put the test.

Thirty volunteers will 'injure' themselves by running non-stop downhill for 40 minutes then have their recovery monitored. Some will receive vibration treatment; others will not. The Vibrogym platform donated for the study can be set to vibrate at between 30 and 50Hz (cycles per second). It moves up and down either 2mm or 5mm each cycle. Pictured are Dr Sue Broadbent and, on the Vibrogym platform, exercise science lecturer Sandie Choate.

Steady growth in value-added food exports

New research shows the proportion of value-added food and beverage exports has continued to rise steadily against commodity products, with the sector enjoying growth of nearly 10 percent in the past five years.

An ongoing study by the Institute of Food, Nutrition and Human Health for New Zealand Trade and Enterprise (NZTE) has found that earnings from value-added food and beverage exports grew to $8.11 billion, or 54 percent of all food and food ingredient exports, for the year ended June 2004.

The earnings in 2004 increased from $7.6 billion in 2003, a rise of 6.7 percent over the 12 months.

The study has been carried out annually since 2000, giving researchers the opportunity to directly compare results. Overall there has been a 53.6 percent increase in revenue from value-added products since 2000 and only a 5.3 percent rise in revenue from commodity exports in the same period.

The study uses a mix of export data, industry identification and financial analysis tools to define the dollar and percentage values of added-value and commodity food products in key export categories.

It breaks down value-added percentages in the main export categories of meat, dairy, fruit and vegetable, beverages, cereals, seafood and miscellaneous and found that the biggest increases in 2004 came from the dairy and meat sectors.

Export revenue earnings in the meat sector rose from $4.30 billion in 2003 to $4.7 billion in 2004, with value-added products accounting for well over half of the increase.

While revenue from dairy products fell overall in the year, the report indicates the sector actually increased exports of value-added products by 20 percent compared with 2003, a remarkable response in a trading climate where commodity revenue continued to decline.

Project manager Professor Ray Winger says the results are encouraging. "During the five years this study has been carried out, different sectors showed a range of value-added from 23 percent to 79 percent, indicating that the New Zealand food industry has a high level of value-added products.

"There is clearly a growing sophistication in product development and marketing innovation which is essential for long term sustainability and to deliver what markets and customers want."

NZTE Group General Manager - Food and Beverage, Rod MacKenzie, says having more than half of New Zealand's food and beverage exports coming from value-added foods is a sign that the industry is clearly focused on change.

"Increasing value-added exports is vital to meet the challenges the sector faces from fluctuating commodity prices and foreign exchange movements," he says.

Download the report from http://www.nzte.govt.nz

Pats to plastic

It almost sounds too good to be true – turning cow pats into plastic. But the murky liquid in the flask Dr Steven Pratt holds could be the stuff of bioplastics: biodegradable plastics produced using renewable resources.

Bioplastics already exist, says Dr Pratt. In the United States, PLA (poly lactic acid) and PHA (poly hydroxyalkanoate) based plastics are being commercially produced using carbohydrates such as corn starch. But feedstocks like this – homogenous and highly refined – are only just becoming cost competitive with oil. How much better it would be if we could produce plastic from something that would cost us virtually nothing. Something, in fact, we want to get rid of: farming and other organic wastes.

A researcher in the Centre for Environmental Technology and Engineering, Dr Pratt says the potential for bioplastic production in New Zealand is huge. "The waste produced by our agricultural and pulp and paper industries is ideal, and there is so much of it."

Just as is done with cornstarch, Dr Pratt and his students will used controlled fermentation to produce organic acids that can be used in biopolymer production. The challenge is to produce a suitable and controlled mix of organic acids from the multifarious brew of substances in organic waste.

He says some acids are better than others for the production of bio-plastic. Acetic-acid-based plastic, for example, is brittle. Adding propionic acid produces more malleable polymer chains.

Part of Dr Pratt's project looks at controlling the fermentation procedure by adjusting factors such as pH so that only one kind of acid is produced. His team of postgraduate students is also focusing on 'transient stages' in the fermentation process.

A transient stage occurs when bacteria are shocked by the input of food (in this case, carbon-based effluent) or when conditions

such as pH are altered. The micro-organisms react to these changes in interesting ways before evening out and producing a consistent volume of mixed acids. Transient stages are imperfectly understood.

"In a transient stage one type of acid may be made in greater proportions, and other unknown or unexpected compounds can also be made. Sometimes the most interesting things are made when things go wrong."

Pasture measurement system wins innovation award

A GPS mapping system that will help farmers to measure pastures more accurately won the innovation section at Fieldays in Hamilton this year.

Trialled extensively last summer, the Rapid Pasture Development system was developed by Dr Ian Yule and the University's New Zealand Centre for Precision Agriculture to meet the need for improved methods of measuring pasture.

The three different models of pasture measurement sensors fit into sledges designed and developed by project partner C-DAX Systems Ltd to be towed by a farm-bike. The sledge and sensor can be towed at up to 15 km/h over rough terrain, wet pasture and mud, taking measurements every one or two seconds.

Expressed in kilograms of dry pasture per hectare, the data collected can then be downloaded into a computer to be integrated with feed budgeting software. Dr Yule says measurements taken before and after pasture has been grazed by stock can be used to assess which areas of a paddock are the most productive, or are preferred by stock.

Currently pasture is measured by New Zealand farmers manually and on foot using the plate meter, but Dr Yule says the time-consuming task often means only a small sample of the paddock is measured and used as a representative section.

The variation of factors such as soil type, water retention and pasture composition, demands a more accurate assessment.

Dr Yule says the beauty of a tool attached to a bike is that a thorough cross section can be measured as a farmer travels across a farm while moving stock or getting from one place to another. The sensor's stainless steel sledge has edges designed to flick off as much muck as possible and the data collected can be calibrated for different plant species. He says previous research suggests that a 15 – 20 percent improvement in pasture utilisation may be made through the use of pasture budgeting systems. This estimate is based on factors such as the better utilisation of pasture, and an improvement in actual pasture yield through better controlled grazing.

The main benefit is that farmers will be able to develop a budgeting approach and make better decisions regarding feed production and use, and the application of fertiliser.

It will allow the identification of areas of low production, which can then be monitored regularly and compared over time, the ability to benchmark against other pasture within the paddock as well as other paddocks or even other farms on similar soil types.

The three sensors begin with a basic model, which calculates the average pasture cover between the stopping and starting of measurement. The intermediate level model stores the paddock number and collected data, which can be downloaded to a computer.

The most advanced model is linked to a GPS unit, and readings are geo-referenced. This allows for advanced mapping. If paddocks have been mapped, the GPS unit will recognise which paddock it is in, and the information can be directly downloaded to mapping and feed budgeting software.

Veterinary software destined for the Swiss

A multi-million dollar animal management and biosecurity system developed by animal health researchers is being used by the Swiss federal government.

In its first phase of implementation, "Kodavet" software has been built specifically for the Swiss Federal Veterinary Office.

Professor Hugh Blair and Bill te Brake, from the Institute of Veterinary Animal and Biomedical Sciences, say the software is designed and developed to manage any type of animal activity. It can track the life of an animal from birth to death, including any treatments or diseases it had, movements from one farm to another, and movements from a farm to a meat-processing plant.

It also maps the outbreak of disease that may have occurred in the area it resided, and documentation of an animal's health including health certificates, movement certificates, treatment advice and final slaughter information can be retrieved and analysed.

The data being input into the Swiss Kodavet system comes from federal and industrial Swiss databases and, in addition to the data outlined above, includes general information about processors, pet stores and other organisations and businesses who manage and handle animals.

Professor Blair and Mr te Brake say Kodavet may eventually incorporate existing software tools developed through the EpiCentre, which specialises in animal health and epidemiology under the direction of Professor Roger Morris. These tools include EpiMAN (used in the 2001 foot and mouth outbreak in Britain) and Interspread Plus.

The second phase of Kodavet was due for completion in August of this year and will include geographic information systems, disease management systems, and incident management. Kodavet will be also used as a platform technology to develop a veterinary animal information management system called VeTech. With contributions from Pfizer and Veterinary Enterprises, VeTech will be marketed internationally at its completion in 2007.

Individual

Distinguished Professor David Lambert is a founding member of the Allan Wilson Centre for Molecular Ecology and Evolution, one of the centres of research excellence established by the New Zealand Government. His successes in ancient DNA research, and those of his research group, feature frequently in leading publications and attract international attention. Overall he has published more than 130 research papers and his significant contribution to evolutionary genetics is internationally recognised.

In the decade that he has been at Massey he has been awarded about $26.4 million in research funding including nine Marsden grants. On six of the Marsden-funded projects he was principal investigator.

His international stature has been an influence in securing major scientific meetings in New Zealand recently. He is often invited to give plenary lecturers at international gatherings.

Professor Lambert relocated from the Palmerston North campus to the University's Auckland campus earlier this decade, adding significant weight to research activity on the campus. Until the mid 1990s he had been Director of the Centre for Conservation at the University of Auckland. He completed his BSc and MSc in Zoology at the University of Queensland and his PhD Zoology/ Genetics at the University of Witwatersrand, Johannesburg in 1980.

Research Team

In the six years since the establishment of the **Centre for Public Health Research**, Professor Neil Pearce and his team have produced an extensive track record in public health research, workforce development and team-based research.

The Centre is a multidisciplinary team of researchers based on the University's Wellington campus. The main function of the Centre is to carry out research of scientific, public health and policy importance.

Its research programme covers all aspects of public health research, with a focus on

- non-communicable diseases (respiratory disease, cancer, diabetes)
- occupational health
- environmental health
- socio-economic determinants of health
- Māori health and
- Pacific health research.

Research findings have major implications for prevention and treatment of asthma, provision of health services to Māori and Pacific people, and managing occupational health and safety.

In nominating the Centre, Professor Chris Cunningham said the team's international standing is evidenced by ongoing relationships with researchers across the globe, and the steady flow of international scholars through the Centre.

"Professor Pearce's support of emerging and mid-career researchers is a strong indicator of the Centre's strategic view is establishing it as a centre of excellence in Massey's research culture," he said.

The principal investigators on the Centre's research projects are Professor Neil Pearce, Associate Professor Jeroen Douwes, Dr Mona Jeffreys, Dr Lis Ellison-Loschmann, Dr Andrea 't Mannetje, Dr Dave McLean, Dr Ate Moala, Dr Sunia Foliaki, and Dr Christine van Dalen. The team also includes researchers, biostatisticians, field workers and support staff.

For more information visit publichealth.massey.ac.nz

Supervisor

Professor Robyn Munford

Professor Munford graduated with New Zealand's first social work degree, from Massey in 1979, with first class honours. She ran an Intellectually Handicapped Children (IHC) residential home for two-and-a-half years then completed her masterate at the University of Calgary in Alberta. She returned to Massey to do her PhD, becoming a lecturer in 1991. In 1998 she was appointed head of the School of Sociology, Social Policy and Social Work, a position she relinquished in August 2006 to devote more time to research, mentoring, and her work on various international boards.

Since 1991 Professor Munford has supervised 20 doctorates and 15 masterates, mostly as first supervisor. All of her masterate students received distinction or honours and many have gone on to become respected academics in their own right or to occupy important managerial positions in New Zealand and overseas.

She has also made a substantial contribution to staff development at the University, by encouraging staff (including Māori and Pacific Islanders) to complete higher degrees. She says a dominant theme in her practice is the supervision of Māori students.

Professor Munford has specialised in research related to disabilities and to families. She is codirector of a project funded by the Foundation for Research, Science and Technology on raising teenagers. She works with the Italian-based International Association for Outcome-bases Evaluation and Research on Families and Children's Services. With research colleagues, she is also studying how vulnerable families can be supported to avoid state intervention.

In 2002 Professor Munford became an Officer of the New Zealand Order of Merit for services to social work education and policy.

Early Career

Dr Barbara Holland

A research fellow in the Allan Wilson Centre for Molecular Ecology and Evolution, Dr Barbara Holland has moved rapidly from her position as a PhD student to a researcher of international reputation.

Centre co-director Professor Mike Hendy says Dr Holland has achieved more in research output than any other graduate he has known, and cites her success in winning research grants as a particular highlight for the Centre.

Dr Holland was awarded the Royal Society of New Zealand Hamilton Memorial Prize last year for her mathematical research in evolutionary biology, described by the society's academy council as "pioneering" work.

Her mathematical analysis of the information contained in DNA sequences is critical to the study of the evolution of a species, and since 2001 Dr Holland has published 21 peer reviewed papers, with a further seven papers awaiting publication.

After a one-year postdoctoral position at the University of Bochum in Germany, she was awarded another at the Allan Wilson Centre, returning to Massey in 2003. This year she was awarded a Foundation of Research, Science and Technology grant and received a full Marsden grant as the project's principal investigator.

Professor Hendy says Dr Holland has been an excellent mentor for other students in the centre, and frequently assists students not directly under her supervision. She is a second supervisor for two PhD students and has supervised a number of honours level and summer student projects.

Centre co-director Professor David Penny says her international reputation has led to a number of invitations to deliver graduate research workshops overseas.

"I don't know any other researchers who have risen so quickly in international profile".

Early Career

Dr Sarah Ross

A scholar of early modern English literature, Dr Sarah Ross joined the School of English and Media Studies in 2003 and is rapidly building a reputation as a significant contributor to the academic realm of women's Renaissance poetry.

In addition to her individual research focus on poetry, women's writing, literature in relation to poetry and society, manuscript studies and bibliography, Dr Ross has contributed to two major British projects specialising in 17th century literary history.

Following her DPhil at Oxford thesis on women and religious verse in English manuscript culture (1600-1668), Dr Ross was awarded the Margaret Roper Prize for graduate research. From there she was appointed the prestigious postdoctoral appointment as a John Nichols Research Fellow at the University of Warwick.

Since 2001 she has published major articles on Renaissance religious manuscripts and the poetry of Katherine Austen, four items in the *Oxford Dictionary of National Biography*, two articles on Hester Pulter in a collection of essays on early modern women for Routledge, several reviews, and a co-edited edition of essays on early modern novelists.

Professor Warwick Slinn, head of the School of English and Media Studies, says Dr Ross's work has quickly drawn the attention of established scholars in her field.

He says the sustained quality and volume of her work places Dr Ross on a par with early career researchers in any field.

"It is unusual for humanities scholars to produce this level and quality of work so early in their career, since research success for them usually follows a lengthy apprenticeship.

"This success confirms the observation of one of Dr Ross's doctoral examiners that she possesses 'admirable critical maturity' and 'a range of skills remarkable in a young scholar'."

the theoretician

At the molecular level the world is a truly strange place. Making sense of it is Professor Peter Schwerdtfeger. He talks to Malcolm Wood.

At going to press, Professor Peter Schewerdtfeger had just been awarded a Marsden grant.
See page 8

Massey's Centre of Theoretical Chemistry and Physics is a modest affair. One among a number of white single-storey prefabricated buildings, it sits at the end of a cul-de-sac, close by a stream and a patch of bush. There is nothing opulent here. Nothing of the marble, inlaid wood and Italianate architecture that so distinguishes the main Auckland campus buildings a ten-minute walk away.

But it's comfortable. In fact 'gemütlich' – that special German word for a sort of snug congeniality – might be the adjective of choice, given that most of the building's rooms are occupied by young, largely-German, postgraduate researchers communing intensely and quietly with their computer screens. If the physical setting is a little out of the way and lacking the trappings of office, Professor Peter Schwerdtfeger doesn't mind.

"When you are working on theoretical physics you don't want your door to open every five minutes so someone can tell you their life story. You become very unsociable," says Schwerdfeger as he invites me to take a chair and places himself on a well worn couch. "If you are deeply involved in some theoretical problem you switch off to normal life completely. You live in the clouds," says Professor Schwerdtfeger.

Other than access to vast amounts of computer power, what he needs is what he has here: somewhere quiet to think.

Once, he says, a complicated problem so preoccupied him for five years that his wife, a classically-trained singer and teacher, threatened divorce. It is not altogether clear whether he is joking.

Professor Schwerdtfeger does not present as some absent-minded recluse. Rather, with his longish hair, a luxuriant beard peppered with grey, and matching tie and waistcoat, he looks a little like a successful rock music promoter (he likes Pink Floyd, Led Zeppelin and Bach, he says) and there is no hesitancy in his manner. He seems larger than life; not in the least abstracted from it.

Nonetheless, he spends a large part of each day in a world inaccessible to those of us without a command of higher mathematics. His space, in the truest sense, is not the physical space of this office, this building, but Hilbert space, the mathematical space of infinite dimensions in which quantum mechanics is explored.

A large sepia-toned photograph of David Hilbert, who, around 1909 introduced the use of the space that bears his name, hangs like an icon in the corridor. Hilbert, another German, is debonair in a stylishly floppy hat, a starched collar and cravat.

"They knew how to dress back then," says Professor Schwerdtfeger, mock nostalgically.

Physics at the level of the molecule or smaller is deeply weird, which is to say utterly logical and self-consistent yet lying outside the intuitions and assumptions we bring from our own large-scale slow-motion land of Euclidian geometry and Newtonian physics.

The land of the infinitesimally small is a place in which energy comes in discrete increments called quanta. In which light behaves simultaneously as a particle and a wave (a statement which in itself Professor Schwerdtfeger regards as an oversimplification). In which the very act of measurement determines the qualities of the thing measured. In which relativity – as in Einstein's theory – has noticeable effects.

All new-age talk of energy levels and quantum effects not withstanding, this is not the way things behave in day-to-day lives, but this is not to say that we cannot see large-scale manifestations of effects taking place at the quantum level or that these do not throw forth some puzzles.

How is it that gold, normally thought of as an unreactive noble metal, can, in the form of nanoparticles, be used as a catalyst to transform carbon monoxide into carbon dioxide, remove odours and toxins and help clean automotive exhaust gases?

Why is mercury a liquid at room temperature, when gold, with an electron fewer, and thallium, with an electron more, are both solids?

These are both large-scale projections of quantum-level effects, and Professor Schwerdtfeger has postgraduate researchers tackling both problems. The imperfectly understood behaviour of mercury, in particular, is a problem that has bedevilled him for two decades.

"It's damned difficult, the solid-to-liquid simulation of mercury. We want to do a relativistic [the inner electrons of heavier atoms move at a substantial fraction of the speed of light] and a non-relativistic simulation from first principles. If, for the first time, we can say that mercury is a liquid at room temperature because of Einstein's theory of relativity, that would be fantastic."

Professor Schwerdtfeger himself is enmeshed in such problems as how to measure the energy differences between asymmetric mirror-image molecules and the chemistry of superheavy elements, including those yet to be created (see pages 28 to 30 for "Through the looking glass" and page 31 for "Table extensions").

Professor Schwerdtfeger did not first set out to be a theoretician. His MSc thesis at Aalen University looked at wastewater discharge into a local river; it was later on in Stuttgart that he attended a lecture and found himself inspired to switch paths. The speaker was a Dr Heinz-Werner Preuss, a former student of Werner Heissenberg, author of the theory of quantum mechanics. "He got me so excited about the field of theoretical chemistry."

But there was another reason for the change of path. Professor Schwerdtfeger fetches his thesis from a shelf and opens it to a graph showing river oxygen concentrations on one axis and distance downstream on the other. The graph begins with high concentrations then shows a series of precipitous declines until the water is too oxygen-depleted to support life. Each point where the oxygen plummets is the location of an industrial wastewater discharge.

Now he flips to the nondisclosure agreement at the front of the thesis. Professor Schwerdtfeger, an environmental idealist, had been presented with a stark choice by his dean: stay silent and be awarded his degree; release his findings and fail. Thirty years on and half-a-world away from mid-1970s Germany, Professor Schwerdtfeger recoils from the actions of his dean and the decision expedience forced on him.

At Stuttgart Professor Schwerdtfeger spent seven years studying the mix of mathematics, chemistry and physics he needed do quantum theory (adding a Bachelor's degree in mathematics and a PhD in theoretical chemistry to his degree count), and driving a taxi while doing so to make ends meet. "I enjoyed that. I met a lot of important people in that taxi and I had a lot of good conversations."

It was New Zealand's unspoilt environment that drew him to holiday here in the early 1980s. Over the course of seven weeks he travelled the North and South Islands, along the way walking the Routeburn and Abel Tasman tracks and the Tongariro crossing. Even after wandering unawares into the Queen Street riots ("A policeman came up to me and asked me 'What are you doing here?' and I said I am a tourist from Germany and he said 'Get out of here at once,' you know?"), he found himself agreeing with the sentiments of Jacques Cousteau who, he says, had declared New Zealand the last paradise on earth. "I really felt sad to leave the country," he says. So before heading home he called on Auckland University to enquire about work.

continued on page 31

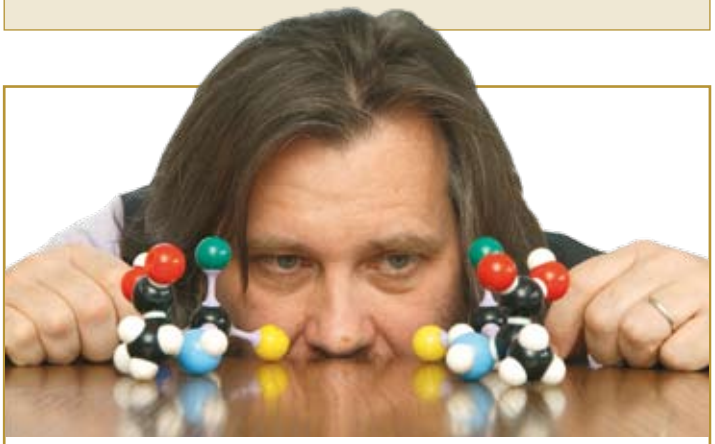
Tool of trade

Simulating the characteristics of different enantiomers – or indeed undetaking any calculation involving quantum mechanics – is very computer-time intensive. "We try to calculate from first principles these tiny energy differences between entantiomers, by putting the electroweak-interaction term into our computer code," explains Professor Schwerdtfeger. "For that we have to use relativistic quantum theory.

"Without a multiprocessor supercomputer we could never do it. Some of these calculations are using 400 gigabytes of disk space, close 60 gigabytes of RAM and can run for two months on 20 processors."

The workhorse for calculations is Massey's Double Helix, a 40-processor parallel computer which Professor Schwerdtfeger hopes to see extended to 80 processors.

Currently one of Professor Schwerdtfeger's PhD students, Christian Tierfelder, is refining the precision of the theoretical calculations being used to identify favourable enantiomers for vibrational analysis.



Professor Schwerdtfeger has been the recipient of numerous awards: Alexander von Humboldt Feodor Lynen Award (1987); Prince & Princess of Wales Science Award (1988); SGS Prize for excellence in basic research from NZIC (1994); Habilitation and venia legendi (Philipps-Universität Marburg) (1995); Fellow RSNZ (1997); Fellow NZIC (1998); Hector Medal (2001); James Cook Fellowship (2001-2003). At going to press, Professor Schwerdtfteger had just been elected to the council of the Royal Society of New Zealand.

Through the looking glass

The tale of the molecular asymmetry and its exploration is best begun with revered 19th century French chemist and microbiologist Louis Pasteur[1], says Professor Peter Schwerdtfeger. Pasteur in his mid twenties set out to solve a puzzle associated with tartaric acid, a substance found in wine lees.

Tartaric acid had the property of rotating a polarised beam of light, while racemic acid, a synthethised substance otherwise identical in its properties, did not. If they were the same substance – as everything else suggested – then why the anomaly?

Pasteur set out to find out. In 1848 he crystallised racemic acid, discovering that two sorts of crystal formed, one the mirror image of the other. Painstakingly he sorted the crystals into their separate piles and prepared solutions. One rotated the plane of polarised light in exactly the same way as tartaric acid; the other rotated light to the same degree but in the opposite direction. Biologically-derived tartaric acid appeared to have a left-handed bias. Racemic acid – or synthesised tartaric acid as it turned out to be – appeared to be half left-handed and half right-handed.[2] Pasteur had come upon the phenomenon of 'chirality' or mirror asymmetry.

"The universe is asymmetric," he is said to have pronounced, "and I am persuaded that life, as it is known to us, is a direct result of the asymmetry of the universe or of its indirect consequence."[3]

What is mirror asymmetry? Think of a left-handed and a right-handed glove. No matter how you twist and turn it, a left-handed glove can never be superimposed over its right-handed counterpart.

In the molecular realm it takes very little to produce mirror asymmetry. Carbon has four electrons in its outer shell with space for four more. If these four missing electrons are supplied by electrons in the outer shells of four other atoms then the molecule formed will be a tetrahedon; if each of the atoms is of a different element, then the molecule will come in left- and right-handed versions that cannot be superimposed.

Now picture yourself, like Alice, stepping up to a looking glass and walking through it into a universe in which every molecule, including every one of your own, is its mirror image. Every coordinate is inverted in space. What's left is translated to right and what once was right is now left. The clocks run anticlockwise, their numbers run in mirror writing.

Would the same physical rules apply? Intuitively it seems they ought to. The system should, in physicists' terms, 'preserve parity'.

The physicist Richard Feynman would tell a story to illustrate this. Let us say that we make contact with the alien inhabitants of some remote solar system. Would it be possible to explain to them what we mean by left and right without there being any asymmetric object or structure we can see in common? If parity holds, then it seems impossible. There is no way of making the distinction.

And why shouldn't the universe be symmetrical in its workings? There is something very appealing about the idea of symmetry. It just feels *right*. So perhaps it is unsurprising that no one set out to test that parity holds until the 1950s.

The trigger was the erratic behaviour of a subatomic particle called the K meson, which was sometimes decaying into two pi mesons, sometimes into three. Something was amiss.

One explanation - which most baulked at – was that parity might not hold. Two Chinese-born physicists, Chen Ning Yang and Tsung Dao Lee, decided to see what the experimental evidence could tell them. Their paper was published in *Physical Review* in October 1956. Four fundamental forces govern all energy and matter: electromagnetism, the strong atomic force, the weak atomic force and gravity. For three of these there was strong evidence. For the fourth – weak atomic force – Yang and Lee found that no verdict could be reached in the absence of experiment.

In 1957 Professor Chien Sheng Wu, another Chinese-born American physicist, set out to put parity to the test. The atomic nuclei of a radioactive isotope of cobalt were held at a near-zero temperature and exposed to a strong magnetic field.

Imagine the cobalt nucleus as a tiny sphere spinning around an axis. The axis has

Through the looking glass

Through the looking glass

two magnetic poles, one we will arbitrarily label 'north', the other 'south'. Normally the nuclei of a sample of cobalt will be oriented randomly. In Wu's experiment the magnetic field induces more than half of the nuclei to line up their north ends and the extreme cold damps their normally frenetic motions.

As each nucleus undergoes beta decay (transforming itself into a nickel nucleus in the process) it emits an electron.[4] If the law of parity holds, then approximately the same number of electrons should be emitted heading north as are emitted heading south.

But when Wu and her colleagues made a count, many more were heading south. Events involving the weak force had shown a bias towards producing particles with a left-handed spin.

Parity had been broken, the universe had become yet stranger place, and, yes, if we ever make contact with those hypothetical aliens we will be able to tell them how to construct a mechanism that will show them what we regard as left and right.

If the universe has 'handedness' at a level of the weak atomic force as Wu demonstrated in 1957, then what will be the consequences at the molecular level? One is that different enantiomers – the mirror images of asymmetric molecules – will hold different amounts of energy in their bonds: if one entantiomer is stablised to some small degree by parity violation then the other will be equally destabilised.

But 'small' is the operative word: the weak force – the best known expression of which is beta nuclear decay – is 100 million million times less powerful than the strong nuclear force and operates at ranges a thousand times less than the diameter of a nucleus.

Measuring parity violation effects at the molecular level will be an extraordinary technical and theoretical feat. Nonetheless, at least three teams are attempting it.

The three teams are Professor Schwerdtfeger's own working with Christian Chardonnet in France[5]; Professor Martin Quack's in Switzerland; and Professor Bob Compton's in the United States.

The hurdles that face them are three: to employ theory to identify enantiomers in which the differences are pronounced enough to be measured; to set about synthesising these candidate molecules; and finally to measure the differences using sufficiently sensitive methods of measurement, such as the use of high-precision lasers.

Who will to get there first? Professor Schwerdtfeger weighs the odds judiciously. Much of it will, he says, will depend on the technique used.

Everything in a molecule is quantised, he explains. "As you put energy in, you go from one stage to another with nothing in between. You can think of these quanta as being like the integers on a digital clock."

By monitoring these quantum changes as energy is fed into the molecule it becomes

1 Pasteur was picking up on the work of Jean Baptiste Biot, who had discovered that quartz crystals rotated the plane of polarised light, as did solutions of certain organic compounds such as sugar and tartaric acid.

2 The term 'racemic' is now used for a half-and-half mixture of two enantiomers.

3 Most of life's molecular constituents exhibit handedness. Life as we know it – and that includes us – turns out to be built around left-handed amino acids and right-handed simple sugars.

This handedness has practical consequences. Different entantiomers may smell or taste different, or have quite different pharmaceutical effects.

Whether the particular handedness of life has come about by chance or necessity is the subject of ongoing debate, as is the corollary: if by necessity, then what role might parity violation play? Professor Schwerdtfeger's view is that if there is a connection, then proving it will be difficult.

4 To be more precise, in beta decay a neutron decays into a proton, emitting an electron and an antineutrino.

5 Professor Schwerdtfeger's collaborators in investigating parity violation effects in molecules are fellow theoretician, Trond Saue; Jeanne Crassous, who is preparing entantiomerenriched molecules; and Christian Chardonnet, who has a particular interest in ultra-high resolution molecular spectroscopy. All three are based in France.

possible to measure its energy state.

"The question is where you put the energy in. You can excite a nucleus, as is done in Mössbauer spectroscopy [or in nuclear magnetic resonance (NMR) spectroscopy]; you can excite an electron, as is done in electronic spectroscopy; or you can excite vibration in a molecule, as is done in vibrational spectroscopy."

The Swiss do not seem to be in the immediate running in Schwerdfeger's estimation.

"Professor Quack has longstanding ideas about how to approach the problem experimentally, but he has struggled to find the funding he needs to build the equipment."

Chardonnet's group, which is using vibrational spectroscopy in a multimillion dollar experimental set up, stands a good a chance of making a successful measurement within the next two years. "If I am optimistic,"

Christian Chardonnet's equipment showing the two Fabry-Perot cavities where the two different enantiomers are placed.

he adds after a pause.

"Christian Chardonnet has the most precise laser set up of its kind in the world, and he is achieving better and better resolution, so I rate our chances highly."

Compton's group, which has the use of the facilities of the famed Oak Ridge National Laboratory, is Professor Schwerdtfeger's next best guess. Compton is using NMR spectroscopy.

Says Professor Schwerdtfeger: "Six months ago no one would have given NMR spectroscopy much of a chance, the effects are far too small. But in a paper going to press co-authored by Trond Saue's research group in Strasbourg we show that if you include heavy elements in the molecules the parity violation effects scale up dramatically. So we are looking at nuclear magnetic resonance again, and I am looking for a suitable chiral compound that includes a heavy element."

One way or other, Professor Schwerdtfeger believes that parity violation at the molecular level will be successfully measured at some time within the next five years.

"And I don't like to say it, but I think the experimental group that gets there first is up for something big."

It's a reasonable assumption. A number of Nobel prizes in physics and chemistry (the most recent the 2001 Nobel prize for Chemistry to Knowles, Noyori and Sharpless for techniques in asymmetric synthesis) have been associated with work involved variously in parity violation effects, chirality and enantiomer synthesis.

If parity violation is measured at the molecular level, what might be the implications? Perhaps initially no more than to show that the assumptions made in the theoretical models are correct.

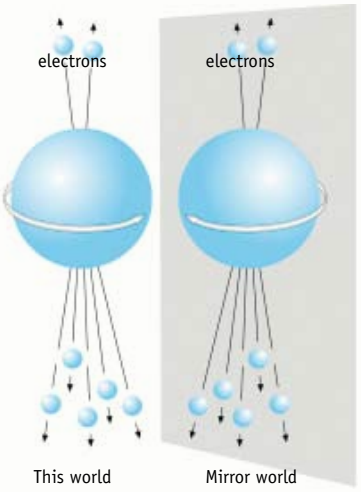
But if measurements can eventually be made precisely enough, they might lead to the revision of theoretical terms – such as the Fermi constant and the Weinburg angle – that are key to modelling the weak interaction. "Though we are further away from that than others are in the field of atomic particle physics," says Professor Schwerdtfeger.

The Standard Model of particle physics – the best proven model available – provides a theoretical framework, but it has parameters that can only be determined by experiment. The more accurate the measurements, the more insights are thrown forth.

The symmetries and asymmetries of the universe do not end with matter, for there is also the complementary world of antimatter. According to the Standard Model of particle physics, the weak force acts on left-handed components of particles; in antimatter the right-handed components.

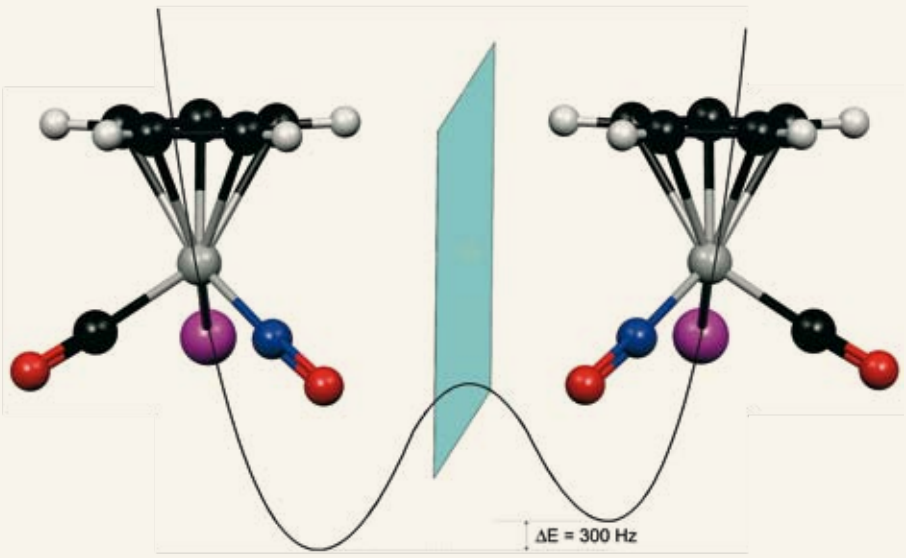
Antimatter in the form of elementary particles has been made in the laboratory, and Professor Quack in Zurich has suggested that if, in some distant time ahead, pairs of chiral molecules and their antimatter counterparts could be synthesised, then hypothetically it would be possible to experiment not just with parity symmetries, but with symmetries of charge and time as well.

"Ha, yes, that would be interesting!" exclaims Professor Schwerdtfeger, throwing his arms wide, his interest flaring. "Wow."



In Wu's experiment a collection of cobalt nuclei with their spins aligned by a magnetic field preferentially emitted the electrons from beta decay from their 'southern' end.
In a mirror world the direction of spin is reversed, while the direction in which most of the electrons are emitted remains unchanged. Hence it is possible to distinguish between the real world and a mirror world.

See http://physics.nist.gov/GenInt/Parity/parity.html



High resolution spectroscopy has yet to confirm the predicted breakdown of mirror image symmetry in molecules. The (C5H5)Re(CO)(NO)I molecule shown here should in theory show unprecedentedly large parity violation energy differences (ΔE) of 300 Hz. With the right techniques and technology this difference should be detectable.

the theoretician

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In 1987 Professor Schwerdtfeger arrived at Auckland University for postdoctoral work in plasma modelling, first based with the chemistry department and then with the school of engineering. All too quickly his allotted two years were over, and he was on the job market.

It was not a good time to be looking. On Monday, October 19, 1987 – Black Monday – the Dow Jones Industrial Average had fallen over 20 percent, triggering a string of financial crises worldwide. The prospect of finding academic work in Germany as a theoretician over the next five years was now slight. He would have to look elsewhere.

The possibilities were a post at Cornell University in New York State or – the offer he took – a Senior Research Fellowship at ANU (the Australian National University) in Canberra. A good position, says Professor Schwerdtfeger, but Australia too was in recession – its unemployment rates as high as they had been in the Depression 60 years earlier – and its research schools were imperilled, so after two years Schwerdfeger returned to Auckland University. He would stay there for the next 15 years before becoming restless.

This time there were offers on the table from Germany, the USA and, of course, from his eventural choice, Massey. "My kids wanted to stay in New Zealand, my wife was undecided. It was a big decision."

And he wavered. Leaving New Zealand would have brought him material benefits, but Professor Schwerdtfeger, who drives a family stationwagon ("My father always said the choice was between a pram and a Porsche," he laments.) and owns a modest house in Glenfield, is not driven by material gain. He and his family live comfortably.

What he wants is an environment that fosters good science, a place in which he and others like him can do their best work.

Before I go, Professor Schwerdtfeger takes me on a tour of his building to meet his postgraduates. Although at least once I am fooled by someone's accent and idiomatic use of English into thinking I have met another New Zealander, everyone I meet is German.

Why are there no New Zealanders? In Professor Schwerdtfeger's view, one reason is that, at the undergraduate level, New Zealand's universities are failing to teaching theoretical physics or chemistry with sufficient rigor or to a high enough level.

Moreover, in his view the emphasis with the university system has increasingly skewed towards applied research, not always of unquestionable worth. In Schwerdfeger's ideal world the funding of research – irrespective of whether it is applied or fundamental – would be governed by merit alone. "That's what you need to build world-class universities."

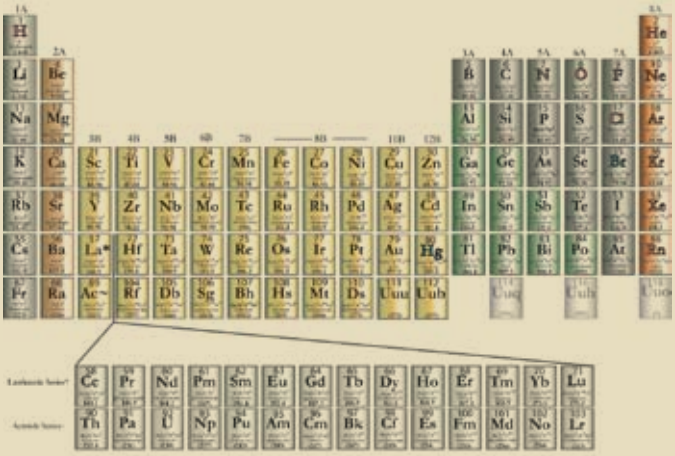
The interview at an end, Professor Schwerdtfeger and I join the Research Centre's two most recent recruits, lecturers Joachim Brand from Dresden and Patrick Bowman from Adelaide, for coffee. Brand's young daughter and his partner are also at the table, and the conversation bounces back and forth in a mix of German and English.

Both Brand and Bowman have realms of expertise that are defiantly non-applied. Brand specialises in Bose Einstein condensates (extremely low temperature gases which behave strangely and have properties that are imperfectly understood); Bowman is a nuclear physicist specialising in quantum chromodynamics.

We talk about New Zealand's bad old days of instant coffee and sweet fizzy white wine, about the strange Australasian addiction to black, salty, yeast extracts on toast, and the social difficulties of explaining what they do.

If you say you are a nuclear physicist, they expect you to be able to build a bomb, says Bowman. People often mishear 'quantum mechanics' and say, "ahh you are a mechanic," says Professor Schwerdtfeger. And when they hear you correctly? It kills the conversation.

Table extensions



The periodic table is growing. For decades it began with hydrogen, ended with uranium and contained 82 naturally occurring elements: elements with half lives comparable to the 4.5-billion-year age of the Earth.

But from the 1940s and on into the nuclear age the number has crept upwards to the point where the 'superheavy' element 116 – and possibly 117 – has been been created in the laboratory. Not that some of these elements are that enduring, some decaying to lighter elements in thousands of years, others persisting for the merest fraction of a second. To create elements with atomic numbers above 106, heavy ions such as lead or bismuth are bombarded with projectile ions with a mass number (the sum of the number of protons and neutrons) of greater than 40. But managing the feat of merging these ions into a compound nucleus is difficult. "You might have one successful event after a month of beam time and only one superheavy atom ," says Professor Schwerdtfeger

And once you have that new element or isotope (an element has a fixed number of protons, but may come in a variety of isotopes with various numbers of neutrons), there comes the problem of how to identify it. "At the moment there are probably three different ways," says Professor Schwerdtfeger. "One is by alpha decay [the nucleus emits an alpha particle, a helium nucleus containing a two protons and two neutrons], but that is only conclusive if you end up somewhere in a known isotope area. If the atom splits into two somewhere in an unknown area then there is a big question mark over the identification.

"Another way is by K-inversion spectroscopy. A nucleus that is very hot kicks out an electron from its inner shell. We have published very precise calculations for this, and the Dubna group [Dubna is a Russian town not far from Moscow] is trying to set up equipment to identify superheavy elements by K-inversion spectroscopy.

"The third way – one in which we are heavily involved – is to do chemistry on that element, predicing its behaviour from theory. This is called atom-at-a-time chemistry."

What makes the enterprise of creating and working with new elements particularly intriguing is the prediction from theory that certain yet-to-be-created elements – elements containing particular 'magic' numbers of protons and neutrons – will inhabit 'islands of stability' where spontaneous fission should play little part. These elements, if they can be created or found in nature, may last for thousands or even millions of years.

'If the language dies, all the traditions, culture, concepts of hundreds and hundreds of years will ultimately fade into oblivion. It was argued before us that if it is worthwhile to save the Chatham Islands robin, the kākāpo parrot or the notornis of Fiordland, is it not at least as worthwhile to save the Māori language?'

Waitangi Tribunal Report on the Wai 11 claim, April 1986

Tō Tātau Reo Rangatira

Professor Taiarahia Black talks to Makere Edwards

For more than 20 years, Professor Taiarahia Black has been committed to the revitalisation and transmission of the language through applied language teaching programmes and traditional Māori knowledge.

The current chair of Te Reo at Te Pūtahi-a-Toi (the School of Māori Studies), Professor Black arrived at Massey in 1982, becoming the youngest lecturer in the Department of Social Anthropology and Māori Studies. Professor Hugh Kawharu was head of the department and its teaching staff, which included well known native speakers of Māori language, Te Pākaka Tawhai, Ted Nepia, Hone Kamariera and Apirana Māhuika.

In 1988 Te Pūtahi-a-Toi was established, headed by Professor Mason Durie. It now has its own building, with more than 30 teaching and research staff in Māori language, culture, policy, research, Māori health and Māori visual arts. Professor Robert Jahnke is head of school.

Professor Black's passion for the oral traditions of his people is reflected in his research.

"There is a great body of Māori oral traditions and literature containing history, customs, mythology, autobiographies, travel stories, personal letters and traditional poetry with a rich repertoire of songs, chants, sayings and genealogies conventional to the oral tradition that depend upon the Māori language to engage Māori with sincerity, affection and loyalty.

"The Māori language is the key to unlocking invaluable knowledge sources for Māori language students because it exemplifies the language of previous generations with their distinctive tribal dialects. This important body of knowledge and scholarship contained in the Māori language will never see the light of day if we allow the Māori language to die."

His love for the language and his belief that hapū (sub-tribe) and iwi (tribe) should be the holders of their traditional knowledge, resulted in his master's and doctoral degrees on Tūhoe traditional waiata. His doctoral thesis was the first to be written entirely in the Māori language.

"I began recording Tūhoe waiata, stories, myths, stories of Māori prophets, Tūhoe military leaders, colonisation, environmental issues and literature, creative short stories, political comments, land confiscation enriched by dialect, personal experience and humour when I was still at secondary school. Some of those old songs and stories were not often heard on our marae and on tribal occasions and indeed the 'keepers' of these invaluable sources were dying. My doctorate represented my commitment to continue protecting, preserving and transmitting this knowledge across all generations of Tūhoe," he says.

Ki te ngaro taku reo, taku mita, ka ngaro aku tika

If we lose our language, our dialects,
we stand to lose our thoughts, customs,
mythology and knowledge

Professor Black's thesis *Kāore te aroha: Te hua o te wānanga – The abiding love, a source of knowledge* discusses the transmission, revitalisation and advancement of Tūhoe oral literature and history through waiata. His work has drawn interest from academics from Ireland and Israel. A First Nations group from Canada is also interested in the framework he used to record tribal history and has requested a translation of the work.

Professor Black was born in Whakatāne, 25km south of his tribal home Rūātoki, to Anituatua and the late Stuart Taiturakina Black. Taiarahia was named after the sacred mountain over looking Rūātoki. He spent some of his childhood in Rūātoki before his family moved to Kawerau. His secondary school years were at St Stephens College before he went on to Waikato University to complete a Bachelor of Social Sciences.

His mother, Anituatua, and his sisters also have a strong love and appreciation of poetry and prose. Anituatua and singer song-writing sister Whirimako won the 2005 Apra Maioha Award for their waiata, *Tini Whetu*. Another sister, Rangitunoa, has an interest in Tūhoe women as holders of traditional knowledge.

Professor Black and his wife Shelley, who is Pākehā and also speaks the language, have four children fluent in Māori. Their two older sons have both reached the finals of the national secondary schools Māori speech competitions, Ngā Manu Kōrero, both winning the competition and regularly placing in the top three.

The past 25 years have gone by quickly. Aside from teaching the basics of the language to newcomers, and challenging the more proficient to delve into the subtleties and intricacies of Māori poetry, prose and literature, Professor Black has been involved with a number of research projects.

He is part of the Massey project, Te Hoe Nuku Roa, a longitudinal study of Māori households that looked at the impact of policies on issues such as health, education, employment and the Māori language. He has led contracts that have produced quality Māori language teaching resources for total immersion and Kura Kaupapa Māori (Māori language schools based on the philosophy known as Te Aho Matua) and that have examined Māori language revitalisation techniques.

He also led and developed the Māori language policy at Massey. Matua Reo Kaupapa, which was launched across all the campuses this year, outlines Massey's recognition of Māori as an official language of the University.

One of the larger projects he directed was a contract with Te Māngai Pāho, the Māori language broadcasting funding agency. The five-year contract analysed the quality and quantity of Māori language broadcasting on 21 Māori radio stations.

"The quality of the Māori language spoken is a big issue. Today's learners of the language don't always have access to native speakers who can model correct pronunciation with the right intonations and accent or with richness and metaphors. As well, our children are raised in predominantly Pākehā speaking communities, which influences the way they speak and think," he says.

"Regardless, it's still the second language learners that are reviving the language by speaking Māori to their children from birth. I get extremely annoyed when I come across able, articulate native speakers who choose to speak to their children and others in English. The second language speakers are the generation whose parents were not raised in the language, and they have felt the pain of not being able to speak it. They are now raising their children in the language, sending them to Kōhanga Reo (early childhood Māori language educational centres operated by the extended family) and Kura Kaupapa Māori. They are the champions. I'm inspired by them."

His day begins at around five in the morning with marking assignments, catching up on correspondence, drafting, writing and reading research reports, writing evaluation reports for NZQA and maintaining links with funding bodies. His voice is familiar on the airwaves of Radio Wātea, an urban Māori station that broadcasts across the nation from south Auckland. He is a regular commentator in te reo Māori on social, political and cultural issues.

He is also pursued by mainstream media on issues such as the controversial new All Black haka and to comment on the recent ascent of the 7th Māori King, Tūheitia Paki. His other research projects are numerous and contribute to the growing body of Māori language teaching and learning resources urgently needed in total immersion schools and classrooms. He was director for the Toi Te Kupu Project, a database of all Māori language resources greatly assisting teachers of immersion programmes to access resources more readily. He's also busy translating documents including job advertisements, reports, policy statements, abstracts and conference proceedings. Some of his research was used as evidence in the Urewera claim at the Waitangi Tribunal hearing that ended last year.

His latest project is the Inaugural Māori Language Conference at Massey in November. The conference will be entirely in the Māori language. It is expected to attract speakers of high fluency, including young Māori from secondary schools as well as tribal researchers, academics, radio and television broadcasters, government workers, and Māori politicians. His guest speakers include Māori Land Court Chief Judge Joe Williams, Professor Aroha Yates-Smith, Carwyn Jones, Haami Piripi, Kevin Prime and Hekia Parata. He is also negotiating for an Irish language scholar and Gaelic speaker, Dr Muiris O'Laoire to be an international observer at the conference. Dr O'Laoire is a visiting scholar at Te Pūtahi-a-Toi and Te Mata o Te Tau, Massey's Academy for Māori Research and Scholarship.

"There are few national or regional conferences or forums available to competent speakers of the Māori language where they might present their paper entirely in the Māori language. The conference is aimed at advancing Māori language as a medium for discussion and debate on education, justice, science, technology, broadcasting and whānau cohesion."

As is the case with many Māori in positions of influence, Professor Black has had offers of full-time work elsewhere including calls to head back home and work among his own people. However, he has plans to keep on researching Māori language issues at Massey. His position as professor and chair of Te Reo Māori means he is constantly looking for research and collaboration opportunities that inevitably require funding.

"I intend to continue being part of the growth of that critical mass of Māori language speakers, writers and researchers from undergraduate to postgraduate level here at Massey. I am supervising a number of Māori doctoral students some of whom will be writing their theses in Māori. I also see the potential in our Māori language secondary students coming through immersion schools and Māori boarding schools. They have the ability to achieve at university and beyond.

"I think it is vital that the Māori language has presence at a senior level in a tertiary institution. Being a part of the university establishment has allowed many opportunities to link with whānau, hapū, iwi, government departments and international indigenous groups on common issues such as the development of our lands, history and languages. I want to continue to be a part of those collaborations. I want to make sure that this generation and the next generation who enter tertiary education can expect quality Māori language teaching, research and support services.

"Te reo Māori cannot be separated from Māori lives. Nor for that matter can Māori lives be separated from the diversity of experience that constitutes modern living. For that reason the dynamics of te reo Māori are inextricable from the social fabric of modern living. Te reo Māori has the potential to reinforce social, cultural and economic heritage, individual wellbeing, self-esteem, confidence, pride, and intellectual potential."

mutual benefits

When two species strike up an alliance to the advantage of both the result is called mutualistic symbiosis. But how do two species reach an accommodation?
Science writer Anna Meyer speaks to Professor Barry Scott, one of her former lecturers, to find out.
Additional reporting by Malcolm Wood

You might not think so, but New Zealand's almost 12,000,000 hectares of pasture owes much of its productivity to a persistent fungal infection. The fungi are endophytes: living out of plain sight within the body of the grass. Only when a grass blade is cross sectioned and viewed through a microscope do the fungi reveal themselves, their long branching filaments penetrating between and into the grass cells.

Most of the dominant species of grass in New Zealand – perennial ryegrass, meadow fescue, and tall fescue among them – have their own endophytes, explains Professor Barry Scott, director of the Massey University Centre for Functional Genomics

"The endophytes and their hosts have been living together for millennia, so there is a very highly evolved association."

And our pastures are all the better for it. A number of fungal endophytes endow their grass hosts with fortunate properties. These can include better drought recovery, better root growth, higher seed production and greater productivity.

In return the fungus gains an ecological niche, an assured source of nourishment, and transmission from generation to generation.

The relationship is one of mutualistic symbiosis: two organisms of different species interacting in ways that benefit both.

But not all symbioses are good for both sides: some are beneficial, some antagonistic. Fungi can also be pathogens, ravaging their host plants.

What is it then that keeps a beneficial symbiosis in balance? The question has been a career-long fascination for Professor Scott, who began focusing on the nitrogen-fixing symbiosis between *Rhizobium* and legumes (including work on symbiotic plasmids in *Rhizobium trifolii* and the characterisation of nodulation genes from *Mesorhizobium loti*), then switched in the late eighties to concentrating on the symbiosis between *Epichloë* fungi and perennial ryegrass.

"I am intrigued at how a plant and a microbe can live together and, particularly, how the microbe can benefit the plant… I still find how it's done chemically really amazing.

"In the *Epichloë*-ryegrass relationship, the fungus produces novel substances called 'bioprotective' metabolites. These protect the grass from insects, and reportedly various endophytes can confer tolerance of drought, or of nematode activity, or of activity of other fungal pathogens.

"If you grow the fungus outside the plant, which you can do quite readily, you won't find those metabolites, and we haven't found conditions to make them produce them. So something about being in the plant makes it happen."

His current research has two thrusts. The first is a major, ongoing effort to unravel the genetics, chemistry and biochemistry of the pathways that manufacture the bioprotective

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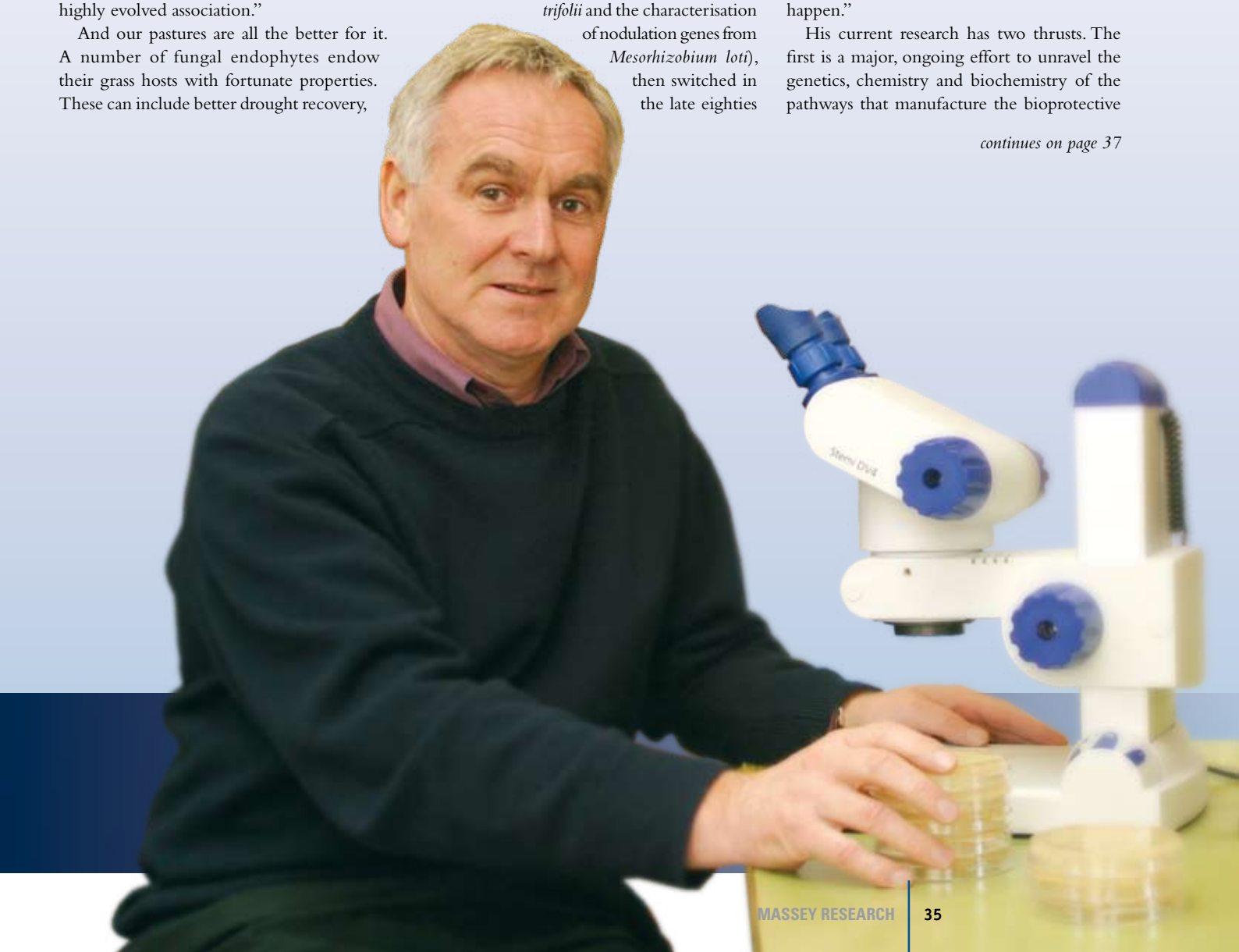


maintaining détente

How does a fungal symbiote regulate its growth to match its host's interests?

Sometimes the best way to find out how something works is to carefully disrupt it. This is the approach Professor Scott and his collaborators – principal among them his postdoctoral fellow Aiko Tanaka – recently took in exploring the relationship between the fungus *Epichloë festucae* and its host the perennial ryegrass *Lolium perenne*.

Foreign DNA was randomly inserted into the genome of the fungus creating a number of mutant strains, among them one that far from benefiting its host, stunted grass growth and led to its premature ageing and death.

An examination under the microscope showed what was amiss: unlike the wild-type fungus, which held its own incursions in check, the mutant fungus was spreading rampantly.

What had happened to the fungal genome? Tanaka *et al* found that a single fungal gene called noxA had been disrupted. The gene normally catalyses the conversion of molecular oxygen to superoxide. Prevented from producing superoxide, the fungus was growing with reckless disregard for its host's health; a mutation in a single gene had turned the fungus from Jekyll to Hyde.

The result, says Professor Scott, "was counter-intuitive but highly revealing".

The production of superoxide has typically been seen as either a cellular defence response or as an unwanted and highly destructive byproduct of such things as cell respiration, UV light exposure or smoking.

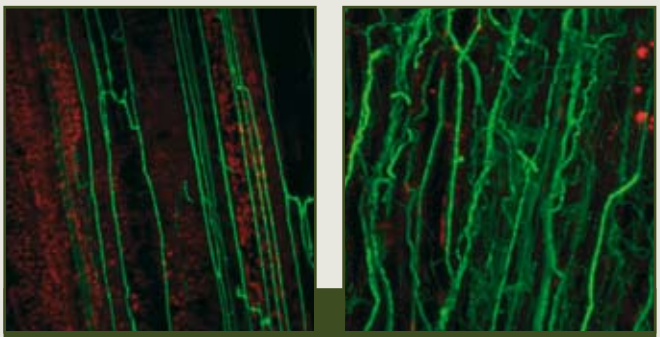
Superoxides have been implicated in cancer and ageing; hence the proliferation of food products boasting antioxidant qualities.

Tanaka *et al*'s research is evidence that short bursts of superoxide may be used to initiate or curb (as in this instance) periods of cell proliferation.

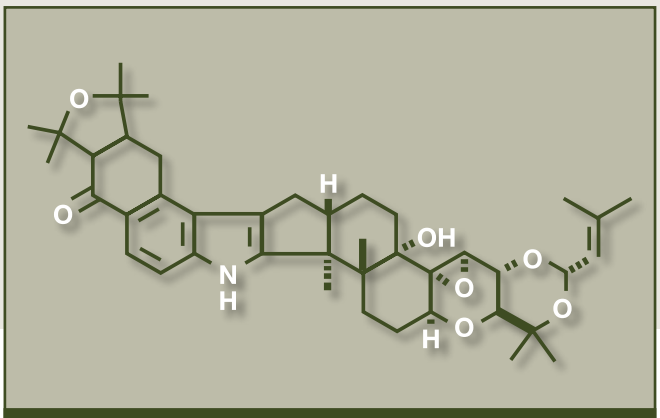
Says Professor Scott: "We think superoxide is produced by the fungus in the plant to control its own growth so it doesn't get out of hand. It's a plant-regulated gene that is part of the fungal genome. We're right at the heart of the plant-fungal symbiosis. This is a major insight."

A Tanaka, MJ Christensen, D Takemoto, P Park, B Scott. Reactive Oxygen Species Play a Role in Regulating a Fungus–Perennial Ryegrass Mutualistic Interaction. *The Plant Cell* (2006), 18:1052-1066.

Perennial ryegrass infected with the fungus *Epichloë festucae*. The two plants at right have been infected with a strain of fungus that has the gene responsible for producing superoxide disabled.



The green strands of fungal hyphal growth in grass as viewed through a confocal microscope. At left the wild strain of *E. festucae;* at right the thickly-clustered hyphae of the mutant superoxide-disabled strain.



Lolitrem, a bioprotective metabolite produced by a fungal endophyte. Professor Scott and his collaborators have cloned and identified the genes that produce lolitrem.

continued from page 35

metabolites provided to the plant by the fungus. He and his group at the Institute of Molecular BioSciences have discovered the genes involved in making several of the substances and, in collaboration with Associate Professor Emily Parker, they have worked out the precise biochemical pathways followed as the molecules are put together, and how the genes are switched on and off.

The second thrust is elucidating how the grass and the fungus achieve a mutually beneficial working relationship. Professor Scott is trying to figure out just how the fungus and its host 'talk' to each other, genetically and biochemically.

"A plant that is being colonised by a fungus will usually mount a vigorous biochemical defence. Why isn't this happening here? We are interested in how the fungus avoids the plant's defence response. What are the biochemical signals that are exchanged between the partners?"

This is 'pure' science, yet, as is so often the case, the fundamental insights it is producing may well turn out to have practical applications.

"Naturally the work has implications for agricultural productivity," Professor Scott says. It might lead to ways of combatting plant pathogens or encouraging useful symbioses.

But other developments could be more adventitious. "Some of the compounds are very interesting biologically, because they interfere with neurotransmitter release [in animals]."

Among the metabolites there may well be candidates for treating a range of medical conditions, such as low blood pressure and neurological diseases.

"As yet there's no product drawn from this class of compounds on the pharmaceutical market, though several are being investigated. The work we've done should make it much easier for someone to develop a useful compound."

This is one of the joys of fundamental science: not to arrive at some predetermined goal but to see unexpected vistas arrive in view.

"The superoxide work [see "Maintaining détente" opposite page] is classic serendipity," says Professor Scott. "You would never set that as a milestone, because you would never have dreamed of arriving at that result."

Professor Barry Scott

Professor Barry Scott grew up in Mosgiel, where he developed an affinity for the natural world and an interest in science early on. "As a kid, I worked on farms, biked all over the Taieri Plains, and fished. I just found natural things very interesting."

He studied at Otago University, back in the pre-internal-assessment days when, in between bouts of intense exam-driven study, time could be given over to cultural and recreational pursuits – in his own case the climbing of mountains.

He found that biology – not a subject that had been available to him at high school – fascinated him. He studied symbiosis during his honours year and his PhD thesis addressed nitrogen fixation. "I got a Nature paper from my PhD. We came up with a scheme for how the nitrogen fixed by the bacteria got transferred to the plant. It's textbook stuff now."

With his PhD complete, Professor Scott, eager for adventure, headed for South America, first to Peru and Bolivia "climbing some 6000-metre peaks", then, with his wife Christine, to Brazil where he took up a postdoctoral fellowship investigating nitrogen fixation in tropical plants.

After Brazil, Professor Scott completed a second postdoctoral fellowship in California, before returning to New Zealand to take up a position at the DSIR in Palmerston North. This was followed by an offer of a professorship at Massey. "I was very fortunate," he said. "This was when molecular genetics was really taking off, and the Vice-Chancellor at the time, Sir Neil Waters, wanted to develop molecular genetics at Massey. I was only 35. I had learned all the cloning techniques when I was in the States, and I was one of the first to do recombinant DNA work in New Zealand."

One of the pleasures of the job is the stream of postgraduates who pass through the laboratory they have nicknamed 'Scott base'. Scott follows their careers and takes pleasure in their successes.

One of his current collaborators, Carolyn Young, first began working for him as a technician, before progressing to lab manager, PhD student, and a principal investigator at the Samuel Noble Research Foundation in Oklahoma.

A major success for Professor Scott's laboratory was the cloning of a gene cluster from *Penicillium paxilli* – a soil fungus found in the tropics – for the biosynthesis of paxilline, a bioprotective indole-diterpene.

"Carolyn carried out much of the research on the cloning and characterisation of the genes under my guidance. We had a wonderful partnership," says Scott.

"I've had some really good people as postgraduates, and I just say to them, 'I'll provide you the working environment. I'll talk you through things when you need me.' Then I let them get on with it," he says.

"Sometimes I compare science to rock climbing," he says. "In fact I have been known to suggest 'must be rock climber' should be part of the researcher's job description. Both rock climbing and science are about problem solving. You have a route that you want to climb. You assess the whole thing, but then you've got to sort out the first few moves and carry those out. Then you solve the next few moves. And once you have strung it all together, there you are at the summit."

Professor Scott on the summit of Mt Hooker while on a recent climbing trip. Mt Aoraki (Cook) is the prominent skyline ridge in the left background.

food by design

Professor Harjinder Singh talks to Anna Meyer about how to engineer food with particular benefits.

If the advertisements and packaging are anything to go by, we are increasingly drawn to foods that have been custom engineered to improve our wellbeing and long-term health. Foods that boast of *Acidophilus* cultures, of Omega-3 oils, of antioxidants and, of course, of a host of vitamins and minerals. Foods that are low fat or low carb. And while we may want to eat our way to better selves, we don't like self denial. Let what we eat be good for us, the voice of virtue says, but let it also be self-indulgently more-ish, comes the rejoinder.

Enter Professor Harjinder Singh, co-director of the Riddet Centre, and his team. To manufacture foods with desirable properties you first have to understand the make-up of food at the molecular level. All food is essentially a mix of varying amounts of protein and peptides, polysaccharides (sugars and starches), vitamins, minerals and flavour compounds assembled into complex structures. Professor Singh and his team are investigating the functions and molecular structures of these food components, and how they interact with each other to produce particular characteristics.

The team is investigating the structures and organisation of food components and how they relate to sensory properties such as taste, aroma, texture and that curious quality called 'mouthfeel'. "There's a relationship between how the materials interact at a molecular level, and how you actually sense them in the mouth," Professor Singh says. "A certain particle size of fat, for example, or the size of sugar crystals, will determine how you experience eating yoghurt or a dessert. Depending on how components are structured, you may get the flavour released slowly or in a sudden burst."

The properties of food components also have a profound role in our health and wellbeing. "You consume a food with a defined structure, and it breaks down in the human body," explains Professor Singh. "The nutrients and bioactive compounds are released and absorbed, and the way this occurs is related to health."

Professor Singh and his group are looking at how the structure and complexity of a food relates to both how it is absorbed and how it influences the consumer's wellbeing. This paves the way for designing foods that have a targeted impact on health. These include foods that are high fibre, low GI, weight-loss-promoting, or high protein.

"There are connections running through our research, from the molecular understanding of food components, to how foods influence human health, to the sensory experience they give, and the delivery of nutrition," he explains. "If we can understand how all these processes work, we can target both the sensory experiences as well as an efficient delivery of health-enhancing components."

Another of Professor Singh's research interests is in manufacturing new 'biomaterials' that can be used as food components. "There are a lot of opportunities to modify molecular structures to make foods that can give us the right kind of sensory experiences as well as the health attributes that are desired," he says. "If you have a food product that doesn't taste too good, even if it's healthy for you, it doesn't seem to work. The whole industry is driven by health and wellbeing, but you can't have this without convenience, flavour, texture and taste."

The research may contribute to the creation of new 'functional foods' – foods that have ingredients added to provide specific health and wellbeing benefits. This is a rapidly growing area, with some products already on the market, and many more in development. Already on the supermarket shelves are margarines with added plant sterols that reduce cholesterol absorption, bread and milk enriched in Omega-3, calcium-fortified milks, yoghurts containing probiotic bacteria, and juices containing added antioxidants and vitamins.

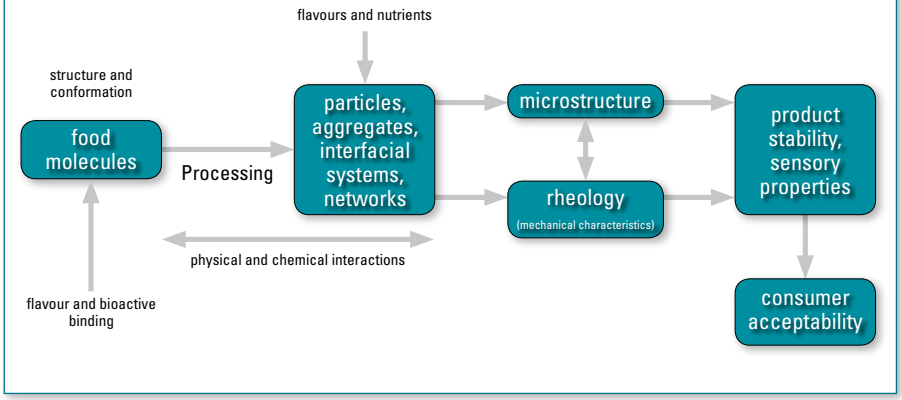
"There are a lot of technical issues surrounding how to add supplements to foods," says Professor Singh. Omega-3, for example, is notoriously difficult to add to foods in useful amounts, as it breaks down easily, leaving an unpleasant fishy smell (see Something Fishy: Solving the Problem with Omega-3). Iron and calcium additives interact with other food ingredients, and cause colour changes and flavour changes. "Food acceptability is totally dependent on how these things interact and change the colour, flavour and, in some cases, nutritional quality."

Currently, functional foods are mainly addressed at the wellbeing of the general population. However, the technology could be used to design specific diets for groups such as the elderly, whose sense of taste is changing as their taste buds deteriorate, and whose digestive systems are no longer so robust. Products that are modified to have a higher flavour and are more easily digestible would suit for this group. Similarly, sportspeople are good candidates for products that allow a rapid uptake of energy and good uptake of amino acids for muscle building.

Beyond functional foods tailored to particular groups may lie foods tailored to an individual's preferences, health issues, and potentially, their genetic makeup. "You might like a certain kind of flavour profile, but you also may have certain health requirements," says Professor Singh. "In the longer term, you could potentially have foods designed especially for an individual's genetic profile and personal preference."

Professor Singh and his colleagues have developed many links with the local and international food industries, and their research has led to several novel concepts, ideas, and patents, resulting in value-added food ingredients and products, particularly for the dairy industry.

Inter-relationships between food structure and acceptability of product



Making Omega-3 oils a part of our diet

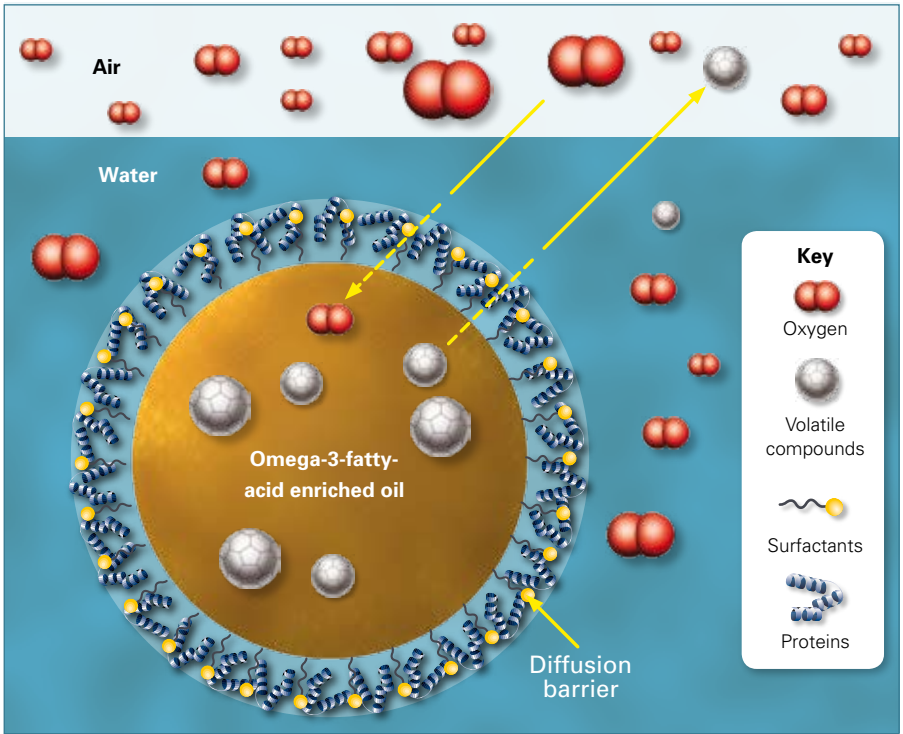
A body of research has shown that regularly consuming Omega-3 fatty acids in the form of fish oil can play a significant role in preventing cardiovascular illness, and that it may also help to stave off a range of other conditions, such as arthritis and Alzheimer's disease.

Omega-3 comes in two forms: eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Both are found in good concentrations in fish oil; hence oily fish such as salmon are a recommended food source for Omega-3. In fact according to some authorities, we should all consume oily fish, such as salmon, at least twice a week. The trouble is, many people can't buy fish locally, can't afford it, or don't like it. Capsules of Omega-3 supplements are an alternative, but many people neglect to take them long term when they fail to see immediate benefits.

Recently, food manufacturers have been trying to develop new ways to add Omega-3 to ordinary food, such as milk or bread, but this isn't as easy as it sounds. "Fish oils are very susceptible to spoilage and oxidation, and you get off flavours and fishiness coming through quickly," explains Professor Singh. "Technically, that's a very difficult problem to solve." Add too much fish oil, or leave it sitting around for too long, and the result is a fishy-tasting product that is unlikely to find a ready market. Currently, Omega-3 enriched foods typically contain small amounts of the substance, meaning that in order to get any real benefit, a larger than typical serving size would have to be eaten. "It's a big challenge to get something that will deliver at least half of your daily requirements in a single food serve."

The answer that Professor Singh and his colleagues have come up with is a technology that encapsulates Omega-3 molecules with a nano-scale-level coating to protect them from light, oxygen, temperature and acidity. With this coating, enough Omega-3 can be added to food products to supply a complete daily requirement in a single serving, without any give-away taste or aroma of fish.

The same patented technology could also be used to target the delivery of substances to different parts of the digestive system. Many useful bioactive nutrients are best absorbed in the intestine, but to get there they must first survive the harsh, acidic environment of the stomach. Professor Singh and his colleagues are now working on nano-encapsulations that only break down in certain parts of the digestive system.



Encapsulation of Omega-3 fatty acids inside an emulsion droplet. An interfacial barrier consisting of proteins, surfactants and other macromolecules can prevent oxygen from entering and volatile compounds from escaping.

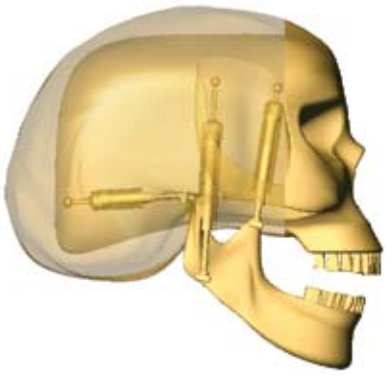
Professor Harjinder Singh

Professor Harjinder Singh has spent his career working with food and its components. Born in India, he completed undergraduate and master's degrees in biochemistry which, he says, "gave me the background and experience in the basic biochemical events", before moving to Ireland to complete a PhD in dairy food chemistry. This was the beginning of a life-long interest in milk and milk proteins. His PhD project, a study of the behaviour of milk proteins processed at high temperatures, was the perfect preparation for his move to New Zealand to work at the Dairy Research Institute in Palmerston North. "They were keen for someone to work on some of the heat stability issues they had in milk powder," he says. While there, he gained a good understanding of the types of problems that exist in the dairy industry. "I worked alongside people who went to factories and saw what the real issues were."

This link with the 'real world' of food products is something he still maintains. "I would say the connection is important, especially in our field. The science is great, but if you can see how it connects with real problems and opportunities, then it becomes very powerful."

In 1989, Professor Singh moved to Massey, "At Massey there was the opportunity to develop much wider research platforms and to work with postgraduate students and postdoctoral fellows," he says. He particularly values the time he spends in mentoring scientists who have just begun their research careers. "The young scientists here continually challenge the received wisdom. They keep our work cutting edge."

Professor Singh is an acknowledged world leader in the science of food structure and functionality, especially as related to dairy food systems, being one of the top five most-cited researchers in his field. He is a Fellow of the Royal Society of New Zealand and was awarded the 2001 Marschall Rhodia International Dairy Science Award by the American Dairy Science Association in recognition of accomplishments in research and development in dairy sciences pertaining to the diary foods industry. Professor Singh holds five editorial board positions and is a frequent keynote speaker at international conferences.



chewing it over

A robotic jaw takes shape

Margo White reports from Auckland; Malcolm Wood from Palmerston North.

Think for a moment about the mechanics of eating: of biting, chewing and swallowing. Evolution has bestowed on us the versatile jaws and teeth of omnivores. We can bite an apple using our incisors. We can crush nuts and grains using our molars. We can move our jaws laterally to tear at the fibres of a steak.

We adjust how we chew to match the type of food we are eating and how well-chewed it is already. And all the while our tongues are sorting the food particles – holding back the smaller ones and pushing the larger particles back between the teeth for further processing – shaping the ball, or *bolus*, of well-chewed, saliva-moistened food we will swallow.

We experience the food: savouring its aroma, taste, temperature and – two properties that change dramatically as the food is chewed – its texture and mouthfeel.

For many foods, texture and mouthfeel are a large part of the sensory point. Take, for example, the crustiness and spring of newly baked bread, the crispness of an apple plucked from the tree, or the just-so give of spaghetti cooked *al denté*.

But how do you measure these qualities objectively and precisely?

The beginnings of an answer are taking shape on a laboratory bench in the form of a prototype robotic jaw.

The team developing the jaw is led by Associate Professor Peter Xu, a specialist in mechatronics (an interdisciplinary field that combines mechanical, electronic and software engineering) and Dr John Bronlund.

Over the past three years, they and their group have been coming to grips with the complicated architecture of the human jaw.

The human jaw involves two rigid bodies, the upper jaw or maxilla, and the lower jaw, or mandible. The maxilla is fixed. The mandible is suspended from the skull through the hinges known as temporomandibular joints. A temporomandibular joint does not simply rotate around a fixed point, as does a joint such as an elbow or knee. Instead, within a fixed range, it is able to move backwards, forwards and sideways beneath the skull while rotating, making the range of paths potentially unlimited.

The movement of the mandible is driven and coordinated by muscle groups that broadly divide into those that open the mouth and those that close it. The mouth-opening muscle groups move the mandible away from the maxilla at high velocity, while the mouth-closing groups allow for the movement of the mandible against the maxilla with high forces. There's also a third muscle group, which isn't exclusively mouth-opening or mouth-closing.

Dr Xu's team has devised a six Degrees of Freedom model (DOF refers to the number of independent movements a robot has) driven by six actuators, or motors. These six actuators, being bi-directional, are able to replace both the jaw-opening and jaw-closing muscle groups, allowing the jaw to follow all of the key trajectories they have identified.

It wasn't easy. In the confined space of the average human jaw – they wanted the jaw to be human-size – the six actuators kept getting in the way of each other. Creating a model that satisfied the demands of both speed and space meant adapting the original design. They expect to adapt it again. Dr Xu: "As smaller motors are being developed we'll be able to make the configuration much smaller."

The prototype of the robotic jaw was completed late in 2005. It looks like a small industrial robot built around a set of dentures, but then beauty is in the eye of the beholder. "It's a work in progress," agrees Dr Xu.

The impetus for the development of the jaw came six years ago from Dr Xu's colleague and project co-leader Dr Bronlund, a senior

lecturer in bioprocess engineering, who had just returned from a sabbatical based at l'Institut National de la Research Agronomique (INRA) in France.

While there, Dr Bronlund had worked with a group at the University D'Auvergne Clermont who were using an instrument called an articulograph to determine how people's chewing patterns changed according the properties of the food they were eating.

Volunteers wearing small transmitter coils on their teeth were seated in a magnetic field and a set of receivers monitored the movement of the coils.

The work took place under the auspices of the University School of Dentistry in the Auvergne. But while the focus was dental, Dr Bronlund was alert to other possibilities.

"I thought, you could take those monitored, measured jaw trajectories from a real person and make a robot to reproduce them. You could incorporate sensors, measure forces in real time, and arrive at quantitative measures of food texture dynamically, as the food is being chewed."

What are the attributes of food texture? Food technologists employ a lexicon of qualities, among them hardness, cohesiveness, viscosity, springiness, adhesiveness, fracturability, chewiness and gumminess.

Although we may not use this vocabulary, we are all exquisitely sensitive to these qualities in the food we eat, and indeed one way of assessing the textural qualities of a food is to convene a panel and have the participants rate food according to a sensory scale.

But humans are expensive to hire, and no two are the same. Their dentition and the structure of their jaws vary; their chewing patterns are idiosyncratic; their judgements are inexact. So it is not surprising that from the 1960s on the food industry has increasing turned to instrument-based methods to measure food rheology – the physics of deformation and flow. These days food technologists can measure physical qualities such as adhesion, breaking point, creep, tackiness and spread with great precision.

But however well-engineered the instruments and however precise the measurements, 'meaningful' data – that is data that correlates well with the way we experience food – is hard to come by. A food product pressed between two flat plates, for example, is not a good analogue for action of your molars.

Nor are texture analysers, which typically take their measurements from a couple of consecutive 'bites', much good at chewing food.

And if you are trying to cook a more tender greenlipped mussel, then employing a texture analyser such as you might find in a food technologist's laboratory may not be that helpful, says Dr Bronlund.

"You can get any answer you want depending on whether you cut across the stringy lip or into fleshy body; different parts of the mussel have different mechanical properties."

A robotic jaw, on the other hand, programmed to reproduce the behaviour of a human jaw, would serve nicely.

In fact, once perfected the jaw could even be customised to match the characteristics of a particular demographic. Says Bronlund: "Children have pointy teeth. As you age your teeth flatten with wear. The pipe dream is that way down the track you will be able to say 'I

Professor Peter Xu

Associate Professor Xu received his degree in manufacturing engineering and his ME degree in mechanical engineering from Southeast University, China, and his PhD in mechatronics and robotics from Beijing University of Aeronautics and Astronautics. He has worked at Southeast University, the University of Stuttgart in Germany and City University, Hong Kong, which was where he developed a high-rise glass-window cleaning robot.

Dr Xu moved to New Zealand in 1999 in search of space and quiet. "I got fed up with life in Hong Kong." He and his family spent their first five years in New Zealand in Palmerston North but last year Dr Xu split his time between the Auckland and Palmerston North campuses. He is now at Auckland full-time, and he and his family have shifted to Orewa. "It takes me 20 minutes to get to work. There aren't many traffic jams on this section of the motorway."

With the move to New Zealand, Dr Xu has been obliged to shift his focus from industrial robots and robots useful in mass production to robots that have implications in various medical fields. He has taken this in his stride, and cheerfully. "Whenever you move into a new direction you have to learn new knowledge, get to know new people, understand new funding agencies. So it's exciting. That's the experience of life."

As well as working on the robotic jaw, Professor Dr Xu is leading a team researching an Image-Guided Surgeon-Instructed Robot Assisted System[1] and coleading a project looking into the development of smart sensors for detecting viruses[2].

This year Dr Xu was elected a Fellow of the Institution of Professional Engineers for his contribution to the advancement of engineering knowledge, a recognition of his expertise in mechatronics and his contribution to the discipline. In August he took up an award from the Brain Pool Program of the Korean Federation of Science and Technology, enabling him to spend time at Daegu Universitycollaborating on a Korean government funded project developing a mobile robot that can assist the vision-impaired.

1. The Image-Guided Surgeon-Instructed Robot Assisted System for long bone fractures is being developed in collaboration with two surgeons at Palmerston North Hospital, Dr Supratim Mukherjee and Dr Richard Lander. This biomedical engineering project will focus on the viability of a semi-automatic robotic device which, guided by a surgeon, could be used to manipulate and operate on long bone fractures.
2. Dr Xu's coleader is Dr Yuan of Industrial Research Limited. The proposed sensors will detect certain viruses through bond rupture scanning, or REVS. These sensors make use of the relationship between a virus and antibodies, or more specifically, the bond that can be ruptured when an oscillating force is exerted on it through a quartz crystal microbalance, or QCM.
   Such ruptures produce an acoustic noise which can be measured and identified by REVS. This frequency is dependent on the virus, which enables the sensing system to detect a specific type of virus.

Dr John Bronlund is a bioprocess engineer in the Institute of Technology and Engineering. His research engagements include food and bioprocess development, functional packaging design, sensor development, understanding the interactions of food texture and human chewing behaviour, postharvest technology and even human in vitro fertilisation (IVF) technologies. He currently supervises 14 postgraduate students, their work being funded by a number of New Zealand food companies and crown research institutes.

want to create a product for six-to-10-year-old Korean kids' and customise the jaw to match. Or, as the baby boomers hit sixties and seventies with their teeth in varying states of repair, you will able to use the jaw to explore how reduced dentition affects food choice."

How far off is that perfect jaw? Still some way. Lacking are a palate-and-cheeks equivalent to hold the food in the jaw as it is chewed, a tongue to sort the food, and – although the current prototype can be programmed to various speed, force and direction settings – the artificial intelligence that will allow the jaw to self-regulate its behaviour according to feedback.

Creating a simple substitute for a palate and cheeks shouldn't be that difficult says Dr Bronlund, and last year Dr Xu, Dr Bronlund and Dr Kylie Foster, a food engineering lecturer specialising in human chewing behaviour, received a grant to explore the development of an intelligent robotic jaw, that is, one that will know how to chew by responding to its own sensors rather than through human instruction.

"We want to develop a knowledge-based system, one that involves jaws, teeth, muscles, all those things that participate in the chewing process," says Xu. "We need to use an artificial intelligence language to formalise how all these parts contribute to the entire process. If we begin research right now we may have the real working robot in five-to-10 years."

A 3-D articulograph – a more advanced version of the apparatus used in France – is due to arrive at Massey in late 2006. It will be used to provide more human chewing trajectory information to help the jaw simulate the behaviour of its human counterpart.

The development of a tongue is more difficult, says Dr Xu, though he and Dr Bronlund are trying to secure funding to develop one.

"A tongue is a flexible structure. Theoretically that requires an infinite number of degrees of freedom. Of course we'll be working on simplified models."

Has all this attention to the way people eat made Xu self-conscious about his own eating habits? "I have started to think about how many chews are required for different foods," he confesses. "I've also started to think about how many chews I make on one side versus the other."

He smiles: "Overall, my chewing is quite balanced."

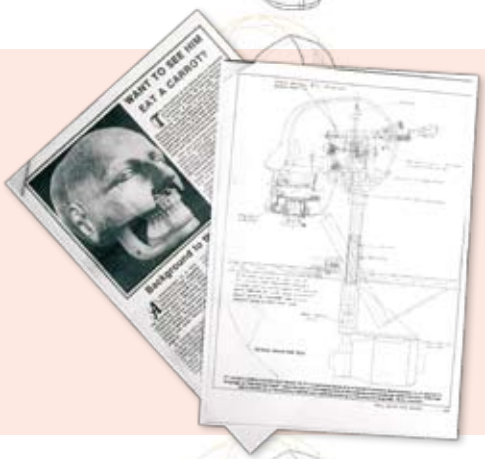
First bite

Oddly enough, the robotic jaw being developed at Massey is not New Zealand's first, as Dr John Bronlund discovered when Jim Parnell of Kilbirnie contacted him.

Parnell, who had read of the Massey robotic jaw, sent in a number of pages photocopied from a magazine called *Roll Back the Years*. They gave an account of the "Dental Prosthetic Demonstrator".

Whatever the Massey jaw was, it was not the first.

During the 1930s, George Burtenshaw, a Taumarunui dentist and Mel Harris, an engineer, created an electrically-driven mechanical head to demonstrate the benefits of correctly fitted dentures. The finished head, which was constructed in the United States, had jaws that could be adjusted to hold a pipe, eat fruit, or even munch carrots.



The credits

A number of final-year and postgraduate students have had a hand in the design of the prototype robotic jaw. Ben Daumas, a visiting French student and Mark Greenbrook, a Massey final-year student developed the initial model; Jozsef-Sebastian Pap, an MEng student, refined the design and made the robot; and PhD student Jonathan Torrence is currently engaged in designing systems to control its motions.

Professor Andrew Pullan and his team at the Bioengineering Institute, University of Auckland, are mathematically modelling the muscles of the human face to reproduce jaw movement through muscle contraction.

Professor Jules Keiser and his team at the University of Otago Dental School have contributed to the design and manufacture of the jaw and teeth used in the robot.

The development of the jaw is taking place under contract to the University of Auckland.

coming into the fold

With 1.7 million farmed deer – more than half of the world total – and a projected $262 million in exports in 2006, New Zealand's deer farming industry is a force to be reckoned with. Yet 40 years ago the industry did not exist and scarcely anything was known about the domestication of deer. What changed things? The ingenity of the New Zealand farming community backed by careful research, much of it carried out by the likes of Professor Peter Wilson and Massey's Deer Research Group.

In a meeting room in Massey's veterinary tower a dress rehearsal is in full swing. Standing before her audience, Alejandra Ayanegui-Alcérreca is going through a trial run for the defence of her PhD, the culmination of four years of work, by delivering her presentation to her fellow postgraduate students.

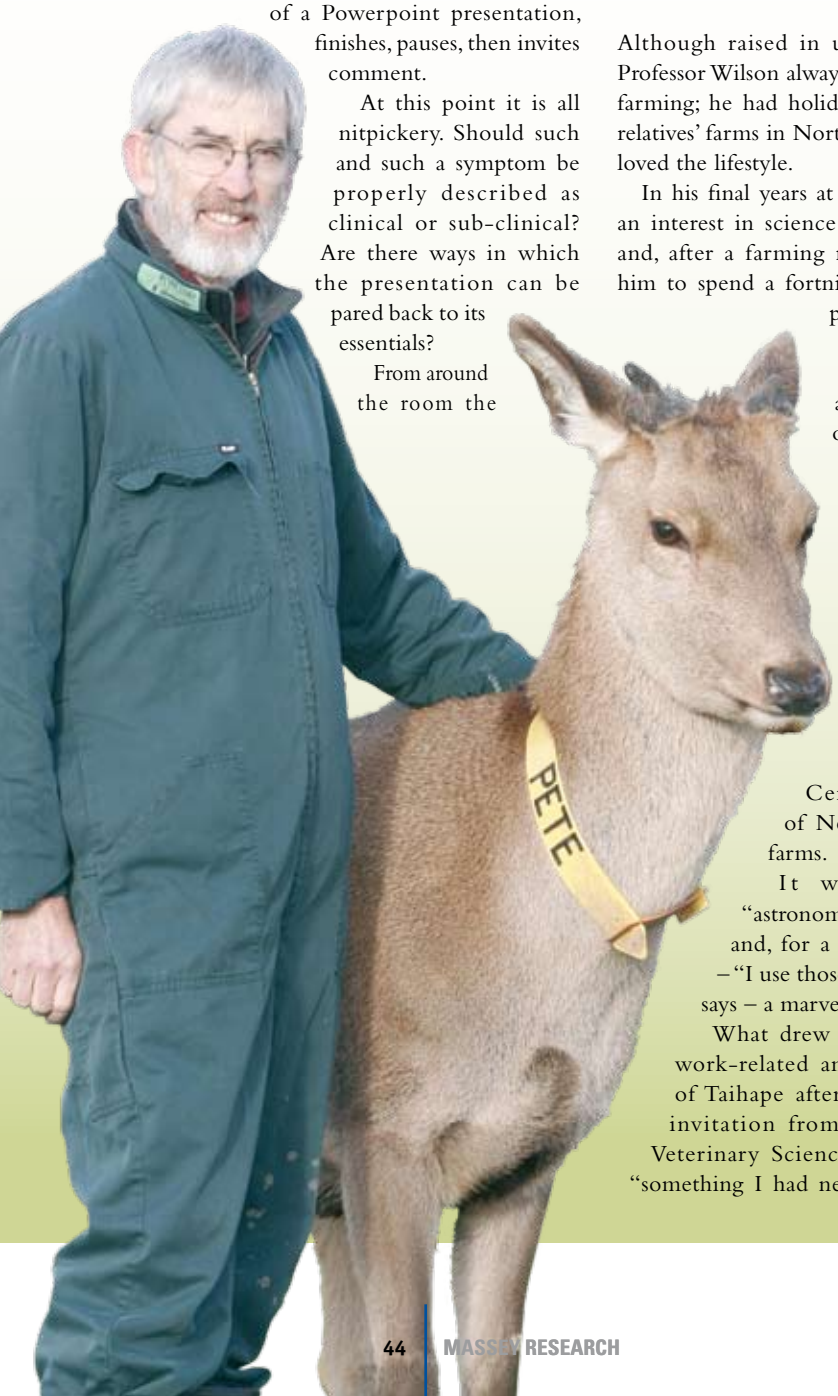
Her English is fluent, but to the New Zealand ear strongly accented by her native Spanish: the 'd' in 'word' becomes more a *t*, 'one' becomes more of a *huan*. Moving at pace, she makes her way through the screens of a Powerpoint presentation, finishes, pauses, then invites comment.

At this point it is all nitpickery. Should such and such a symptom be properly described as clinical or sub-clinical? Are there ways in which the presentation can be pared back to its essentials?

From around the room the suggestions come in a medley of accents as exotic as Alejandra's own. Alejandra is Mexican. Her audience hails from places as far afield as Australia, Thailand, France, Holland, Kenya and Italy.

They are in their twenties and thirties. Most are women. The odd one out – neither young, female nor foreign – is the quiet, white-bearded figure seated inconspicuously at a corner table.

When he speaks, the room defers. He is Professor Peter Wilson, one of the world's foremost experts on deer and deer farming.



Although raised in urban Christchurch, Professor Wilson always had an affinity with farming; he had holidayed and worked on relatives' farms in North Canterbury and he loved the lifestyle.

In his final years at school he developed an interest in science and animal biology, and, after a farming relative arranged for him to spend a fortnight accompanying a practising veterinarian on his rounds, his mind was made up: at 17 he took himself off to Palmerston North and the rigors of veterinary study.

On graduating he joined a Taihape-based practice, serving a geographical area that included three towns and a military camp – with their assorted populations of pets – and, on the Central Plateau, some of New Zealand's largest farms.

It was, he says, an "astronomically busy" practice and, for a young single person – "I use those words advisedly," he says – a marvellous opportunity.

What drew him away from the work-related and social attractions of Taihape after just a year was an invitation from Massey's Dean of Veterinary Science to pursue a PhD, "something I had never imagined myself being considered for", he says.

He had enjoyed his time as a practising veterinarian; he found he enjoyed research, and, when he took on a junior lectureship to tide him through his studies, he discovered that he enjoyed teaching as well.

An academic career in an applied field in a clinical area seemed ideal to him, so when offered the opportunity he chose to stay at Massey, becoming a lecturer in farm animal medicine. At first he dealt mainly with dairy cattle (his PhD had, in fact, addressed the reproductive endochronology of sheep), but it was 1978 and the tall posts of deer fencing were marching across the landscape.

Supported by a sympathetic head of department and dean, Professor Wilson began delivering a deer course for final-year veterinary students, starting with two lectures a year. "Within five years my time – in teaching, research, practice and extension – was fully given over to deer," he says.

Deer had been introduced to New Zealand in the mid-19th century to Anglicise the landscape. Liberated into a land that had never known the attentions of browsing mammals, they were fruitful and multiplied. Multiplied many times over.

One informed estimate, made in the early 1920s, put the population of deer roaming New Zealand's bush and mountains at 300,000-and-counting.

The deer broke fences, damaged crops, displaced stock. They ate out forest undergrowth. Their numbers were such that sometimes many starved. What had been thought of as a noble animal began to be seen, in a country newly conscious of the value of its own native bush and wildlife, as a pest and a menace.

To keep the numbers in check, from the 1930s on the Government employed cullers who were paid a basic wage, supplemented with payments for deer killed and skins retrieved. The carcasses, most often, were left to rot.

In the 1960s this changed, as ready markets were found for wild venison in US and Europe and for deer velvet in Asia.

Small planes began touching down in the remote valleys of the Southern Alps to collect

continued on page 46

Ultrasounding a pregnant hind. Left to right: Jenny Nixey, veterinary technician, Pania Flint, veterinary lecturer, Professor Peter Wilson, Supatsak Subharat, PhD student. One of Professor Wilson's early research projects established equations for estimation of age of a deer foetus by using the measurements gained from an ultrasound. Later he and the group took data from scans of 23,000 deer, allowing the patterns of reproduction within and between herds to be quantified and compared. A booklet for farmers was one result.

Professor Peter Wilson, at far right, alongside a group of Deer Research Group postgraduate researchers. Seated from left: Natasha Swainson, a PhD candidate, is working on methane production and mitigation in deer; James Mwenda, a masterate student originally from Kenya, is working on deer growth and parasitism; Giske van Es from the University of Wageningen in the Netherlands is in her final year of an undergraduate degree in animal science and is interning with the Deer Research Group. Standing: Eleanor Andreoli, a PhD candidate visiting the Deer Research Group from the University of Milan; Supatsak Subharat (Art), newly arrived from Thailand, will be undertaking a PhD continuing the group's research into leptospirosis, including investigating its incidence among slaughterhouse workers; Jaimie Glossop, a veterinarian and PhD candidate from Australia, is working on the epidemiology and control of Johne's Disease in farmed deer; Maria Alejandra Ayanegui-Alcérreca, from Mexico, has just completed a PhD establishing an understanding of the epidemiology and control of leptospirosis in farmed deer in New Zealand.
Absent are Dr Simone Hoskin, a senior lecturer with a particular expertise in nutrition and parasitology; Pania Flint, veterinarian and lecturer, who is working on a PhD researching humane methods of antler removal and the control of drug residues in velvet; and Delphine Weissman, a visiting animal science student from France.

The Deer Research Group

The Deer Research Group consists of six principal researchers and an ever-changing contingent of visiting and postgraduate researchers.

The research facilities available to the group include the deer research unit, which sits atop a hill overlooking the central Palmerston North Campus. The unit runs around 200 red deer on twenty-six hectares of land.

Aside from the deer research unit, there are a number of laboratories and research groups and Individuals on the Massey campus available for deer-related research. They include facilities for elucidating

- clinical biochemistry and haematology
- parasitology
- microbiology
- histology, histopathology, immuno-histochemistry and electron microscopy
- virology
- soils
- meat
- plant science
- endochronology
- separation science (bioactive compounds)
- pharmacology
- diagnostic pathology
- epidemiology and data analysis
- nutrition and feed evaluation science.

The University also owns Estendart Ltd, which undertakes commercial contract research into products designed to enhance deer health. Estendart's facilities include a three-hectare deer unit complete with deer handling facilities.

Close by the Palmerston North campus have been two AgResearch deer research units (with whom collaborative research is often undertaken) and the commercial firm Veterinary Diagnostic Laboratories.

The DRG collaborates extensively with agricultural and veterinary industry bodies and companies.

The work of the DRG has so far resulted in 163 reviewed scientific papers, 148 conference proceedings, more than 30 general articles, 12 industry reports, one book and two videos being published. More than 28 doctoral, masterate and honours theses have been completed within the DRG.

national velvet

Mature stags grow and cast their antlers annually. The growing antler, which contains an abundant blood and nerve supply and has a covering of skin coated in fine, soft hair, is known as velvet antler, and is customarily removed in New Zealand deer farming, both because deer velvet is a valued ingredient in Asian traditional medicine (in 2006 velvet exports are provisionally forecast to be nearly $21 million) and because, once it calcifies and hardens, the antler presents a hazard to deer and people.

To avoid pain and distress to the stag, velvet antler can only be removed under anaesthetic, either by an accredited farmer or under the supervision of a veterinarian.

It is important to the welfare of the deer and to the perception of the New Zealand industry that the process is humane and seen to be so.

A component of the Deer Research Group's work has been into velvet removal. Pania Flint, a veterinarian and a recent recruit to the DRG, is focusing her PhD on aspects of humane velvet removal and controlling drug residues in antler.

"We have an obligation to be ethical, to act as an advocate on behalf of the animal and be prepared to challenge the perceived wisdom about current techniques," says Professor Wilson. "The best protection for the industry against any uncertainties expressed about the acceptability of velvet harvesting is valid and publicly accountable science."

deer carcasses. Soon helicopters joined the fray, first to pick up deer, then as a shooting platform.

By the early 1970s, Alpine Helicopters, owned by deer industry pioneer Tim – now Sir Tim – Wallis, was processing up to 130,000 deer carcasses a year, numbers that could not be sustained from the wild alone.

There had been agitation for changes allowing the farming of deer for some time, and in late 1960s Parliament acceded. New Zealand's first legal deer farm was founded north of Taupo in 1970.

This was not the first time deer had been farmed – in China the practice of deer farming stretches back hundreds of years – but it was the first time they had been farmed year-round on pasture.

Red deer *Cervus elaphus,* the predominant species in New Zealand, proved surprisingly easy to domesticate. As had been planned, the farms meant continuity and control of supply. And they brought other benefits: the velvet could be harvested in optimum condition and the stock could be inspected before slaughter, a condition of access to some countries' markets.

Deer may have taken to domestication, but many aspects of their biology and management were mysterious.

"Farmers and veterinarians were coming to me and saying 'I am seeing this sort of disease outbreak or this abnormality, what's causing it?' We had never had to provide veterinary services to an entirely new industry. We were being asked questions for which there were no off-the-shelf or in-the-textbook answers," says Professor Wilson.

He took students into the field to help veterinarians deal with disease outbreaks. He spent time with the farmers setting up deer farms in the Manawatu region, of which the Palmerston North campus is a part. Many were clients of the Veterinary School's farm clinic. He travelled New Zealand talking to farming and veterinarian groups.

In 1980 he was instrumental in creating the Deer Special Interest Group of the Veterinary Association, which in 1984 became the Deer Branch of the New Zealand Veterinary Association; Professor Wilson would be the Deer Branch president for 20 years as it ran continuing education for veterinarians, "and put out those", he says, waving a hand in the direction of a shelf of publications.

For his services to the deer industry and veterinary profession he has twice been awarded the prestigious NZVA President's Award, the only New Zealand veterinarian to be so doubly honoured.

One by one the diseases afflicting deer were characterised. "And once you understand the cause and manifestation, you then have paths to prevention," says Professor Wilson.

Productivity became an emphasis as the industry matured. One of Professor Wilson's early research projects established equations for estimation of age of a deer foetus by using the measurements gained from an ultrasound scan. Those findings resulted in a 130-page booklet and a 20-minute video, and the combination of ultrasound scanning and foetal ageing is now a management tool used widely within the industry.

"Someone using a scanner can ultrasound a pregnant hind and from the readings use the Deer Research Group's equations to say 'That is a 45-day-old foetus' for example," says Professor Wilson.

"We subsequently teamed up with veterinarians in Canterbury and Hawke's Bay and took data from scans of 23,000 deer, allowing the patterns of reproduction within and between herds to be quantified. Our study allowed us to identify the key factors that contributed to the success or failure of hinds to conceive, a vital measure of farming efficiency."

Says Professor Wilson: "This means I can look at the information from two herds and say 'this one has an early reproductive pattern and low non-pregnancy rate, and this one has a late reproductive pattern and high non-pregnancy rate'. Being able to characterise reproductive outcomes is pure gold in terms of managing farm efficiency."

The study has been instrumental in establishing benchmarking within the deer farming industry, and models drawn from it have been adopted industry-wide to optimise deer health and production.

leptospirosis - a hidden hazard

Today New Zealand's deer industry is substantial. In 2004 there were an estimated 1.7 million deer being farmed in New Zealand – half of the world's farmed deer population – on around 5000 farms ranging from lifestyle properties to substantial stations. The provisional figures from Deer Industry New Zealand place the value of total deer industry exports in 2006 at $262 million (of which approximately $213 million comes from venison, $21 million from velvet, and the remainder from hides, co-products and live exports).

But there is no cause for complacency. In the past two years the market returns for venison and velvet have fallen away (though at writing they are climbing again) exposing some uncomfortable truths. The first is that productivity varies enormously between farms; the second, that in general deer are not currently achieving anything like the biological efficiencies of other more traditional livestock such as cattle or sheep.

Professor Wilson is constantly witness to the difference farm management practices can make. "Some farms have close to zero mortality, others have groups of animals where they have up to 15 percent mortality. Some will achieve 100 percent conception rates in their hinds, others 50 or 70 percent. Growth rates vary enormously," says Professor Wilson.

And whereas only some part of increasing market returns will make its way back through the chain of intermediaries to the farmer, almost every increment of productivity on the farm translates to profitability, says Professor Wilson.

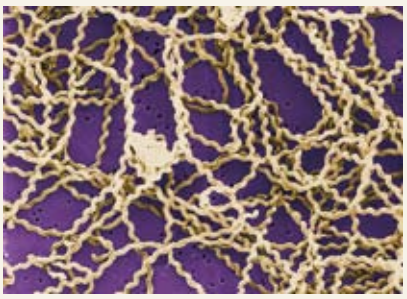
The second wider truth, that deer are not necessarily any more efficient at converting feed to meat than other livestock species, cuts against an ingrained belief that deer, an animal so recently taken from the wild, can prosper on the faintest whiff of a blade of grass.

They can't, but informed farming practices can make all the difference to how productive they are. For an example, Professor Wilson needs to turn no further than to the work of Dr Simone Hoskin.

Dr Hoskin, now a DRG staff member, undertook her PhD under the supervision

Leptospirosis may not have the grim reputation of its family members leprosy and syphilis, but it is not a trivial disease. Carried by animals, the disease strikes humans as a secondary host. In 1994 the New Zealand adventure racer Steve Gurney became one of the disease's most high profile victims. It nearly killed him.

Gurney caught the disease while racing in Borneo, possibly from contaminated water. Environmental contamination is a factor in a number of countries, but in New Zealand most of those who catch leptospirosis do so because their livelihoods place them in contact with farm stock – such as cows, cattle, deer or sheep – and particularly with stock urine, which is the principal means of disease transmission.



A scanning electron micrograph (SEM) depicts a number of *Leptospira* sp. bacteria atop a polycarbonate filter. Leptospirosis causes a wide range of symptoms, and some infected persons may have no symptoms at all. Symptoms of leptospirosis include high fever, severe headache, chills, muscle aches, and vomiting, and may include jaundice (yellow skin and eyes), red eyes, abdominal pain, diarrhoea, or a rash.

Janice Carr, Centre for Disease Control photo collection

While farmers and veterinarians carry some occupational risk – the disease has been called dairy farm fever – it is meatworkers who bear the brunt of the disease. One estimate puts the chance of a meatworker catching leptospirosis during the course of his or her career at one-in-twenty.

In its mild form, leptospirosis may give rise to only mild flu-like symptoms, and it is possible to catch leptospirosis and display no symptoms at all. At the other end of the scale, the disease can be debilitating; more than half of the people who are diagnosed with severe forms of leptospirosis will be hospitalised, some for a month or more, and many require intensive care.

Tracking down the source of the infection can be a problem, says Professor Wilson, who has been supervising a PhD project undertaken by Ms Alejandra Ayanagui-Alcerecca into the epidemiology and control of leptospirosis in farmed deer.

"One issue relates to how people are exposed to leptospirosis. A lot of meatworkers are pig hunters and the question has always been whether they caught leptospirosis from the pigs or the slaughterhouse. The tendency has been to say that it must be the slaughterhouse, and there is really no way of telling the difference."

Are there ways in which leptospirosis can be controlled in stock? There are. The stock carrying the disease can be identified, isolated and treated, and vaccination programmes can be carried out. (Vaccination programmes are the reason the prevalence of the disease has declined within the dairy industry, and Ms Ayanagui-Alcerecca's research has shown vaccination reduces the shedding of leptospirosis by infected deer.) If leptospirosis can be held at bay or eliminated then the likelihood – slight but cumulative – of farmers and meatworkers catching the disease will fall away.

Good reasons to take the disease seriously. And there are others that have more immediate effects on the farmer's bottom line. A deer carrying leptospirosis may appear quite healthy, with no symptoms evident, a state of affairs where the disease is called 'subclinical'. Even so, the DRG's has found the disease may still be having an effect, slowing the growth of young deer and, in some situations, making hinds less likely to successfuly wean calves.

of Professor Wilson and his deer research colleague Professor Tom Barry.

"Simone looked at providing alternative forage species [such as chicory and red clover] and she achieved some of the greatest increases in production that I think you have ever seen in the agricultural industry," says Professor Wilson. "We were seeing growth rate differences of 20 percent and, for some seasons, 50 percent."

The DRG's work has shown than even such things as grazing pasture at 10cm rather than five can make a dramatic difference to deer growth.

Are deer 'difficult'? Not if viewed objectively. Professor Wilson believes that the farming world needs to forsake the idea of exceptionalism, that in terms of production principles deer are somehow a special case, set aside from other livestock.

"Deer do have particular requirements and some specific disease manifestations," he admits. "But so does every animal. The products – velvet and lean, low-cholesterol venison – may be exceptional, but from a farming standpoint the deer themselves aren't. "

In fact, belying the reputation deer have for being more difficult to farm, the mortality rates on many deer farms are significantly lower than on many sheep farms, says Professor Wilson, and it is no more difficult to control disease among deer than it is among sheep and cattle.

But aren't deer more temperamental and harder to handle than other livestock? Again, Professor Wilson sees the question as fundamentally misguided. When farmers understand the way deer think – and most farmers are astute animal psychologists, says Professor Wilson – they adapt their practices to suit.

"There is a certain amount of confidence trickery in handling deer," says Professor Wilson.

Having evolved in an environment where they were the subject of predation, deer have developed a stronger flight-or-fight response, so the answer is to avoid situations that provoke it.

"Eighty percent of the time I can go up to one of a group of deer in a pen, put my arm around its neck, find the jugular vein and deliver a drug or take a blood sample. That's without anybody else helping. I challenge anyone to do that with sheep and cattle. You can't. Not at that percentage. "

By thinking of deer as principally another ruminant and choosing to farm them alongside other stock, deer farmers can hedge themselves against the vagaries of the market. If the market prices for one commodity are in the doldrums, then the prices for another may not be. Moreover, multispecies farming is also better biologically, says Professor Wilson.

"The more monocultural a system is, the less sustainable it is. Look at challenges: environmental management, disease, phytosanitary arrangements, chemical resistance, anti-parasitic drug resistance, antibiotic resistance. If you're farming multiple species you have more options."

The 27 years that have passed since he first began working with deer have also wrought changes in Professor Wilson's working life. These days, with a substantial team of people to manage, he no longer has the time – nor any overriding desire – to get his hands too dirty as often as he used to.

Though he still makes it a practice to spend time alongside his students helping them become confident in handling deer, what he most enjoys is helping researchers – whether colleagues or students – design and plan experiments, and then watching the results come in. "The research and analysis, the writing of papers, the intellectual challenge, that's incredibly exciting stuff."

A deer being monitored for methane emissions. Methane is a much more potent greenhouse gas than carbon dioxide and forms the major part of New Zealand's greenhouse gas emissions.

Professor Wilson has to be prescient, anticipating the problems that are likely to confront the industry some years ahead and deciding the Deer Research Group's research priorities accordingly.

In 2000, when in his assessment Johne's disease (a member of the same disease family as tuberculosis), looked like becoming the major emerging disease of the deer industry, Professor Wilson collated the information available, looked at the likely scenarios, and along with concerned colleagues helped convince the industry body DINZ (Deer Industry New Zealand) that action was needed. (Research into the control of Johne's disease has since been collaboratively mounted by DINZ, AgResearch and the Deer Research Group, and a PhD project is under way.)

Will New Zealand's deer industry face issues to do with greenhouse gas emissions? In the developed world New Zealand is an anomaly in having a substantial part of its greenhouse gas emissions take the form of methane rather than carbon dioxide. One of the Deer Research Group's students, Natasha Swainson, is undertaking a PhD about deer and the production of methane, under the supervision of Dr Hoskin.

Are there likely to be issues associated with animal welfare? Again, Professor Wilson's team has produced a number of studies looking at the use of anaesthesia in the removal of deer velvet, sometimes challenging industry practices in doing so. Pania Flint, a veterinarian recently appointed to a newly established lectureship to assist the increasing deer teaching at Massey, has embarked on a PhD study into aspects of welfare associated with velvet antler removal and into matters to do with quality assurance.

Professor Wilson's next educated prediction is that the resistance of parasitic worms to standard treatments is going to become an issue in deer farming, just as it has already in the sheep industry,

"We have evidence that antihelminthics

that we have been relying on may be reducing in efficacy. The deer industry hasn't had resistance problems that have arisen in the sheep industry, but in present circumstances they will have. So now is the time to develop a better understanding."

The group has published a number of studies, and a new PhD candidate has just arrived from the US to address antihelminthic resistance as the topic of his thesis.

How does Professor Wilson feel about the uptake of the knowledge gained from research? Twenty-five years of experience have made him a realist. He warns against hubris. Researchers cannot expect to tell farmers what to do. "There's no group that can give you a reality check more quickly than deer farmers!"

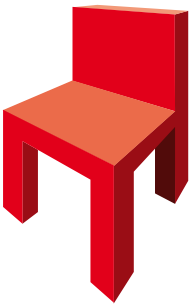
Often, he says, it will be a decade or more before a particular practice is picked up, by which time where it came from will have been long forgotten. Take the use of ultrasound and embryo ageing, which Professor Wilson helped pioneer in deer. These days it is commonplace, but it took time.

"Researchers should never set out to tell a farmer what to do. The most we can do is provide the farmer with a choice of options."

good behaviour

Professor Ian Evans talks to Malcolm Wood

At going to press, Professor Ian Evans had just been awarded a Marsden grant. *See page 9*



At first, they seem shy, almost endearing. In fact they look an awful lot like ordinary children: sticky-fingered, wide-eyed, guileless. A cruel joke, of course. As the cameras soon reveal, these are not children, but changelings. Little emperors whose demands are simple yet capricious and all they want is total subordination, absolute fealty, unwavering attention, freedom from any restriction.

Their parents are bowed and broken. Hollow-eyed from lack of sleep, they speak in the broken sentences of those who have witnessed unspeakable atrocities.

Enter Supernanny. No-nonsense Jo, with her British accent, her naughty chair and her schedule, come to Sort Things Out. It hasn't been the children, it turns out, who have caused the havoc, so much as the practices of their parents. Cue astonishingly well behaved children and tearfully grateful parents.

Professor Ian Evans is an admirer. "I think Supernanny is very good. Some other psychologists criticise her because she perhaps doesn't pay enough attention to family dynamics and the complexities of the system; she focuses on the child's behaviour. But the principles she uses are positive: she doesn't approve of punishment; she doesn't approve of spanking."

These are principles of behavioural modification at work. The famous 'naughty chair' is easily recognisable to him as a behavioural tool called time-out; the wall chart or the charm bracelet – with stars or charms as rewards for good behaviour – is what might, in the language of a psychologist, be labelled a 'token economy'.

Whatever Supernanny is doing, it works.

As a student at Witwatersrand University in the early 1960s, Professor Evans chose an honours degree in behavioural psychology over one in history partly because it offered him more career options and partly because of the insights it offered. "I thought here are some principles that do explain why people behave as they do."

In 1966, having completed an BA Honours in behavioural psychology (working with the effect of environmental enrichment on rats), Professor Evans took up a scholarship to Britain, a land he had last seen at age seven when departing it with his parents for South Africa.

His destination was the Institute of Psychiatry at Maudsley Hospital in London and a famous psychology-training programme headed by the equally famous Professor Hans Eysenck. For an ambitious psychologist in the making, says Professor Evans, Maudsley was Mecca. "It was the place to be."

Professor Evans – who up until now had done most of his work in the laboratory – worked in a public hospital in a unit specialising in children with 'severe behavioural disorders', such as aggression or self injury. Many were autistic, locked inside their own worlds, and unable to interact socially. Professor Evans and his colleagues set out to extend the children's useful vocabulary – and their ability to interact – by employing simple reinforcement principles such as rewarding the child for appropriate responses with half a chocolate Smartie, and gradually adding to his or her store of words.

Nowadays children like these would not be held in a hospital ward, says Professor Evans. "They weren't sick; they had significant behaviour problems." And the behavioural modification trials he and his colleagues conducted now seem very limited in their ambitions; they would not find much place in today's practice. Nonetheless, good was being done. "We were shaping up some fairly simple if useful skills: we were teaching children words."

It was, he says, some of the first work being done using behaviour modification, or applied behaviour analysis strategies, to deal with what now falls under the rubric of 'challenging behaviour'[1].

With his PhD completed (his thesis dealing with human classical conditioning was experimental rather than clinical, he says) Professor Evans wrote to Professor Arthur Staats of the University of Hawaii asking about the prospect of work. A job offer duly came. He had been presumptuous. "You couldn't do that today," he says. He remembers teaching classes of postgraduates "all of them older than me!".

Professor Staats had shown how basic learning principles could be applied to language and thought. He emphasised the complexity of behavioural repertoires at a time that most behavioural psychologists were dealing with single, isolated behaviours, and he showed the interactions between children's advancing or declining skills and their social environment. (Supernanny watchers note: Staats has some claim to inventing 'timeout' and systems of 'token reinforcement' as procedures for training children.)

From apartheid-era Johannesburg to the liberation of swinging-sixties London – "an absolute gas," he says – Professor Evans was now moving to the Bali-Hai territory of the tropical Pacific.

He landed on his feet. His British accent was a much admired novelty, and the Hawaiians saw him as something other than another 'haole' – some culturally insensitive American blow-in come to tell them how to live their lives. He liked Hawaii's cosmopolitan mix of Japanese, Korean, and native-Hawaiian cultures. And it would be during his Hawaiian sojourn that he would eventually meet and marry his sometime academic collaborator, educationalist Professor Luanna Meyer.

In 1982 Professor Evans and Professor Meyer moved to New York State, Professor Evans to become Professor and Director of Clinical Training at Binghamton University, (a campus of the State University of New York) and Professor Meyer as Professor of Special Education at the nearby Syracuse University.

Binghamton University was one of the top ranked public colleges in the Northeast United States, but the city and its surrounding district were blue collar. Many of the locals lived lives of poverty and social disadvantage.

Professor Evans became the director of Binghamton's clinical training programme, taking on research projects that addressed issues that mattered to Binghamton's population: 'mainstreaming' (the integration of students with severe disabilities with their non-disabled peers), the role of mentoring, and assessing the efficacy of a rural high school drop-out prevention programme.

He and Professor Meyer settled on a 100-acre former dairy farm. Their children, born during their years in Honolulu, attended school and went on to university

In 1988 Professor Meyer took up a year-long appointment as the Roy McKenzie Foundation Visiting Professor in Disability Studies at Otago University and Professor Evans came along on a sabbatical. They had, says Professor Evans, "a wonderful time".

Back in New York State, unsettled by their year away, they weighed their options. Their children having graduated from university, they were footloose. "So we thought 'Why not?'," says Professor Evans. They began applying for jobs in New Zealand.

In 1995 Professor Evans took up a position at Waikato University heading the clinical training programme, and shortly afterwards Professor Meyer was appointed as Pro Vice-Chancellor of Education at Massey. They bought a house in each city and began

1. Challenging behaviour continues to be one of Professor Evans's key research interests. Contracted by the Ministry of Education, he is collaborating with Victoria University to evaluate the international treatment literature. Massey postdoctoral fellow Shane Harvey has also worked on the meta-analysis.

commuting turn-and-turn about. "We got to know the Desert Road very well."

Which was at least better than the commute between Binghamton and Hamilton, says Professor Evans. But sooner or later, they accepted, one or other would have to move, and when Professor Meyer accepted a promotion to Assistant Vice-Chancellor Academic at Massey, Professor Evans became that person. He first took up a quarter-time position as a Professor of Psychology at Massey, avowedly moving into retirement. But quarter-time worked out in practice to be nearer full-time, and when he was offered the position of head of school he accepted it as almost foredestined.

Forty years ago, when Professor Evans made his first forays into behavioural psychology, traditional psychoanalysis with all of its baroque trappings – repression, penis envy, thanatos, eros and all the rest – ruled the therapeutic roost. It had done so ever since Freud's work in 1890s Vienna.

Even so, there were dissenters. Where was the evidence that psychoanalysis actually worked? they asked. Professor Hans Eysenck, whom Professor Evans studied under in the 1960s, was one of the first to critically examine the empirical evidence and find it wanting.

In the 1950s, Professor Eysenck's criticisms were seen as heresy in many quarters. They would hardly be contested today. The process of psychoanalysis has come to be seen for what it is: a lengthy, complex, and expensive treatment – sometimes lasting years – the benefits of which are, at best, difficult to measure.

For psychoanalysis, think in television terms of *The Sopranos*: Tony Soprano as dysfunctional as ever after several seasons of analysis. For behavioural therapy think *Supernanny*: a family 'fixed' in a few carefully directed interventions.

No wonder then that CBT – which adds the 'C' of 'cognitive' to the BT of behavioural therapy – is fast becoming the new orthodoxy. Here is a therapy that indisputably works: one empirically verified through extensive randomised control trials.

In a sense, CBT's widespread acceptance is a vindication of both behaviourism and Professor Evans's choice of career path.

In fact, his only reservation seems to be about the grafting of near-Zen concepts like 'mindfulness' on to certain CBT offshoots. This poses certain theoretical contradictions, he says, with the it's-bound-to-happen-anyway shrug of a purist.

During the decades of Professor Evans's career, many disciplines have generated insights into the workings of the brain. Functional neuroimaging has given us the ability to literally see the brain at work. The rise of DNA sequencing technology has enabled us to pinpoint some of the genes associated with particular traits. Sociobiology has emphasised our kinship with the other higher primates. Pharmacology has allowed us to address brain chemistry with increasing sophistication.

How have these developments impinged on Professor Evans's thinking? For him, many of them seem to best fit the category of interesting-but-irrelevant. Or even damaging. In his view viewing people through the lens of neuroimaging, genetics, or sociobiology can be curiously debilitating.

"Sure, ultimately everything comes from the brain, with this area lighting up with one activity or another with that, and people like the idea that obesity is a gene, that alcoholism is an inherited affliction."

But this atomistic approach is too deterministic in its implications for Professor Evans's liking. Such things as drinking, eating and smoking are, he says, first of all behaviours, and behaviours can be modified.

He is a positivist, profoundly optimistic about the ability of people to take charge of their own lives.

"Of course I am not saying that there aren't other influences. As a society we make it easier to be obese than slim: we put additives in food, we make junk food cheap and easily accessible, we limit people's need to exercise in their daily lives.

"Every time you tie something back to personal biology you limit someone's responsibility for behaviour."

"But its not *fair*!" Fairness, punishment and reward

One of the difficulties encountered by 'mainstreaming' disabled children with their non-disabled peers – as happened during Professor Evans's time in New York State in the 1980s – is dealing with perceptions of 'fairness'. Professor Evans explains: "If a child is excused certain tasks and activities because of a disability then the other children may see this as unfair."

But how do children register fairness? Professor Evans was intrigued. He began working on children's perceptions of fairness, and it has been a strand in his research ever since.

Several of his studies have addressed children's perceptions of parental practices.

"The issue is, if a child is being treated unfairly, how does it feel, and does the child consequently hold feelings of animosity and hostility towards the parent?"

A technique Professor Evans and doctoral student Tomoko Yamaguchi have used recently is to read seven-year-olds stories and ask them how each of the characters in the story would feel. The choice of age, says Professor Evans, is dictated by how accurately children can express their feelings. "If you ask children age five or six how they feel when they are treated unfairly, they say 'sad'. At age seven or eight they say 'mad'."

"We have shown if a child is treated unfairly he or she will retaliate with feelings of hostility; however mothers are often forgiven for minor mistakes. The child will think 'Mum is a good person who does a lot of good things for me, and this is just one aberration'."

Does the same thing apply to fathers? Professor Evans has yet to test children's responses.

"Boys are more upset than girls if they fail to receive a deserved or expected reward. They don't get so upset at being punished unfairly. "

The studies have thrown up some interesting gender differences. "Boys are more upset than girls if they fail to receive a deserved or expected reward. They don't get so upset at being punished unfairly. Girls see these events as equally bad. So there is some reason to think boys are reward-dominant. They value rewards and are not that perturbed by punishment."

A child's experience of fairness may also have a bearing on another strand of Professor Evans's research, teenage cynicism. Professor Evans has been measuring cynical attitudes in teenagers using a simple nine-question scale, testing levels of agreement with statements such as "If someone does something nice for you it's only because they want something."

Strong levels of cynicism correlate with measures of adolescent depression, says Evans.

Where does this cynicism and its accompanying hostility towards authority come from? "It's very possible that it relates to experiences of unfairness: of insufficient rewards or of rewards promised and not delivered."

At which point, Professor Evans returns to Supernanny and its ilk. One of the best things about the techniques modelled by Jo Frost, he says, is that they direct the children towards fun things to do, activities that are their own reward. Extrinsic rewards like stars on a chart or charms on a bracelet have their limitations, he says. The research literature has instances where children rewarded with money for reading books would then only read books for money.

"You have to have activities that are naturally rewarding."

Stormy weather *Investigating 'classroom climate'*

Ben Smith

From the moment you walk into the classroom you will be attuned to it. Are the children subdued, cooperative or boisterous? Do they help each other? Do they listen? Is the class cohesive, or a collection of cliques? Is the teacher respected, tolerated or – as can happen – held in contempt?

This is what Professor Evans refers to as the classroom climate, and the person most influential in determining the climate – the weather god – is of course the teacher.

"We are interested in the way teachers deal with children's issues, concerns and conflicts in ways that can teach them about emotions and feelings, their own and other people's. Some teachers are very good at this," says Professor Evans, who together with postdoctoral fellow Shane Harvey is trying to determine just what it is about a teacher's practices that makes for a good climate.

"How do you create a context in which emotion is acceptable and positive emotion is valued? That is the kernel of the issue?"

The difference in how children react to different teachers can be dramatic. "We interviewed children about what they thought of individual teachers. What they said was incredibly revealing," says Professor Evans. "They said 'I didn't behave for this teacher because I didn't like him. He was just doing it for the money. He wasn't really interested in us kids'. Or 'My new teacher likes us, she thinks of us as family. I want to be good for her. I respect her and I value her opinion of me.' These are huge differences, and these sorts of opinions can come from the same kid in different classrooms."

The research dovetails with work Professor Evans has done in school drop-out prevention programmes and in measuring teenage cynicism.

"One or two years in which you don't enjoy school can set you down a path on which you decide teachers are bad, school is not for you, parents are unfair and can't be trusted. You become cynical and mistrustful and you go off in antisocial directions."

Professor Evans and Dr Harvey have interviewed much-admired teachers nominated by principals and school advisers and Professor Evans believes they now have a good theoretical perspective on how it is that teachers create a positive classroom climate.

But can a theoretical understanding lead to changes in practice? Aren't good teachers born rather than made?

"Lots of people think of there being an X-factor that some teachers have and some don't," Professor Evans admits, and clearly there are some people who are naturally gifted.

Nonetheless, there are skills and practices that can be taught. "You can increase people's awareness and insight into what it is that they are doing and saying in the classroom that is more or less effective or beneficial for students. We believe you can teach a certain basic level of skill."

Rāranga Whatumanawa

In the year ending June 2005, ACC paid out $25,586,000 in the area of 'sensitive claims', most of which originated in sexual abuse.

Professor Evans is the senior research consultant for Rāranga Whatumanawa, an ACC-funded research project designed to develop practice guidelines in the assessment and treatment of people who experience mental injury as a result of sexual assault or sexual abuse. The project is headed by Professor Evans's colleague senior lecturer Cheryl Woolley, and is supported by a large team of clinical researchers affiliated with the Turitea Psychology Clinic.

"We believe the guidelines should be neutral as to whether you should do psychoanalysis or CBT or Rogerian therapy or whatever," says Professor Evans.

"But we think there should be a system for monitoring client progress, some way of knowing whether the goals the client and counsellor have set together are being met.

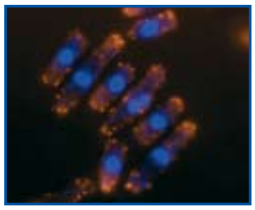
"We can distil from the literature some general principles about what is effective, such as, say, you need to concentrate on the client's immediate and current concerns rather than the events of 20 years ago.

"We want clients who have been sexually abused to get a treatment that's effective, so that they can stop being damaged by the experience and start to live a life."

Given the right help, people can move on, says Professor Evans. He pauses, then digresses.

"There's an odd link back to forgiveness. There are some people arguing that one way to move past a negative experience is to go through some sort of radical forgiveness thing where you are no longer obsessing and dwelling on revenge you are going to take on the person who has done you harm. Because if you do, then the harm is just being perpetuated.

"It is easy to say this and it sounds somewhat quasi-religious, but of course we are talking about a cognitive shift here, not about morality or about a spiritual shift. Cognitive-behavioural therapy is often thought to be about formal evidence-based techniques. But if you think of it as having its roots in understanding what makes people change, then one can see that new improved methods of psychotherapy can be developed through ongoing research. And so the goal of the Rāranga Whatumanawa – to develop practice guidelines that will benefit clients – is really another way of translating good research into everyday clinical practice. That is what I'd like to feel I've contributed to."



divide and conquer

What can an obscure species of yeast tell us about cell division, cancer and rare genetic diseases? Anna Meyer talks to Professor Jeremy Hyams to find out.

Yeast. The word conjures up images of crusty bread, frothy beer, vegemite sandwiches and, although we may rather not think about it, some less-than-pleasant infections. But that's not all these single celled creatures are good for – yeast is also a powerful tool for genetic research, an excellent 'model organism' for how our own genes behave. Using yeast, Professor Jeremy Hyams, Head of the Institute of Molecular BioSciences, is combining genetic techniques and modern microscopy to study cell division; unravel how cells take up extracellular materials; and shed light on a devastating genetic disease.

Professor Hyams's species of choice is *Schizosaccharomyces pombe*, otherwise known as fission yeast. Unlike the more familiar brewer's or baker's yeast, *Saccharomyces cerevisiae*, which reproduces by budding, fission yeast replicates by dividing in half, making it a very useful model of how human cell division behaves. "Those of us who work with it say that fission yeast is a much nicer organism, because it shares more properties with mammalian cells than budding yeast does," says Professor Hyams. "Budding yeast is the best organism on the face of the planet to do genetics with, but then again it's a weird, weird organism, because it divides by budding, which is a very unusual mechanism."

Though not as widely used as *S. cerevisiae,* fission yeast is also excellent for genetic research. It contains many genes that perform a similar function to those in humans, meaning that information gained from studying yeast genetics can often be translated into learning more about how our own genes operate. It is also very easy to produce mutant fission yeast strains which have specific genes missing, and the organism proves surprisingly viable despite this manipulation. "We can knock out genes very easily, and look at the effect on the cell," says Professor Hyams. "Surprisingly, you can delete most of the genes in the genome. It's bizarre – a mystery as to what is going on in evolutionary terms."

Professor Hyams, who moved to New Zealand from London just under two years ago, is currently the only fission yeast researcher in the country, and one of only a relatively small number worldwide. "That's quite good, because I know I'm the best fission yeast person in New Zealand!" he jokes. "It's nice, actually, being part of a smaller community, because you know everyone."

Professor Hyams's main, longstanding interest is in unravelling how the cell division cycle is regulated. This is not only interesting for its own sake, but is relevant to understanding the causes of cancer, and how it could be treated. "Cancer is exclusively a problem of cell division," he explains. "Yeasts don't actually get cancer, but everything we learn about cell division is relevant." Any new gene that is identified as having a role in regulating how cells divide is potentially of interest to cancer researchers. Not only could such genes be involved in causing the disease, they are also potential new targets for chemotherapy.

Professor Hyams and his colleagues use genetic techniques to visualise the dynamic processes that occur in cells as they divide. Commonly, this involves 'tagging' specific proteins inside living cells with markers such as green fluorescent protein, and watching how the proteins move around and change in cells throughout the cell cycle with a powerful microscope and imaging equipment. "We do lots of cloning and a lot of biochemistry, but the ultimate aim is to go back to the cell and see where things are, who talks to what, and how that changes through the cell cycle," he says.

Recently, Professor Hyams has taken up a new scientific interest, prompted in part by his move halfway around the world. "I came to New Zealand and I thought – it's a new life, I'll start something completely different," he says. His new research programme involves studying endocytosis – the process by which cells take up materials from outside by engulfing them into a fold in their cell membrane, which then buds off to form a 'vesicle' that stores and processes the material inside the cell. "Fission yeast has a cell wall, so you might think it would have trouble getting things inside," he says, "but it just sucks stuff up. We don't know why, because we have mutants that don't endocytose, and they grow fine anyway - so it's not necessary for survival."

The process of endocytosis, and the mysterious reason why it exists is interesting in itself, but the path that led Professor Hyams and his colleagues to study the process was the role it was thought to have in a serious human neurodegenerative disease, known as Batten disease. The condition is an inherited disorder of the nervous system that usually manifests in childhood. Although rare, it is very serious, causing progressive vision problems, seizures, and loss of motor skills. Usually, it eventually proves fatal. The condition is known to be caused by a single gene defect, though what the gene does, or how mutations to it lead to the condition, has been a mystery.

When the fission yeast genome was sequenced recently, it became apparent that the organism contains a gene that is equivalent to the one that causes Batten disease in humans. Professor Hyams decided to begin a research programme to discover what this gene does in yeast, to see if this could shed any light on the cause of the disease in humans. After cloning and examining the yeast gene, it seemed that mutations to the gene might cause defects to endocytosis – a process about which relatively little was known. This prompted the major new research programme for his group – the study of endocytosis itself.

As they learned more about endocytosis, it eventually became apparent that the Batten disease gene mutants did not have an endocytosis defect, and for now, the function of the gene still remains a mystery. "We know more about the Batten disease gene than anyone in the world," says Professor Hyams, "but the only thing we don't know about it is what it does. There's a saying in science that if you want to get your paper in a really good journal, you need three things: mechanism, mechanism, mechanism, so that gene has been a real bugger!"

The endocytosis research programme is, however, a classic example of how one question in science can lead to something else entirely, something that Professor Hyams believes is vitally important. "I think you need to just follow your nose. You write a grant, and say we're going to do A,B,C,D and E, and then you do A, and you find, crikey, A is much more interesting than I thought, we'll carry on with that, and then you find F, which you didn't know existed. I think you have to trust your instincts. You've just got to support basic science. You've no idea where it will go and what will come out of it."

Professor Jeremy Hyams

British born and bred, two years ago Professor Jeremy Hyams decided it was time for a change. "I spent 25 years in London, at University College, and it was important to me to do that, although you don't get a gold watch or anything!" he says. "Then I thought, I've got 10 more years left to work, if I'm going to do something different, I've got to do it now. I had a nice job with good colleagues, but decided to have an adventure." Soon after, he applied for his job at Massey, and moved to New Zealand.

"I'm a microbiologist by training, and a geneticist by inclination," he says. "There's nothing like looking at living cells. It's just amazing what you can see. Now, with good cameras, you can see things in a microscope that you can't see with your eyes. You hardly look down a microscope now. In one way, the days of being a great microscopist are gone, where they just sat and looked – that was just remarkable. Now, you have all this imaging equipment, but it means you just do things so much quicker." Microscopy, he believes, has had something of a comeback in recent years. "There was a time when people dismissed microscopy as just 'looking at cells', and not analytical or experimental, but now there are even various biochemical assays that you do by looking at cells. Microscopy is now no longer limited by the laws of physics, because it's all done through computers and you can enhance things."

Professor Hyams strongly believes in linking New Zealand scientists with those working overseas – something that he sees as particularly important for the intellectual development of postgraduate students. "One of the things that I think I can contribute is to bring people from outside," he says. Professor Hyams is convenor of this year's Queenstown Molecular Biology Meeting, which brings a variety of well-respected researchers to New Zealand from countries including the US, Australia, the UK, Japan and Mexico. "Because it's me, it's called Molecular Biology of the Living Cell," he laughs.

once more with *feeling*

Dr Anders Warell talks to Malcolm Wood

We live in the golden age of stuff. Of stuff that is cheap. Stuff that is reliable. Stuff that performs as advertised. Of stuff available in multiple permutations to suit the whims of the purchaser. All of which presents a challenge to manufacturers: how do you convince the consumer to buy your product rather than your competitor's? The answer may lie in 'affective design', in tailoring products that we bond with emotionally.

Senior Lecturer Anders Warell heads Massey's Centre for Affective Design, "Affective" being used in the psychological sense of producing an observable expression of emotion.

None the wiser? It may help to think of Volkswagen's reincarnation of the classic beetle or of Apple's iPod. Somehow the beetle is more than just another car, the iPod more than a music player. We have invested them with values beyond the strictly functional. We have *feelings* for them, which is, of course, why we pay a premium.

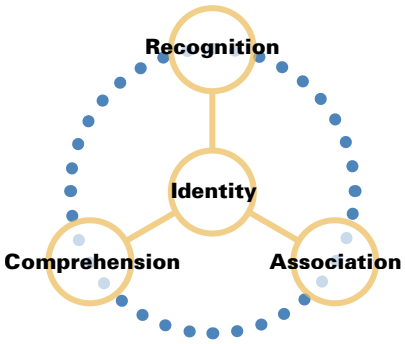
How do you create that X factor? How do you make products that don't just perform, they make consumers love them? That is the business of affective design.

Anders Warell was born in Husqvarna (namesake of the manufacturer), a medium-sized town in southern Sweden, and grew up in a small town 50km to the west. He was one of those boys who would fill the margins of his school books with sketches of cars, and when it came time to go to university he chose a mechanical engineering degree majoring in ergonomics and industrial design at Linköping University. "I wanted the mix between the artistic side and being able to understand why things work as they do, and I wanted to understand the product development process."

After industrial design studies at Gothenberg University, Dr Warell embarked on a PhD in Industrial Design Engineering at Chalmers University of Technology. "I had a good thesis supervisor who understood that more needed to be known about the relationship between industrial designers and engineers in industrial development."

His research took him into a number of large industrial companies.

"I got to see lots of shortcomings in how different groups understand one another, and in how they communicate. Engineers are very influential in an industrial environment because there are many more of them than designers and they have methods that are more objective, methods that give you figures. Engineers can prove things in ways that ergonomists and industrial designers can't. As an industrial designer you are in a weaker position.



"I set out to understand the core business of what industrial designers do: giving form to product. I wanted to know what drives the process and how can we communicate the reasons for form-giving and describe the form of products in a way that other disciplines can understand."

In 2003 the Swedish Industrial Design Foundation, recognising him for outstanding achievement in design research, made him a Torsten Dahlin Scholar, the first such scholarship to be awarded.

In 2005 he left the staff of Sweden's Chalmers University of Technology for the adventure of New Zealand.

Think yourself a true anti-consumer, oblivious to brand and blind to product? It's unlikely that you are right. Like it or not, we can't consciously stop our first impressions; they are processed by innate subconscious systems. We are wired to make emotional value judgements. In fact, various studies have shown that far from reason and emotion sitting at opposite poles, emotion is essential to rational decision making.

In our normal passage through the world we swim in a sea of brands and products freighted with emotional values. We may not *consciously* see the design content of the products around us, but we notice, evaluate and respond to it all the same.

Brands and products are part of who we are, of how we identify ourselves. We are what we wear and what we drive.

After all, as Dr Warell points out, if cars were just about getting from point A to point B with relative ease, why ever would we have so many brands?

The Japanese realised earlier than most that their product development methods were not revealing the deep insights into customers' feelings that enabled emotional needs to be satisfied. Their answer, an approach called Kansei engineering, was founded in the 1970s and is now embedded in the design processes of many Japanese corporations.

Kansei engineering typically relies on harvesting and analysing large amounts of data. A company might, for example, ask a sample of consumers to score a product on a number of different adjectives, – How soft is the product? How showy? How feminine? – analyse the results, tinker with the design to change the consumer perception, and iterate the process over and over.

At its technological extreme, some implementations of Kansei engineering include tracking the consumer's eye movements or video recording his or her facial expression or body language when interacting with a product.

The Japanese often integrate Kansei engineering with the latest incarnation of Total Quality Management, an approach known as Quality Function Deployment.

Although Dr Warell can see the merit of the Kansei approach, he has reservations. "You can use Kansei engineering to tell you how people feel about a product, whether it is 'exclusive' say, or 'sporty'. Their methods for analysing data are excellent; it's how they go about gathering the data and what they do with the results that I sometimes question. You have to understand the implications of the questions you are asking. You have to understand what people are actually *saying*. And then you have to know how their responses can be used to address product-related issues.

"I believe that you need to understand how people react, how they think about things. You need qualitative approaches to understand phenomena.

"I would never go as far as doing statistical studies on a large scale as they do in Kansei engineering. I am skeptical about metrics, about the possibility of reducing very complex phenomena to that simple thing, a number. One reason why Kansei design has become 'successful' is because it is easy to communicate to non-designers."

Can he point to another good example of affective design? A number of Italian designers, though they lack the systematic, disciplined approach of Kansei engineering, nonetheless embody the principles of design for emotion in their works.

An embodiment of affective design can be seen in the success of particular brands and their expression through design. Dr Warell suggests that the way we understand brand identity in design is at two levels, syntactic and semantic.

Take, for example, a BMW car's distinctive twin grill. This is brand recognition being achieved at the syntactic level.

Above the syntactic level of recognition is the semantic level, with elements of design perceived as expressions of brand values. The chunkiness of Volvo design is emblematic of safety; the sculpted aerodynamic lines of a Porsche, of speed and freedom. These qualities are part of the creation semiotics.

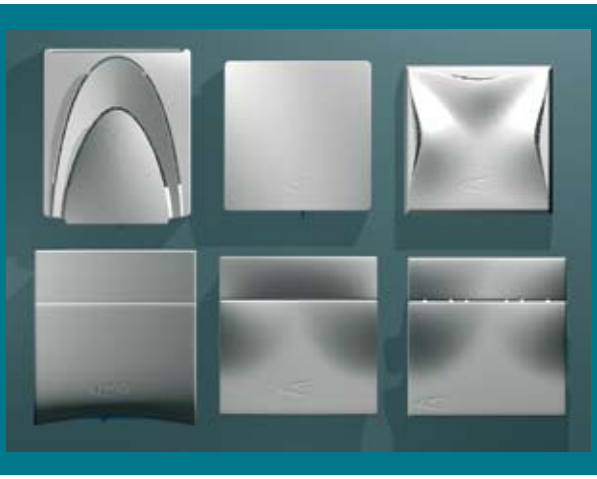
In one research project Dr Warell took the design of a Volvo truck cab, removing or shifting elements and gauging the reaction by using a semantic scale.

In another he has taken the signature design values of a number of car brands and sought to extend them into a range of products unrelated to cars: a Jaguar and Toyota drink containers; a Citroën and Hyundai wrist watches; Cadillac and Alfa Romeo handheld mixers.

In a third, he and his research partners canvassed the response to a Saab SUV design (the very idea of a Saab SUV was an anathema to some purists), discovering a significant difference between Saab employees, who were of the opinion that the car clearly expressed Saab design values, and consumers who were less convinced.

How can affective design be used to help the individual manufacturer? Dr Warell suggests three representational modes that contribute to visual product identity: 'recognition', 'comprehension' and 'association'. The process of affective engineering can help companies develop an understanding of what consumers want, need and desire *before* they begin a design process. It can tell companies whether their design processes are considering the right factors. It can break down how consumers and users experience products, 'perceptually', in the sense of the product's appeal to the senses; 'cognitively', in the sense of the bundle of attributes surrounding the product, including such things as product identity and semantics; and 'affectively', in the sense of creating feelings.

By focusing on product experience and the theoretical tools for its analysis Dr Warell believes that industrial design is marking out a distinct and vital territory of its own, differentiating itself from disciplines such as product design or engineering.



Dr Warell designed this wall ventilation unit for the the Japanese and German markets. The Swedish firm Fresh is now selling around 50,000 units a year. At left are some of the prototypes for, at right, the final design

New Zealand does not have anything to compare with Sweden's tradition in industrial design. With certain shining exceptions, New Zealand's tradition is of producing products that represent pragmatic solutions to engineering problems.

Will this approach be enough to sustain a competitive edge? Unlikely. The world is full of highly competent manufacturers churning out good quality, functional, user-friendly products.

Like Apple with the iPod, manufacturers should be constantly innovating and striving to create products that are inviting, pleasing and intuitive to use. Like Volkswagen with the new-look beetle, manufacturers should be producing products that address the socio-cultural and emotional aspirations of their customers.

"There are many companies in New Zealand that could successfully design and make products that appeal to world markets, says Dr Warell. "We believe one of the main reasons this isn't happening as much as it should is that they aren't producing the right kinds of products. In terms of function they may be, but they also need to produce products that are desirable and designed with the user in mind."

Dr Warell and his colleagues are working to link the expertise residing in Massey's School of Design with New Zealand's iconic design-led companies. Companies such as Navman, Macpac and Gallaghers.

"New Zealand is home to a number of extraordinary enterprises. I see no reason why New Zealand should not establish an international reputation for the quality of its product design."

A study in product semantics: a computer-gaming joystick designed by Dr Warell

Through Swedish eyes

If you did not know already his origins, you might miss the signs. The look is simple, understated, unadorned: a plain V-necked sweater, jeans. The frames of his glasses are elegantly engineered.

His dress sense might be seen as an expression of the values of Swedish design, of a certain pared-down simplicity. The only odd note is a conspicuous wristwatch the size of an industrial pressure guage. But once you know that Dr Warell is an avid outdoorsman – one of the reasons he and his partner relocated to New Zealand – that too makes sense. (The watch turns out to be a Finnish Suunto wrist-top computer, which Dr Warell has worn when guiding ascents of South America's highest mountain, 6,959-metre Aconcagua.)

What does Dr Warell see as the Swedish aesthetic? "Honesty with materials. Honesty and clarity in function, design and construction. Considering the user rather than the product as an end in itself," says Dr Warell.

"I think Swedish design is also associated with the sensitive use of natural materials, and with design that focuses on the user, the human being. I think Swedish design is strong in considering the user ergonomically, and not just the able-bodied user but the disabled as well," says Dr Warell.

Has the Swedish aesthetic left its mark on him? "It is very difficult to escape if you have grown up with it."

What are the totemic Swedish brands? Think Husquavarna, Saab, Ikea, Volvo, Electrolux, Asea, Ericsson and Absolut Vodka.

It is an impressive lineup for a country which in some ways resembles New Zealand. Sweden's population, at around nine million, though more than double New Zealand's, is still comparatively small. Both have clean, green images and venerate the outdoors. (Dr Warell's floor fills with visiting friends and family every summer.) Both countries are resource poor; and while nowhere near as remote from its markets as New Zealand, Sweden is still a European outlier.

How is Dr Warell finding the School of Design as a working environment? He praises the industrial design workshops on the Wellington campus as being as good or better than any he has seen in Europe, and, paradoxically, in some ways he feels more "part of the global design context" here than he did in Sweden. The larger European firms are more innately conservative, he says, tending to draw on their own extensive design histories; New Zealanders are more open to looking outwards for inspiration, something that may be to our advantage in catering to world markets.

A Warell-designed cabinet in Swedish ash

bend and stretch

Professor Gaven Martin talks to Adam Gifford about the mathematics of physical transformations.

When substances cool or bend or stretch, the physical transformations can't be described with the techniques of conformal geometry. They need a new sort of mathematics - the mathematics being forged by Distinguished Professor of Mathematics Gaven Martin and colleagues around the world under the unwieldy tag of quasiconformal geometry.

"The quasiconformal community is a group of people who have grown up in tge past 30 years who study the interactions between conformal geometries and things like material science so there are real world applications," says Professor Martin.

Many of the main theorems of conformal geometry date back to the 19th century, when mathematicians worked out the main rules governing two dimensional objects - the sort of transformations that happen when you rotate or stretch or invert an object.

"When you move to three dimensional objects, conformal geometry is too rigid to deal with the sorts of materials you might care to look at or the deformations or the solutions to partial differential equations.You have to give up some regularity," Professor Martin says.

"In a plane (conformal geometry) is a surprisingly rich theory, because there is so much flexibility. But in the mid 1970s it was proved that at higher dimensions all the flexibility is gone and it becomes an extremely rigid theory. That is no good if you want to study deformations of objects or how materials cool or how crystal forms and so you have to go beyond these conformal theories to study more general sorts of partial differential equations."

Not that his work stops with practical applications like modelling crystal growth or the cooling of iron.

"As far as pure mathematics goes, a practical application would be to some other area of pure mathematics, such as proving the regularity of some solution to some partial differential equations.

"These are important things. These days, if you want to describe a physical system, say you want to learn something about the weather, what do you do? You write down a partial differential equation to describe this object, you describe a state and the state evolves according to physical laws and in certain ways."

Type the equation into a computer and you will get an answer - whether the problem is soluble or not.

"Knowing there is a solution is a very important thing if you are going to try to find it. It is best to know there might be one there in the first place. That is what pure mathematicians do, sort the wheat from the chaff, especially when it comes to differential equations."

Even distinguished journals have published papers where computational artefacts from partial differential equations are reported as potentially biological effects. "People have built a model and not really understood the model, they just implemented it on a machine and reported the results," Professor Martin says.

As well as geometric function theory, specifically quasiconformal mappings and non-linear analysis, Professor Martin has done significant work in discrete groups and hyperbolic geometry, which includes low dimensional topology and geometry.

His work with Tadeusz Iwaniec on quasiregular mappings has influenced several branches of analysis, and included solving a question on the rigidity of conformal geometry which eluded mathematicians for 150 years.

"In 1850 Joseph Liouville asked whether there are any conformal transformations of space other than the obvious ones, and the answer in two dimensions is yes, there are very very many, it is a huge theory and much of 19th century mathematics was devoted to it. Liouville also showed that in higher dimensions, if you assume enough regularity, then there are none.

"This is an important result, because the symmetries of physical theories, such as the theory of relativity, are often conformal transformations. Indeed, modern physics posits that symmetries are themselves physical laws or physical objects.

"That left the question, are there any symmetries of these theories around that are not the obvious ones?"

Professor Martin and Iwaniec showed that under the absolute minimal hypothesis needed to even make sense of the equations, there are no additional symmetries.

"The equations describing these symmetries are highly non-linear multi-dimensional very complicated equations which you could never hope to solve, but what you can do is say that if there is a solution, then it has this property and that property," Professor Martin said.

"This is the only fully non-linear system of partial differential equations in more than two dimensions for which the exact regularity theory is known, so it was a big breakthrough and hundreds of papers have followed from the results we proved."

Professor Martin says even more important than proving the theorem, "we developed an entirely new technique [non-linear Hodge theory] to approach this problem and these new techniques proved to be very powerful in looking at regularity problems or solutions to other sorts of differential equations, so we have been able to build bridges between these theories and theories of non-linear elasticity."

Solving Liouville's problem helped Professor Martin resolve part of the Hilbert-Smith Conjecture, part of the fifth of 23 questions German mathematician David Hilbert proposed in 1900.

The question related to Norwegian mathematician Sophius Lie's theory of continuous groups. The symmetries of physical theories are always Lie groups, such as the Lorentz group in relativity,

Bieberbach groups in crystallography and the Unitary groups in field theory. Professor Martin proved a locally compact group acting effectively and quasiconformally on a manifold is a Lie group.

Professor Martin says sometimes solving problems is the result of a long period of focused grind.

"Other times this spark, this idea comes from nowhere almost, but what is happening is your subconscious is churning away at these things.

"I think mathematicians work hard. It is not unknown for me to be up at one or two in the morning calculating, calculating, calculating and it's just so damn interesting. How can you not do it all the time? But it is hard to convey that to someone outside the area."

Professor Martin caught the mathematics bug in his senior years at Henderson High School, and followed it to Auckland University where he competed a BSc with Honours and an MSc before heading off in 1981 on a Fulbright fellowship to the University of Michigan, where his lecturers, Mavina Vamanamurthy and David Gauld, had studied.

His PhD thesis was judged the best at Michigan in 1986, and won him a Sloan Foundation fellowship he spent doing additional research in Helsinki (where he developed an appreciation for Finnish glass) and Germany.

After postdoctoral research at the Mathematical Sciences Research Institute in Berkeley and two years as the Gibbs assistant professor at Yale, Professor Martin took up Gauld's invitation to return to New Zealand in late 1988 as a lecturer at Auckland University.

Professor Martin, wife Dianne and their new baby went back to the northern hemisphere for challenging and productive spells at the Swedish Academy of Sciences' Mittag-Leffler Institut and at the Institute des Hautes Etudes Scientifiques in France.

On his return to the Antipodes in 1992, a bidding war broke out. The upshot was a personal chair at Auckland University, making him the youngest full professor in New Zealand, and a professorship at the Institute for Advanced Study at Australian National University in Canberra, a dual role he filled for four years.

In 2004 Professor Martin joined Massey's Auckland campus, becoming a Distinguished Professor.

Professor Martin has supervised numerous doctoral and postdoctoral students, but he says New Zealand faces a problem: our best mathematics students are often lured overseas.

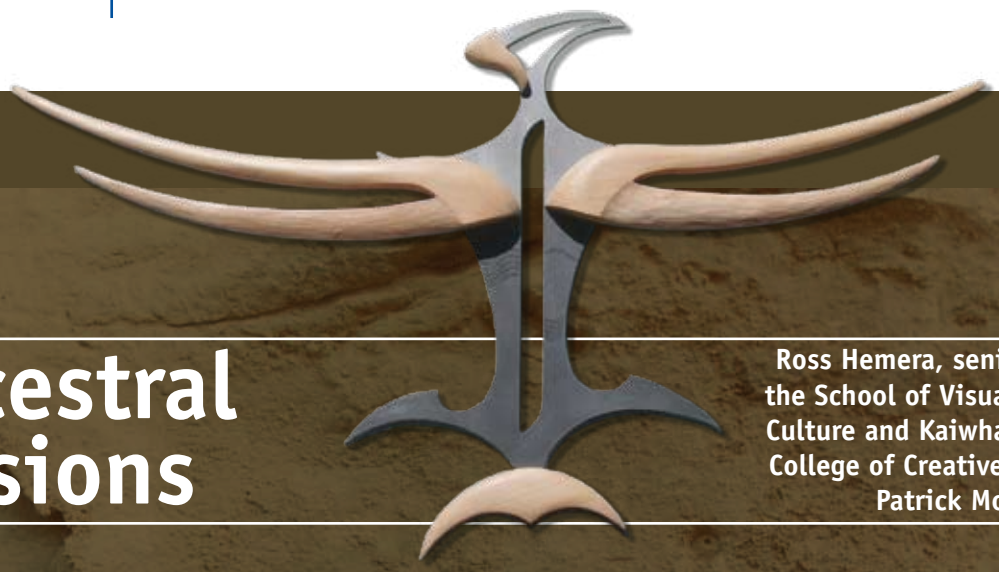
"We have fantastic BSc and first and second year MSc students, but English is usually their first language, they are incredibly well prepared mathematically, they often have some teaching experience at university level and that makes them irresistible to US universities.

"The US system relies on teaching assistants, people coming in to do PhDs, to teach first year calculus to undergraduates. With the push by the US government to spend more on mathematics by way of grants for their own students, the American students have been taken out of the teaching pool. That means they need more and more English-speaking good students."

The other side of the coin is that a spell in a top flight US university is a chance to establish an international reputation.

"It is easy to be good at a place like Yale. If you want to publish in a good journal, you walk down the corridor and talk to the editor. Here you are much more isolated, and when you present work there is much more scrutiny, so it is substantially more difficult to maintain an international reputation from New Zealand, which is the only reputation which counts."

Ancestral Visions



Ancestral Visions

Ross Hemera, senior lecturer in the School of Visual and Material Culture and Kaiwhakaahua at the College of Creative Arts, talks to Patrick Morgan.

For visual arts senior lecturer Ross Hemera, the best thing about art is what he calls the gift of vision. He says it has taught him how to see, "to use my eyes to see with my mind".

Sitting in his tidy office in Massey's Museum Building in Wellington, Mr Hemara picks up a plain white plate. "Take this," he says. "Where did the clay come from? Who dug it out of the ground? Who made it? Things are not just things.

"For instance, when I look at a person's face, I don't just see the person. I see their parents, and their parents, and so on."

He says we hone our senses to those things that intrigue us. "Consider early navigators – they could read the stars like you read a newspaper. I guarantee they could see more stars than you or I will ever see."

These are central ideas to visual and material culture, the subject Mr Hemara teaches to fine arts and design students at Massey. Simply put, he says his job is to help people see things, to see the detail and stories within.

"Art is absolutely a critical part of human endeavour. If perception is important to the human journey, then art is perception."

Mr Hemara recalls a seminal encounter with art, from almost 50 years ago. When he was seven years old, his father took him and his brother Teri down to the Ahuriri River, in north Otago. "There he showed us caves and rock overhangs with ancient drawings in them," says Mr Hemara.

His brown eyes glow and his soft voice lifts as he talks about the source of his artistic inspiration.

"While dad was off fishing we took paper and pencils and copied the amazing images and markings. I realise now that these caves are my wananga – they contain messages from my tipuna."

The Waitaha people created drawings on rock shelter walls and in limestone caves in many areas of the South Island, including his home district of North Otago. Mr Hemara considers these New Zealand's foremost art galleries. "More than 500 years old, these ancient drawings are our most valuable taonga."

For Mr Hemara, this whakapapa is the link between his academic work and the rock drawings that inspired him as a boy. These drawings made a significant impression on him, and they became the major topic of his creative work.

"They hold knowledge about our culture, and the materiality and visuality of the culture. Those rock drawings are like windows from which to peer into a culture – that's why I found them so intriguing."

He says it's the things we are shown when we are young that make such a lasting impression on the mind. He thinks most children have a propensity for wanting to draw, but what matters is whether that is nurtured in the home.

Growing up as one of six children near Omarama, where his father drove a grader for the Ministry of Works, Mr Hemara says the kids were encouraged to draw.

As a child he had no doubt where he was heading. He had a feeling he and his brother Teri were talented at primary school, because they were always getting prizes for art. They got their names in the paper for getting the highest marks in School Certificate art. "Teri got 96 and I scored 97 – I still don't know where those other three marks went!"

He recalls the first time he was paid for his work, as a first-year art and design student at Otago Polytechnic. A professor asked him to illustrate a book about the biomechanics of sports techniques. "That was my first job as a professional artist. It felt amazing."

The connection with his ancestors still motivates Mr Hemara in his teaching and art practice.

He held his first exhibition while teaching in Auckland in 1975 and has since exhibited regularly. With the international spotlight on contemporary Māori art, Mr Hemara has found his work in demand.

Known primarily for his mixed-media sculptures, he has completed significant public commissions, including the Whakamarama waharoa (gateway) at Te Papa, and windows for Ngai Tahu's Te Waipounamu House in Christchurch and for Massey's Auckland campus. His work has been exhibited in contemporary Māori art shows, including Māori at the British Museum (1988), Kiwa–Pacific Connections (2003) in Vancouver, Whenua–Born of the Land (2004) in Wellington, and Manawa: Pacific Heartbeat (2005) in Vancouver.

This year he was one of a group of Ngai Tahu artists who exhibited in Melbourne at the Burrinja Centre of Aboriginal and Oceanic Art. His two pieces in the exhibition, Hokiwai (pictured) and Tiki-Manu, were made from kauri, aluminium and ink, and referenced the birdman figures of the rock drawings.

The exhibition was an outcome of the exchange begun in 2002 with the tour of the Burrinja Aboriginal Art Collection through seven galleries in the South Island.

Another piece of Mr Hemara's work, Te Wairua o Hokioi, featured at an exhibition in Vancouver this year. It sold quickly. Mr Hemara declines to reveal the price, but his broad smile offers a hint. The hokioi, also known as Haast's eagle, was a giant bird of prey known to Māori .

Tinakori Gallery owner Marcia Page knows the value of art. She says work by leading New Zealand artists can sell for five-figure sums overseas, even more for major work by Ralph Hotere.

She has a theory on the growth in demand for contemporary New Zealand art. After having been in the business for more than 20 years, she observes that New Zealanders are better informed about art than ever: "More people have studied art or art history, young people have more disposable income, and the number of apartment dwellers has exploded."

She says people living in modern apartments often look for contemporary art to complement their décor. "They get pretty enthusiastic about contemporary New Zealand art. Compared to

Photographs by Brian Allingham, reproduced with permission of Te Runanga o Moeraki. Thanks to curator Amanda Symon and the Ngai Tahu Māori Rock Art Trust.

abstract work, modern Māori art is more narrative – it tells a story at many levels."

Mr Hemara says he has noticed an increasing number of businesses are using Māori art in their offices, both in New Zealand and overseas, to establish their identity. The international trend towards indigenous art has also helped to boost demand.

On the other side of the demand and supply equation, Ms Page says there's a new generation of Māori artists who have adapted customary methods to contemporary materials. Many are producing work in the European tradition, using non-customary materials and methods. Artists such as Cliff Whiting and Para Matchitt led the way for the new generation in the 1960s.

She warns that art buyers need to pay attention to quality: the boom in Aboriginal art in the 1990s led to the mass production of lower quality work. "But there's nothing new here," she says. "Whenever a style of art is popular, the supply increases. In the 19th century, landscape painters lined up at the Pink and White Terraces near Rotorua to produce art for tourists."

Clearly, the challenge is to keep standards high. When Massey created the Bachelor of Māori Visual Art degree in 1996, it was responding to demand for a formal recognised qualification in Māori visual art.

Mr Hemara says it's a good time to be working as an artist in New Zealand. "From the point of view of being an academic working in a creative and performing arts institution, it's fantastic. In the new tertiary funding environment, creative work is validated as a research output."

The Government gets some credit here, for responding to the aspirations of Māori artists. In 1973 a hui held in Te Kaha spawned the Māori Artists' and Writers' Society, which successfully lobbied for a stronger Māori voice in arts policy development. By the time the Te Māori exhibition opened in New York in 1984, no one could deny the power of Māori art.

From the mid-1980s there's been steady growth in the Māori arts sector, with the advent of Te Waka Toi (the Māori Arts Board of Creative New Zealand) in 1990 providing a significant boost to spending and the visibility of the sector. By 2005, Te Waka Toi was funding 86 arts projects worth $1.3 million.

And the market is significant. According to Statistics New Zealand's study *A Measure of Culture: Cultural experiences and cultural spending in New Zealand*, an estimated 985,000 people, or 36 percent of adult New Zealanders, purchased an original work of art or a handmade craft object in 2001. Typical purchasers were female, Pākehā, aged 35–54, and tertiary-educated. The study also showed that 447,000 people, or 16 percent of New Zealand adults viewed exhibitions of taonga or Māori art.

Tertiary institutions introduced new arts programmes, and the gallery scene is strong, with many more exhibition spaces than when Mr Hemara was a student in the 1970s. "What government support did was establish an environment for art-thinking people, and those people have an effect, a sphere of influence," Mr Hemara says.

As a teacher, his message to his students is to do everything in the pursuit of aesthetic excellence. "If there's one thing I want my students to learn, it's to investigate materials and master the process of working with them, whether it's wood, ink, paint, fibre or metals. It's a journey of discovery. Anything to do with a technique, a shape, a material or an image must be done perfectly, to the best of your ability. Nothing shoddy, nothing half-hearted."

He also tells them to make reference to their whakapapa. He says it's one of the greatest reservoirs of knowledge they will ever have. And it's a message borne out by Mr Hemara's lifelong fascination with the rock drawings made by his tipuna down by the Ahuriri River.

I was awakened by the singing of the birds ashore, from whence we are distant not a quarter of a mile. Their numbers were certainly very great. They seemed to strain their throats with emulation, and made, perhaps, the most melodious wild music I have ever heard, almost imitating small bells, but with the most tunable silver imaginable, to which, may be, the distance was no small addition.

Joseph Banks, Queen Charlotte Sound, 1770

Songlines

A male bellbird in song. The female is smaller and browner in coloration and carries a narrow white stripe across her cheek. *Photo courtesy of Libby Hitchings*

Editor Malcolm Wood visits Tiritiri Matangi Island
reprinted from MASSEY *magazine*

"I hate boats, I love boats," mouths Associate Professor Dianne Brunton as she clings to a metal pillar on the pitching upper deck, spray raining around her and the ship's bell ringing of its own accord whenever there is a particularly violent lurch. Behind us the suburbia of Auckland falls away; ahead rises the green profile of Tiritiri Matangi Island. The 4-km Tiri Channel crossing is feeling longer; today the northeasterly is making the seas particularly rough.

I feel for her. I too am beginning to feel queasy, and Dianne, not a natural sailor, carries another disadvantage – a late night hosting a meal for her postgraduate students and then working on the same funding application she will return to tonight.

So we are grateful to come into the lee of the island where, on the narrow jetty, a guard of honour awaits the ferry's arrival. At its head are longtime caretakers Ray and Barbara Walter, followed by other Department of Conservation staff. Then the representatives of Supporters of Tiritiri Matangi, whose volunteers act as guides. Then the tractor and trailer that will take baggage up the hill to the visitors centre. And, at the last, Greg, resplendent in his green-blue plumage, and shiftily on the lookout for a handout. For the ferry's passengers – sensibly-clad and -shod types carrying day packs, cameras and trekking poles – Greg the takahe is the first representative of the wildlife they have come to see.

Greg the takahe *Photo courtesy of Luis Ortiz-Catedral*

Tiritiri Matangi Island is unrivalled as a place to get close to a number of the must-sees of New Zealand birdlife in the wild, the ones every bird spotter wants to add to a life list: the stitchbird or hihi, the black-and-chestnut-plumaged saddleback or tieke, and the kokako with its blue wattles and haunting song.

Tiri's birds have little fear of people and obligingly appear at water troughs and sugar-water feeders before a battery of cameras wielded by birding's paparazzi. We, on the other hand – Dianne, Royal Society Fellow Barbara Evans, master's student Taneal Cope and I – are here to meet a commoner, a bird many visitors won't give so much as a second glance: *Anthornis melanura*, the New Zealand bellbird or korimako.

When botanist Joseph Banks marvelled at the sound of the dawn chorus in Queen Charlotte Sound in 1770, the principal vocalist was almost certainly the bellbird. Today, for many New Zealanders the call of bellbirds remains the essence of the soundtrack of the bush.

We are fortunate the bird has lasted the distance. In 1873 ornithologist Walter Buller prophesied the bird's extinction, and with good grounds. In the wake of European settlement – with land clearance, the arrival of predators like rats, weasels, stoats and cats, and possibly as the consequence of new diseases – the number of bellbirds had fallen steeply, particularly in the North Island (South Island numbers began falling from around 1900.) By the end of the century the species had vanished entirely from parts of the North Island. In regions such as Northland it has yet to return.

For its part, while Tiri managed to escape the predator invasion (though kiore or Polynesian rat were present until eliminated in 1993), it was temptingly fertile land. By the time of Buller's prophesy the island had been farmed for decades, and by the 1940s just 6 percent of the island's land area persisted in bush. In 1969 the Ornithological Society found just 24 bellbirds there. Today on the reforested island there are more than 1500.

A little way up the track at a feeding station tucked into the bush we meet our first: a half dozen small, drab birds emitting peep, peep, calls. Juveniles, says Dianne, probably from the last brood of the breeding season; the peeps are a 'feed me' cry.

The peeps are unmistakable, but it is fast becoming apparent to me how lacking my powers of discrimination are. My companions are constantly identifying birds through the foliage while I catch occasional flashes of plumage and little more. Where I hear a hubbub of birdsong and struggle to remember which call belongs to which species, Dianne is picking out the voices of individual birds the way you or I might focus on a single conversation at a noisy party.

Beyond identifying the birds by ear, she is also managing the Doctor Dolittle feat of interpreting the content of the calls. In the case of the bellbirds she can say whether it is male or female, a get-off-my land call, an assertion of status, or a be-my-mate come-hither. In the case of the Tiri saddlebacks she can even pick out the differences in dialect that announce which end of the island the bird hails from.

Not all birds are songbirds and not all song bird vocalisations count as singing. The parakeets chittering in Tiri's tree tops do not count as songbirds, nor do the little blue penguins nesting on the water's edge with their nightly Hammer-Horror cries. No romantic poet has ever penned a much-loved ode to a duck.

The songbirds, phylogenetically speaking, are members of the Oscine suborder of the order Passeriformes. They include – to name some obvious suspects – the nightingale, starling, thrush and mockingbird of the old world, and the tui, kokako and bellbird, and lyrebird of the new.

In fact, among the world's 30 orders of bird the Passeriformes (small land-based birds with feet adapted for perching) are by far the most diverse, making up around 5500 of the world's 9000-plus bird species, and all bar around 1000 of these belong to the Oscine suborder.

So what is it that defines birdsong? The peep, peep of the adolescent bellbirds is not birdsong: it is a 'cry', an unvarying genetically-encoded vocalisation which will elicit a genetically-encoded response. Birdsongs, by contrast, are as much learned as they are innate.

While in the nest these bellbird adolescents have been busily memorising the sounds of their own kind and shortly they will begin tuning up, testing the possibilities, and

At left: Master's student Taneal Cope, Associate Professor Dianne Brunton and Royal Society Fellowship recipient Barbara Evans with a bellbird captured for a health check

At right from top: forest gecko; little blue penguin; banding paradise shelducks

The Ecology and Conservation Group

Associate Professor Dianne Brunton joined Massey and set up the Auckland–based Ecology and Conservation Group in December 2004, spending her first months working out of temporary accommodation while a laboratory was built to her specifications. The group shares accommodation with Dr Mark Oram's marine research group and the Sir Peter Blake Trust.

Currently the group includes Dr Weihong Ji (research officer), Ms Marleen Baling (technical support), Dr Rosemary Barraclough and Dr Nathalie Patenaude (postdoctoral fellows), and postgraduate students from New Zealand, Mexico, Malaysia, South Africa and Germany.

Among the birds that are the subject of postgraduate theses in progress are bellbirds, kiwi, kakariki, saddleback, penguins, tomtits, brown quail, and the grey warbler and its parasite the shining cuckoo.

Among the non-avian wildlife are geckos, invertebrates, and avian blood parasites. Students are also working on conservation policy.

So successful has the group been in attracting postgraduate students that further laboratory space has had to be sought.

Whenever she can, Brunton tries to bring the group together socially and in the field. Most recently the group set out to capture, band and blood-sample paradise ducks – arguably the most successful and least studied of New Zealand's endemic birds – at Tawharanui Regional Park.

rehearsing and self-correcting like any student musician. Their instrument is an extraordinary organ called the syrinx, which has two chambers where the human larynx has only one, effectively allowing songbirds to duet with themselves. "You'll hear them going doodle-oodle, just practising away," says Dianne.

Whales, dolphins, humans and songbirds are the only creatures known to pass on learned vocalisations.

As a child growing up in urban Henderson in Auckland's Waitakere District, Dianne Brunton had no great interest in birds. But for the future field researcher there was a creek to play in at the back of the family house and she acquired an interest in animals early on: "I wanted to be a vet and I had a pet everything – turtles, skinks, cats and dogs and sparrows and goodness knows what else."

Birds weren't her first choice of topic either for her MSc at the University of Auckland: she would have liked to work with freshwater invertebrates. Only when the funding failed to come through did Dianne turn to birds as a default, and her thesis topic became the calls of southern black-backed gulls.

For her proposed PhD thesis at the University of Michigan, Dianne again turned determinedly to invertebrates, proposing to study the social behaviour of semi-social wasps. The University of Michigan, where Dianne would study, had a colony of semi-social wasps that had been studied for decades and had become something of an institution. "Then they had the coldest winter in 50 years. The whole colony died."

Again her fall-back was avian – the killdeer plover (the name of which approximates the call) – and this time Dianne found she was hooked. After her PhD she went on to a two-year postdoctoral fellowship at Yale University, teaching ornithology and occupying the office in the Peabody Museum of the recently retired and world-renowned ornithologist and molecular biologist Charles Sibley.

But it wasn't birds that gave her her break. Michigan had also given her a good grounding as a biostatistician, and in 1991 that was what she returned as to the University of Auckland.

We begin to make our way up to the path towards the crest of the island, heading, according to Taneal, towards the municipality of Upper Wireweed. Now in the second year of her masterate, Taneal Cope, a lively woman in her early twenties, spent part of 2005 tracking the movement of bellbirds to identify nest sites, and she has designated districts for the researchers' convenience.

The view from Tiritiri Matangi Island

Upper Wireweed (there is a also a downmarket Lower Wireweed) turns out to be a sunny plot of thick grass and low trees. Stopping at one isolated tree, Taneal delves into the thick foliage to reveal a bellbird nest, a haphazard mass of twigs deserted now the breeding season is done.

Over the past year Taneal has bonded completely with her topic of study. "I always make a pitch for them," she says. Bellbirds are one of the most important pollinators in the bush, she says. They are also very loyal to their chicks. In one instance where a nest had fallen from a tree, the parents continued to come to feed the chicks on the ground.

And they are feisty. An attempt at monitoring the activity in the nest foundered when the female took an aversion to the camera and vandalised it. The last shot on record is a full-face view of an angry female through a cockeyed lens.

Banding the chicks always felt like an intrusion, Taneal says. "The female lets loose with an alarm call or mimes having a broken wing to lure you away, the chicks freeze, and the male looks on going 'bop, bop, bop'. It gets to you; just the way it's meant to," she says, taking on the movements of an agitated bellbird as she speaks.

Knowing where the nests were and having the birds banded was a precondition to investigating how female bellbirds employ song. In most temperate northern hemisphere birds it is the male that sings. (In fact the one way to reliably induce the female to sing is to dose her with testosterone.) But in the southern hemisphere and the tropics there are many species where both males and females sing. The bellbird is one.

The questions surrounding female bellbird song are one of Dianne's many interests. Certain things she knows already: that the females sing shorter, simpler songs than the males, that they sing discrete songs rather than continuously, and that during the breeding season they sing more than the males.

But why do they sing? Does female song serve to ward off other birds from territory, with its food, space and nest sites; to communicate with the male; or to hold family together? Or might it be about keeping other females from gaining access to her mate?

The way to find out was to gauge the females' reaction to female bellbird song, venturing first to the edge and then inside the bounds of a bellbird's territory and, at each stopping place, playing back variously the female bellbird's own call, her female neighbour's and a female stranger's.

Dianne, Barbara, Taneal and research officer Weihong Ji worked as a team, one of them playing back the recordings while the others observed, noting the bird bands and the female's behaviour – did she hop, fly, sing or do nothing at all? Then the team would hasten to some other non-adjoining territory.

"You want to maximise the time between playbacks at neighbouring territories," explains Dianne. "You don't want them all wound up in response to what you played before."

The results? The female, they found, responded strongly to her own call, very strongly to her neighbour's call, and hardly at all to the call of

Master's student Taneal Cope reveals the location of a bellbird nest abandoned after the breeding season.

Why bellbirds matter

It is an environmental snuff movie. In a grainy matchbox-sized video on Alastair Robertson's computer screen, a stoat takes the chicks from a bellbird nest with economical efficiency, returning to the nest repeatedly over the course of ten minutes to take the chicks one by one.

"We had expected most of the predation to happen at night," says Robertson, a senior lecturer in ecology with Massey's Institute of Natural Resources, "but most of what we saw happened during the day."

The birds, he says, are easy meat. The chick's clamour of 'feed me' calls, which continues after the parents have left to forage, alerts the passing stoat. The stoat takes what is offered and carries on the hunt.

How great an impact is the presence of introduced predators having on New Zealand's bellbird population? Between late 1999 and early 2001 Robertson and researchers from the University of Canterbury took a 400-hectare plot of beech forest in the Craigieburn Conservation Area and embarked on a trapping programme, catching 33 stoats in two successive breeding seasons. The difference was dramatic: the number of bellbirds present increased by 80 percent.

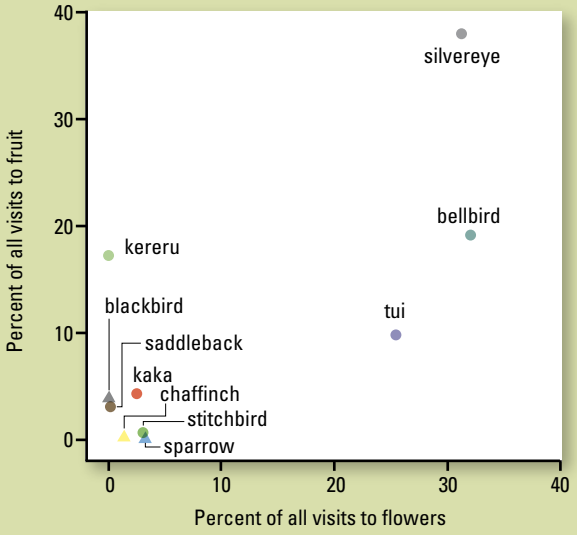
A similar catchment left untouched showed no change in bellbird numbers; all four of the nests under video surveillance there were raided by stoats. In the trapped catchment bellbird nests were four times more likely to succeed.

The absence – or near absence – of bellbirds has larger consequences. A number of New Zealand's native plants are highly reliant on native birds for pollination (red mistletoe and climbing fuschia) or seed dispersal (nikau, kotukututuku and karo). Introduced birds, though much more widespread, seem to be no substitute.

Understandably, much of New Zealand's conservation effort has gone into birds that are endangered or threatened – birds 'on the brink'. Birds that, like the bellbird, have remained relatively widespread have commanded less attention. Yet their populations are a fraction of what they might be without predation – on the Poor Knights Island there are 71 bellbirds per hectare, or 54 times the average mainland density – and their decline is affecting the health of our forests, says Robertson.

Can something be done? The good news is that it can. Rats can be poisoned, ferrets and stoats can be caught using fenn traps, and this is happening in a number of private and public ventures around New Zealand.

Relative (Un)Importance of Introduced Animals as Pollinators and Dispersers



Overall mean contribution by different bird species to flower visits and fruit visits on native plants throughout New Zealand. Introduced birds are marked with triangles, native birds with circles. Kereru are marked as doing zero pollination, but actually have a negative effect on pollination by eating flowers.
Courtesy of Dave Kelly, University of Canterbury

Alastair Robertson, a senior lecturer in ecology with Massey's Institute of Natural Resources

a stranger. Earlier work had shown that females hardly respond to male calls at all.

Until now, bellbirds have been thought to be monogamous (most birds are – at least socially). But on the evidence of her bird-call studies Dianne is willing to hazard that while the species is socially monogamous, when it comes to its mating habits there is an amount of polygyny: some males are mating with more than one female.

She suspects that the female's defence of her territory against incursions by other females is her way of keeping rivals away from her mate, making sure that his parental efforts are devoted to her own chicks.

Of course there is a corollary to the polygyny hypothesis. Sometimes the female's defence of her male must slip up, so some males must have sired chicks by a number of females. This extra-pair paternity will be one of the things Taneal will test for over the next year when she arranges DNA tests of the blood samples from the parents and chicks, tests that should also help identify just where the bellbird fits phylogenetically within the Australasian honeyeater family.

Dianne first visited Tiri in 1991, shortly after beginning work as a biostatistician, spirited there by a colleague John Craig (along with Neil Mitchell, he first put forward the idea of an open sanctuary), who offered her an impromptu helicopter ride. Her visit came midway through the decade of planting that re-established Tiri's bush cover, and many of the birds and animals Tiri is known for had yet to be reintroduced.

The kakariki, the first of the reintroductions, had arrived in 1974, and at the time of Dianne's first visit the first two takahe, Mr Blue and Stormy, had just arrived. Still to come were robins, kokako, fernbirds and tuatara.

At the University of Auckland Dianne had begun by advising graduate students on how to resolve their statistical problems, a role that had its frustrations: "If the students haven't come to see you when they started their projects and then come to you because they need help, it can be nasty."

Soon, however, she found herself teaching undergraduate students and then supervising postgraduates. She also started a family. A memory she has from the time is of lumbering through the Mamaku Ranges in pursuit of North Island robins (acting as part of Doug Armstrong's catching team) while heavily pregnant with her second child.

And she and her postgraduates became deeply involved in the translocation of species to Tiri. Each brought its peculiar difficulties. The fiercely territorial robins captured in the Mamakus had to be kept rigorously apart while

in transit to Tiri or they would have torn each other to pieces.

The fernbird, rescued at the eleventh hour from the path of motorway development, went to ground once it arrived on the island; only months later was the characteristic 'Geiger counter' call heard.

The tuatara arrived, ignored the artificial burrows constructed for their pleasure, and wandered off to settle where they liked. One was found in a distant seabird colony. "At least with birds you can find them afterward, read the bands and see if they survived," sighs Dianne.

One of the tomtits brought across from the mainland was found back in the Hunua ranges, and sightings of those that established have been elusive.

As we drop away from Upper Wireweed and down into one of the relict patches of bush, the island begins to take on another aspect. It feels almost wild. The noise of cicadas becomes near deafening; on the forest floor are patches of humus disturbed by kiwi probing; and in the top of a tree fern deep in a gully roost a pair of morepork, one of which flies about us as silent as a moth.

Tiritiri Matangi has been a triumph both for the conservation movement and for the idea of an open sanctuary. It is the ideal place to conduct scientific research into New Zealand's native wildlife and to arrive at effective forms of conservation management.

But then offshore islands are easy. The real challenge for New Zealand conservation is to take back the mainland.

In places this is happening. A few kilometres north of Tiri on the end of Tawharanui Peninsula, a fenced predator-free headland, a stepping-stone for native species has been established. Here, too, Dianne and her students have begun an involvement in species translocation. The most recent arrival was a consignment of endangered Auckland green geckos – as well as the more common grey and brown forest geckos – rescued from the footprint of a planned motorway extension. The lizards were released at a dawn service attended by members of the Ngāti Whātua and Ngāti Manuhiri iwi. "My younger daughter got to release the first gecko," says Dianne.

And yes, there are bellbirds at Tawharanui now, singing on a peninsula that last heard their melody over a century ago. A planned translocation was pre-empted by the birds themselves, which probably crossed to the mainland from Little Barrier Island.

In recent times a population of tomtits has manifested itself in the bush close by Dianne's own home. She and some of her neighbours had begun trapping pests and predators. Which only goes to show that given the right conditions the New Zealand natural environment can rebound.

Back on the grassy summit of the island the day trippers have gathered for the return trip home. Dianne chats with researchers and volunteers in residence at the island's hut. I wonder how Barbara is feeling with her year-long Royal Society Fellowship coming to an end and the prospect of returning to teaching at Rangitoto College looming.

Around us, takahe are placidly wandering, some grazing, others hanging expectantly about the feet of the picnickers. I have never come so close to takahe before, nor to the saddlebacks or kokako we will see on the path going down to the jetty.

Yet these will not be my strongest memories of Tiritiri Matangi Island. On the way back down the hill we stop to catch and band a male bellbird – a simple matter of triggering the trapdoor on one of the wire-enclosed bird feeders. The image I carry is of the gaze of the male bellbird held carefully in Taneal's hand. I never realised how red the eyes of a bellbird can be. They glow like coals.

A female bellbird (note the 'white moustache' stripe)

Further reading

- For the history of Tiritiri Matangi Island the open sanctuary: **Tiritiri Matangi: A Model of Conservation**. Anne Rimmer. Tandem Press, 2004.
- For a well-written and accessible account of the science of birdsong: **Birdsong: A Natural History**. Don Stap. Scribner, 2005.
- Author Donald Kroodsma, an emeritus professor at the University of Massachusetts has spent three decades recording and analysing birdsong. The title of his book describes it exactly. **The Singing Life of Birds : The Art and Science of Listening to Birdsong**. Donald Kroodsma. Houghton Mifflin, 2005.

More information

- If you would like to join the Supporters of Tiritiri Matangi check out **www.tiritirimatangi.org.nz**.
- The 2.5 km coast-to-coast predator-proof fence at Tawharanui was completed in August 2004. If you are interested in membership of the Tawharanui Open Sanctuary Society point your cursor at **www.tossi.org.nz**.
- Wellingtonians have the Karori Wildlife Sanctuary close to hand. As well as species such as kiwi, kaka and hihi, the sanctuary has a thriving population of bellbirds, the species being reintroduced between 2001 and 2003. To learn more go to **www.sanctuary.org.nz**.

Associate Professor Dianne Brunton at the Cornell Ornithology Lab's workshop carrying a shotgun microphone. The locals favour parabolic microphones which enable them capture birdsongs at a greater distance. Many of the birds of the Sierra Nevada keep to the treetops or are highly wary.

Push record

Although humankind has been observing birds for millennia and the first bird recording dates back to 1889, the science of birdsong really only began to take off in the wake of World War II with the arrival of the tape recorder and the audiosonograph.

The tape recorder put recording within reach of researchers; the sonograph – which produces maps of sound frequency against time – made it possible to compare birdsongs objectively.

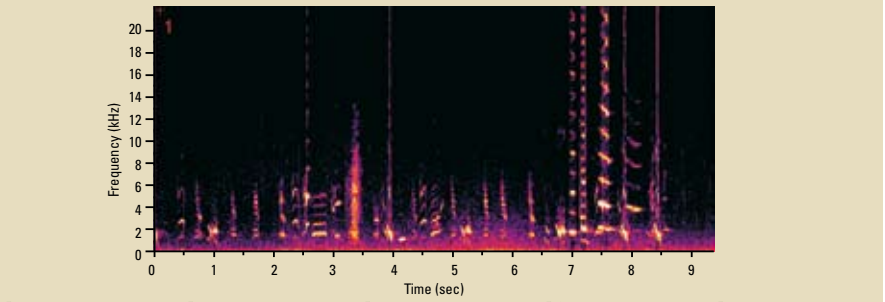
Associate Professor Dianne Brunton's current workhorse is a cheap, battery-frugal minidisc recorder smaller than a pack of cards, paired with a directional microphone (although the gold standard remains Digital Audio Tape and hard drive and chip-based recorders are taking over). Her audiosonograph is not the piece of specialist equipment of yesteryear, but a piece of computer software written by the Bioacoustics Research Program at the Cornell Lab of Ornithology.

If the science of birdsong has holy ground, then the Cornell Lab is it. Comparatively modest when Brunton first visited it as a graduate student at Michigan, the Lab has morphed into one of those only-in-America enterprises, employing hundreds of people in everything from writing the specialist software to 'citizen science'. In the Macaulay Library attached to the Lab are over 160,000 sound recordings, including 67 percent of the world's bird species. Currently, at Dianne's request the Lab is digitising some 60 deteriorating reel-to-reel tapes of saddlebacks made in the 1970s.

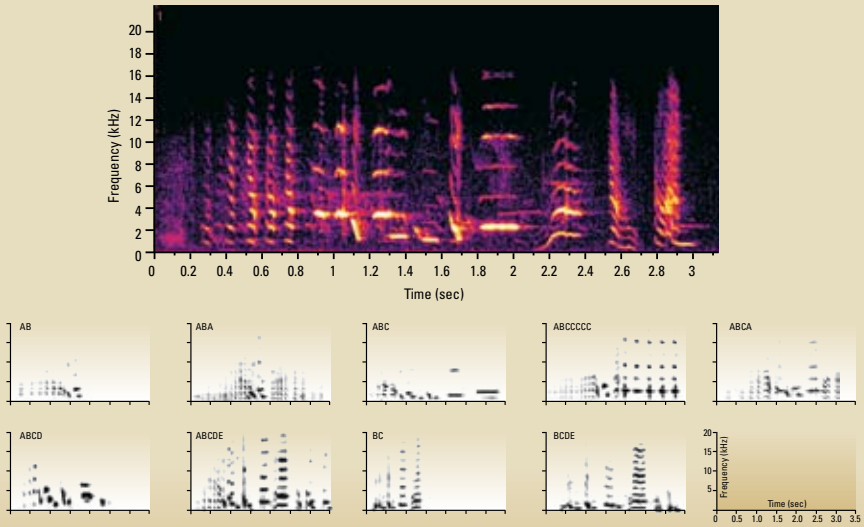
The Lab is also famed for the bird recording workshops it runs in the Sierra Nevadas. Dianne's students are regular pilgrims to these. She herself is attending her second this year with her fellow researcher Dr Weihong Ji.

Is there scope in New Zealand for citizen science in bird recording? Dianne recalls being contacted by a woman after an appearance on National Radio.

"She was an itinerant farm worker, picking fruit and travelling the South Island, and she said she had a good microphone and had been recording bellbirds on minidisc. She sent me the disc together with a map showing the location, and it was fantastic." The only technical fault Dianne could pick was some handling noise. "So I sent her a shotgun mount for the microphone and some minidiscs. She continues to send me recordings, the latest being from the Nelson region."

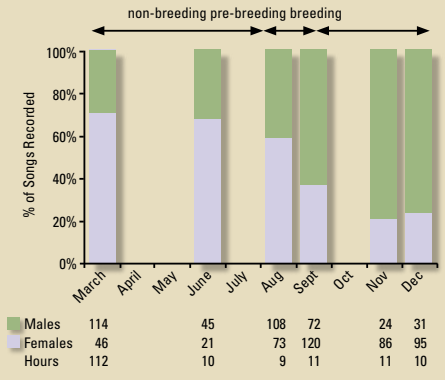


Spectrograms of male bellbird song types.



Spectrograms of female song types. These are less varied than those of the male and are composed of song units, which is how they are labelled here (for example, ABCCCCC is composed of song units A, B and C).

To hear samples of male and female bellbird song visit the ***MASSEY*** magazine website.
http://masseynews.massey.ac.nz



The percentage of singing bouts by male and female bellbirds during the course of a year.

Bellbird song 101

The males sing regularly whatever the time of day or year. Sometimes they sing continuously with no intervals between songs; sometimes they sing discrete songs with large intervals between them.

The continuous song can, in turn, be one of two types: either a single song type repeated, or a variety of song types. The repetition of a single song often happens when the males have gathered by a food source such as a sugar-water feeder or flowering plant. Once one male begins singing he will often be joined by others. These choruses can last up to five minutes.

Seasonally the males sing most often in August, at the start of the breeding season, and in March, at its close when the birds separate into flocks of males and flocks of females and juveniles.

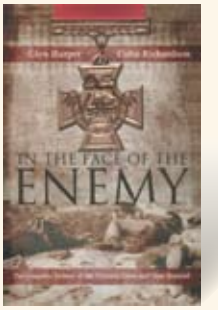
Singing most often has to do with attracting mates, and then with establishing a place in the flock hierarchy. "Often it's the male that is literally and figuratively at the top of the tree that initiates the singing," says Associate Professor Dianne Brunton.

The females sing simple songs, which all exhibit similar structures. The songs are discrete, with intervals of at least three seconds between them. During the breeding season the females sing more frequently than the males.

Counter-singing among females is common. Often, says Dianne, you will hear a female's song from one territory set off the female in the next, in a chain of musical pass-the-parcel.

How large is the species' song repertoire? Based on 26 days of recording of bellbirds carried out on Tiri between March and December 2000, Dianne and researcher Xiaoling Li of the University of Auckland arrived at 10 frequently used song types for male bellbirds and up to five for females.

Although this is almost certainly an underestimate – no one has yet tracked individual females to tally their entire song repertoires – this is a small repertoire when put alongside that of the tui or, for that matter, the North American brown thrasher, which has over 2,000 song types.



In the Face Of the Enemy: The Victoria Cross and New Zealand

by Glyn Harper and Colin Richardson, HarperCollins New Zealand, paperback ISBN:1869505220, NZD$35.99

The latest book by military historian Associate Professor Glyn Harper launched to a barrage of international media interest.

Co-written by Dr Harper and Colonel Colin Richardson, *In the Face of the Enemy*, examines the events, politics and philosophies of the highest Commonwealth military decoration for gallantry. It features the controversial stories of the New Zealand servicemen who were recommended for the Victoria Cross but who did not receive it.

In the Face of the Enemy was launched by Defence Minister Phil Goff at the Queen Elizabeth II Army Memorial Museum in Waiouru, alongside the opening of the Museum exhibition "The Highest Honour: 150 Years of the Victoria Cross". Outside of national major media coverage, the book has been profiled in feature articles in *The Daily Telegraph* (UK) and *The Canberra Times* (Australia) and Dr Harper has been interviewed by the BBC.

The launch was attended by more than 200 people, including Chief of Army, Major General Jerry Mateparae (soon to take up the role of Defence Chief), General Don McIver, Colonel Kevin Burnett, Major Chas Charlton and families of Victoria Cross recipients.

In his speech Mr Goff described the bronze Victoria Cross as "a symbol of extraordinary courage, in the face of an enemy". He says the men awarded the Cross would likely endorse the view expressed by Dr Harper and Colonel Richardson that the award of gallantry decorations can be something of a lottery.

"This is because extreme courage can go unrecognised, or not be fully recognised… the analysis of the way various factors featured in the chain of decisions that lay behind the award of each Victoria Cross is one of the areas in which *In the Face of the Enemy* breaks new ground."

Of the servicemen who were recommended for the VC but who did not receive one, the story of Māori Battalion Lance-Sergeant Haane Manahi is pertinent amid current lobbying by the Manahi VC Committee. Mr Goff says Sgt Manahi displayed outstanding courage and leadership, leading three men 500 feet up a near-sheer face of a mountain. He was awarded a Distinguished Conduct Medal.

"His citation for the VC was signed by those who witnessed his exploits and supported by the entire chain of command including generals Alexander, Montgomery, Freyberg and Kippenberger."

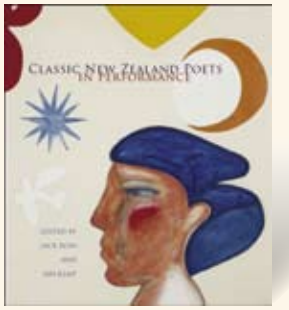
The Ministry for Defence is working with the committee to see if the case can be reconsidered, acknowledging, however, that the consistent position of the Palace since the late 1940s has been to not revisit such decisions.

Mr Goff praised the book and "the fact that Glyn Harper and Colonel Richardson have again ensured that the feats of Haane Manahi and others like him who deserved but did not get the VC will not be forgotten".

Dr Harper heads the Centre for Defence Studies at the Palmerston North campus and is the author of several military histories. He joined the Australian Army in 1988, transferring to the New Zealand Army where he held the rank of Lieutenant-Colonel until leaving in 2001.

Colin Richardson currently serves at the headquarters of the New Zealand Defence Force and has taught military history and strategy at the Australian Army Command and Staff College. He has a long interest in the history of the Victoria Cross.

Both authors started their military careers as Territorial Force soldiers in the 2nd Canterbury Nelson Marlborough West Coast Battalion in the Royal New Zealand Infantry Regiment, a unit that claims five Victoria Crosses as part of its heritage.



Classic New Zealand Poets in Performance

edited by Jack Ross, selected by Jack Ross and Jan Kemp, Auckland University Press, paperback with flaps, 2 audio cds, ISBN-10: 1869403673, ISBN-13:9781869403676, NZD$45.00

Jack Ross has spent much of the past two years hearing voices.

Haunting voices. The voices of Janet Frame, of James K Baxter, of A. R. D. Fairburn, of Denis Glover, of Hone Tuwhare, of Fleur Adcock.

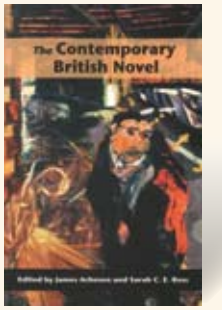
Classic New Zealand Poets in Performance, co-edited by Mr Ross and poet Jan Kemp, includes two CDs of recordings, totalling two hours of poetry readings by 27 of the country's major poets.

Mr Ross, an Auckland-based Massey creative writing teacher, English lecturer and author, says the readings show how the poets intended words and phrases to be emphasised and inflected.

"Poems performed by their authors expand meaning further, enhancing the rightness of cadences and the exactness of language," the book's editors say.

Among the readings is Denis Glover reading *The Magpies* with the immortal "Quardle oodle ardle wardle doodle" lines, as well as Janet Frame, recorded in 1974 and then again shortly before her death in 2004.

The cover features painter Pat Hanley's 1983 work *Wonder Full*.



The Contemporary British Novel

edited by James Acheson and Sarah C E Ross, Edinburgh University Press, ISBN:0748618953 £14.99 paperback, £45.00 hardback

Literary critiques of the work of more than 20 major British novelists from 1980 comprise a recently published book of essays co-edited by Dr Sarah Ross.

From the School of English and Media Studies, Dr Ross worked with author and former Canterbury University lecturer Dr James Acheson to edit *The Contemporary British Novel*.

Dr Ross also contributed an essay on the literature of Pat Barker, titled "Regeneration, Redemption, Resurrection: Pat Barker and the Problem of Evil".

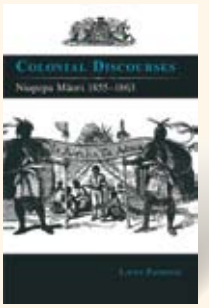
She says the book of essays is ideal for students, teachers and researchers, as well as for general readers looking for supplementary information to accompany "the often baffling novels of the recent past".

All essays are previously unpublished and examine the literature of popular authors such as Salman Rushdie, Zadie Smith, Irvine Welsh, Iain Banks, A S Byatt, and Jeanette Winterson.

The novelists are some of the most widely taught at educational institutions in Great Britain and elsewhere in the English-speaking world, as well as being some of the most widely read by members of the public interested in 'serious' contemporary fiction.

In their introduction the editors describe contemporary British literature:

> An increasingly complex contemporary world has given rise to increasingly complex contemporary novels – novels that students in schools, colleges, polytechnics and universities around the world often find daunting.
>
> The novels themselves, as well as the reviewers, scholars and others who discuss them, frequently invoke views of the world, ideologies and theories that can baffle.



Colonial Discourses: Niupepa Māori 1855 – 1863

by Dr Lachy Paterson, Otago University Press, ISBN:101877372269, NZD$39.95

A new book by Māori history lecturer Dr Lachy Paterson shows how the government and churches used Māori newspapers to promote their policies, values and Christianity and discourage traditional Māori spiritual and social practices.

Colonial Discourses: Niupepa Māori 1855 – 1863 looks at how nine bilingual newspapers, provided a platform for propaganda and also how they were used as a forum by Māori and Pākehā to debate issues of the day.

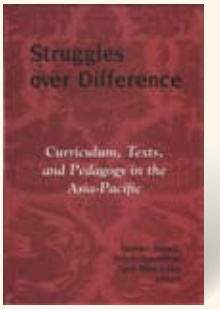
Dr Paterson says the government and the churches published most of these papers in both languages as a way of colonising and assimilating Māori into Pākehā society. They also used the papers to promote the sale of land, legislation and the advantages of the Pākehā way of living.

He says Māori also realised the power of the press and the benefits of using newspapers to spread their own messages. Two Waikato chiefs, Hēmara Rerehau and Wiremu Toetoe learnt how to use a printing press when they were invited to visit Vienna. The Emperor of Austro-Vienna gifted a press to the chiefs, and on their return home they started up the Kingitanga newspaper called *Te Hokioi o Niu Tireni*, which was also used to influence thinking and promote the Kingitanga movement.

Dr Paterson says Māori also contributed to the debates by writing in response. The viewpoints varied, with some opposing the views presented and others supporting them. Māori also saw an opportunity to allow a wider audience to hear what had been said at hui, so whaikōrero and waiata at significant events were also published.

The book will be of particular interest to all those concerned with New Zealand's social, political and religious history. Dr Patersen believes that the Māori newspapers have been under valued as an historical record of Māori-Pākehā relations and provide a window into Māori society in the 19th and early 20th centuries.

The book is based on an eight-year span of the newspapers from January 1855 to September 1863, covering a vital period in Māori-Pākehā relations, leading into the wars of the 1860s, when many of the many of the papers ceased printing temporarily.



Struggles over Difference: Curriculum, Texts, and Pedagogy in the Asia-Pacific

edited by Yoshiko Nozaki, Roger Openshaw, Allan Luke, ISBN:0791463974 ISBN:0791463982, hardcover USD$81.50, paperback USD$24.95

Struggles over Difference co-edited by Professor Roger Openshaw in Massey's College of Education has been named by the American Education Research Association as one of four outstanding new books of the year on the school curriculum.

Struggles Over Difference: Curriculum, Texts, and Pedagogy in the Asia-Pacific is an international collection of essays that claims to "disrupt" popular myths about education in this part of the world.

Professor Openshaw says it contains examples of how a textbook writer's subjectivity can be used to shape the knowledge of others.

The holder of a personal chair in education history, he says he found it fascinating to research not just the information that went into a textbook, but also content that was left out.

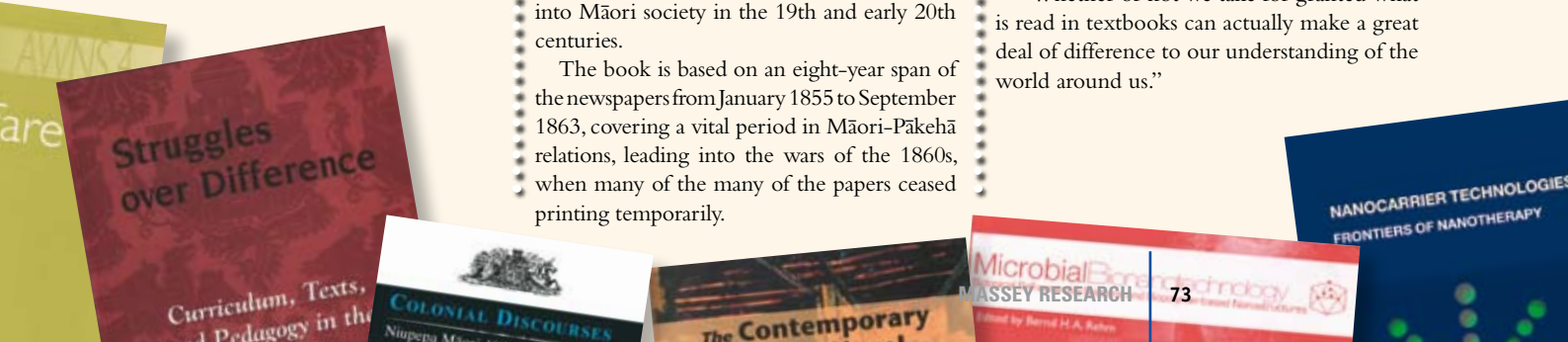
For instance, "In the earlier versions of *The Story of New Zealand*, Māori were portrayed as a war-like race. During World War II, this was considered to demonstrate for the benefit of both allies and enemy states that New Zealanders possessed superior military virtues," he says.

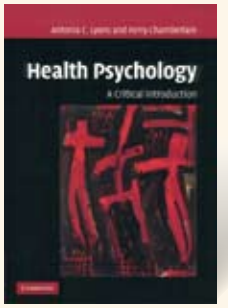
"Later, the description was dropped, as the United Nations was established and the term 'war-like' was considered to be undesirable in peaceful times."

Professor Openshaw believes the book's strengths lie in the diversity of knowledge drawn from its many contributors from the Asia-Pacific region.

"Many textbooks tended to present an 'ideal society' and in South Korea, for example, lower-class social problems, such as poverty and crime, were completely ignored in many school texts.

"Whether or not we take for granted what is read in textbooks can actually make a great deal of difference to our understanding of the world around us."

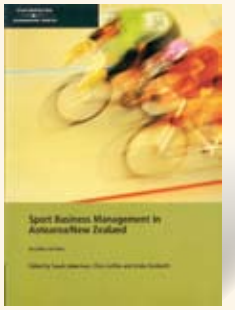




Health Psychology: A Critical Introduction

by Antonia C Lyons and Kerry Chamberlain
Cambridge University Press, paperback
ISBN-13:9780521005265
ISBN-10:0521005264 AUD$75

Health Psychology: A Critical Introduction provides students with a stimulating alternative to the textbooks currently available by placing the discipline within the context of the social world and encouraging them to question some of the assumptions and values underlying much current research. A comprehensive survey of the discipline is provided, framed within a lifespan approach, and emphasising social-cultural factors such as gender, ethnicity and socio-economic status. Psychologists Dr Antonia Lyons and Professor Kerry Chamberlain are both based on Massey's Auckland campus.



Sport Business Management in Aotearoa/New Zealand

edited by Sarah Leberman, Chris Collins, Linda Trenberth, Thomson-Dunmore Press, ISBN:017012896 NZD$88.80

Rapid change in the management of sport in New Zealand is documented in a new edition of *Sport Business Management in Aotearoa/New Zealand*.

New chapters in *Sport Business Management in Aotearoa/New Zealand* cover Māori sport and its management; sport in the global marketplace; sport and the law; strategic alliances and facility management.

The book is edited by senior lecturer in sport management Dr Sarah Leberman, chief executive of the Eastern Institute of Technology Chris Collins and Dr Linda Trenberth from Birkbeck College in London – both former Massey staff members.

Dr Leberman says the chapter on Māori sport, by former Black Ferns captain and College of Business academic Dr Farah Palmer, represents the only such analysis of a sector that is growing in size and importance.

The increasing professionalism of sport was also a factor in the updating of the book. As an example, Dr Leberman says the chapter on sport and the law covers such issues as player salary caps, contracts and safety matters.

The new chapter on facility management covers the growing number of sport complexes and the need for them to be multi purpose.

Sport Business Management in New Zealand/Aotearoa was first published in 1999. It is intended for students, practitioners, volunteers and all who have an interest in the management and administration of sport.

The Welfare of Dogs

by Kevin Stafford, Springer, ISBN:1402043619, hardcover, USD$149

The welfare of dogs – of which there are an estimated 500 million worldwide – is the subject of a book written by Professor Kevin Stafford.

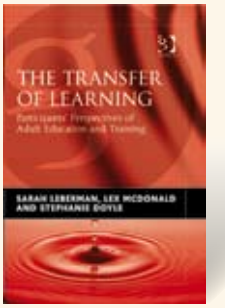
The Welfare of Dogs is the fourth in an academic series published by Springer, and provides a comprehensive examination of the provision for the welfare of the species.

A senior researcher in the Institute of Veterinary, Animal and Biomedical Sciences, Professor Stafford is an internationally recognised expert in canine behaviour. Horses, cats, and laboratory animals are the subjects of the first three books in this series, which consider welfare in relation to the animal's needs, concentrating on nutrition, behaviour, reproduction and the physical and social environment.

In his preface Professor Stafford introduces the canine species and its global distribution. Only a small percentage of them live as pets, while the majority live free-ranging lives in Africa, Asia and Latin America.

He says that while the physical requirements of the pet dog are comparatively easy to meet, the social and activity requirements are more difficult to define. There is also a paucity of research into the psychological status of companion dogs, and a surge of interest in their behavioural problems suggests an increase of these types of problems.

Professor Stafford says that understanding the welfare of dogs is always going to be a challenge, but physically, dogs have never had it so good in many parts of the world and their psychological needs are being addressed more now than ever before.



Transfer of Learning: Participants' Perspectives of Adult Education and Training

Sarah Leberman, Lex McDonald and Stephanie Doyle, ISBN: 0566087340, hardback, £49.50/USD$94.95

Before publication, *Transfer of Learning* was described by an assessor as a wonderful exposition of ideas. The book, co-authored by Dr Sarah Leberman addresses a crucial issue for those involved in education and training: the transfer of learning to new and different contexts.

The publishers, Gower Press, observe that educators, employers and learners face the problem of ensuring that what is learnt in the classroom can be adapted and used in the workplace. "The book focuses on adult learners in professional and vocational contexts. The authors aim to provide an accessible book…which draws on multi-disciplinary perspectives from education, psychology and management."

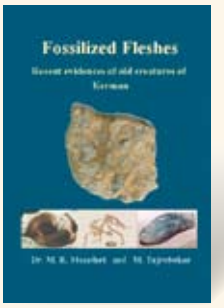
The book's authors are all directly involved in learning transfer. Dr Leberman is a senior lecturer in the Department of Management at Massey and is also programme manager for the Sport Management and Coaching group. Lex McDonald and Stephanie Doyle are both senior lecturers in Educational Studies at Victoria University of Wellington.

Microbial Bionanotechnology: Biological Self-assembly Systems and Biopolymer-based Nanostructures

edited by Bernd H A Rehm, Horizon Bioscience, ISBN:1904933165, USD$210

Edited by professor of microbiology Bernd Rehm, this collection features contributions in the field of bionanotechnology from 36 international academics. A strongly emerging multidisciplinary field fusing nanotechnolgy with biology, bionanotechnology combines biological principles with physical and chemical procedures to generate nanodevices – nano-sized building blocks with specific functions and novel properties.

The book surveys the most striking and successful approaches to produce nanodevices using microorganisms. It displays the diversity of biological nanostructures, and the enormous potential for their application in medicine (such as in the targeted delivery of drugs within the body) and in technology (such as biocomputing).



Nanoliposomes: From Fundamentals to Recent Developments

by M R Mozafari and S M Mortazavi, Trafford Publishing, ISBN:1412055458, softcover, USD$62.14

An ideal source to turn to for learning about or teaching lipid-based carrier systems, including nanoliposomes, archaeosomes, immunoliposomes, ultradeformable vesicles and their preparation, characterisation and applications in areas from pharmaceuticals to food technology.

Fossilized Fleshes: Recent evidences of old creatures of Kerman

by M R Mozafari and Mohsen Tajrobekar, Massey University Press, ISBN:0473110504, USD$22

This is the very first book written on fossils of soft parts of ancient living organisms discovered in Kerman province of Iran. The book includes a brief history of Iran and of Kerman, where the fossils were found.

Nanocarrier Technologies: Frontiers of Nanotherapy

edited by M Reza Mozafari, ISBN:1402050402, hardcover, USD$125.00

Nanobiotechnology is a combination of nanoscience and biotechnology and covers areas ranging from gene transfer and nanoencapsulation to food technology. Nanocarriers are a means of providing protection, site-specific delivery, enhanced bioavailability and controlled release of pharmaceuticals, genetic material, imaging agents, nutraceuticals and cosmetics – to name but a few applications. Nanocarriers and their properties have attracted a great deal of interest over recent years. An advanced survey of the field, this book describes the key research parameters of nanocarrier technologies including their preparation, evaluation of their safety and efficiency, their interaction with biologicals and their application in biotechnology, drug delivery, gene therapy and food technology areas.

Dr Reza Mozafari has produced 22 publications, including two books, since joining Massey and the Riddet Centre in March 2005.

College Research Awards

Early Career

College of Sciences

Dr Barbara Holland

As the recipient of a Massey University Early Career Research Medal, Dr Holland is profiled on page 25.

College of Sciences

Dr Paul Plieger

In 2005 Dr Paul Plieger was awarded a Fast-Start Marsden Grant, was given approval to purchase a microwave reactor, and initiated a research contract with Los Alamos National Laboratory. He has 23 publications in international refereed journals, including nine in the past three years, with seven of them in them in the top 10 chemistry journals. His current research is in the field of supramolecular chemistry, the study of molecular assembly using weak forces.

College of Sciences

Dr Jaspreet Singh

Spanning a broad range of areas in Food Science and Technology, Dr Jaspreet Singh's research work includes understanding the effect of starch granule morphology on the various properties, modifications and food applications of starches. He has produced publications in peer reviewed international journals and is currently researching starches isolated from different New Zealand potato cultivars.

College of Education

Dr Margaret Walshaw

Dr Margaret Walshaw's research examines various aspects of the relationship between mathematics and education, and draws across, and contributes to critical scholarship within sociology, education, gender studies, and history – making use of postmodern, feminist mathematics and educational history. Dr Walshaw has been awarded a Teaching and Learning Research Initiative grant of $180,000 from the New Zealand Council of Educational Research as co-principal investigator for a two-year study and she is the editor-in-chief of the *Australasian Referred Mathematics Education Research Journal*.

College of Humanites and Social Sciences

Dr Sarah Ross

As the recipient of a Massey University Early Career Research Medal, Dr Ross is profiled on page 25.

College of Creative Arts

Dr Anders Warell

Dr Anders Warell was instrumental in establishing the Centre for Affective Product Design, of which he is the inaugural director, and has played a key role in linking the Centre's objectives with wider industry and government policy. He is a member of the Institute for Design for Industry development Research Committee. Dr Anders and his work are the subject of a profile appearing on pages 56 to 59.

College of Business

Dr Sebastian Link

Dr Sebastian Link has published more than 40 articles in prestigious international journals and conferences for his work which is considered to be on the leading edge of international research in database theory. He has recieved a Fast-Start Marsden Grant from the Royal Society of New Zealand. Since 2002 he has been associate investigator of the Information Science Research Centre at the University, and his current research is concerned with different areas of database research including extended markup language, conceptual data modelling, and natural language processing.

Individual

College of Sciences

Professor David Lambert

As the recipient of a Massey University Individual Research Medal, Professor Lambert is profiled on page 24.

College of Business

Professor Klaus-Dieter Schewe

As the recipient of a Massey University Fellowship, Professor Schewe is profiled on page 77.

College of Humanities and Social Sciences

Professor Paul Spoonley

Professor Paul Spoonley has contributed towards building research capacity in the College of Humanities and Social Sciences. He is a leading light in the Building Research Capacity in the Social Sciences consortium, a collaborative multi-university venture formed two years ago with an $8 million grant from the Tertiary Education Commission. His work, which includes 44 refereed articles and 21 books, has a focus on racism and the extreme right, and on patterns of immigration and immigrant culture. Professor Spoonley represents New Zealand on the Metropolis International Steering Committee for the study of international migration.

Supervisor

College of Business

Professor Lawrence Rose

In 1998, Professor Lawrence Rose was appointed as the foundation Head of Department of Commerce, where under his guidance a strong research culture was soon established. His own research in finance has attracted him high esteem from his peers both in New Zealand and internationally. He was recently appointed Pro Vice-Chancellor of the College of Business.

College of Education

Professor Wayne Edwards

Professor Wayne Edwards is the only university academic in New Zealand who holds a professorial appointment in the field of educational leadership and administration. His specialised research interests include leadership, evaluation and organisational improvement, organisational culture, qualitative research, the use and development of grounded theory and ethnography as research approach. In conjunction with the Education Review Office, Professor Edwards established the Postgraduate Diploma in Evaluation.

College of Sciences

Professor Barry Scott

Since his appointment as Professor of Molecular Genetics at the University in 1985, Professor Barry Scott has supervised 21 PhD, 9 MSc and 11 BSc(Hons)/DipSci students. Professor Scott and his work are the subject of a profile appearing on pages 35 to 37.

Massey University Postdoctoral Fellowships

Dr Fiona Alpass, from the School of Psychology, receives a Massey University Postdoctoral Fellowship for her project, Cultural Pathways to Retirement.

The project will investigate the cultural and ethnic influences on the retirement process.

It will complement a Health Research Council-funded project on the health of older people in the transition from work to retirement. Analysing data from that project will enable the research team to make comparisons with longitudinal data from the US and 11 European countries.

The project will study the factors influencing continued labour force participation decisions, such as the ability to work, financial need, and the desire to continue working. Comparisons will be made across Māori, European, Pacific and Asian groups in New Zealand and internationally, with a focus on indigenous people and new immigrant groups.

Dr Isabel Castro, from the Institute of Natural Resources, receives a Massey University Postdoctoral Fellowship for her project, Predator-prey Interactions in New Zealand.

The project aims to study the ecology of predators and their prey in order to develop better management of introduced mammalian pest populations.

The traditional response to predation has been to been to kill the predators. This has backfired on many occasions because of the consequent ecological responses by other predators and prey. For example, eradicating feral cats may cause an increase in other pest populations such as rats, which are preyed on by cats.

The project will establish baseline data about the numerical and functional relationships between vertebrate predators and prey in a defined New Zealand ecosystem. This will enable future experiments leading to more effective pest management.

The two-year project will study feral cats, ship rats, kiwi, ruru and other forest bird species on an island in the Hauraki Gulf.

Professor Martin Hazelton from the Institute of Information Sciences and Technology, and **Professor Nigel French,** from the EpiCentre, receive a Massey University Postdoctoral Fellowship for their project, Spatial Models of Animal Diseases.

The fellowship will fund the appointment of a postdoctoral fellow, to improve collaboration and productivity of statisticians and epidemiologists.

The project aims to develop new statistical methods for analysing spatial data on the determinants of veterinary diseases. It aims to apply these methods to designing better disease surveillance. Better surveillance systems would improve our preparedness for infectious diseases, such as foot and mouth disease or bird flu.

The project will benefit veterinary, public health, biosecurity and disease control organisations.

Professor Janina Mazierska, from the Institute of Information Sciences and Technology, receives a Massey University Postdoctoral Fellowship for her project on Cellular Low Temperature Co-fired Ceramic based Filters.

The project could lead to smaller and lighter wireless communication devices such as cell phones.

Progress in electronic systems has been achieved through the miniaturisation of active components and circuits, such as transistors and silicon chips. However passive components such as capacitors and inductors have only halved in size over the past 50 years.

The size and capability of cell phones is determined by passive circuits, so new technologies aimed at their miniaturisation are required. Low temperature co-fired ceramic (LTCC) based filters are emerging as the most efficient and powerful way of achieving this.

The fellowship will fund the appointment of a postdoctoral fellow to develop advanced microwave filters for wireless telephone handsets based on new LTCC technologies. Results are expected to have a significant potential for commercialisation.

Dr Jasna Rakonjac, from the Institute of Molecular BioSciences, receives a Massey University Postdoctoral Fellowship for her project, Unlocking the Gate of a Giant Channel.

The project has two aims: first, to determine the structure of pIV secretin at atomic resolution; and second, to investigate how opening of the secretin is triggered by its payload.

Secretins are gigantic outer membrane channels of bacteria. They can be open or closed, like a gate. When open, genetic material or disease-causing toxins can exit the bacteria, including those that lead to cholera, salmonella or gastric ulcers.

The project will identify and characterise the gate of secretin pIV, a safe and easily amenable model secretin channel that exports filamentous bacteriophage from non-pathogenic *Escherichia coli* strain K12.

If successful, high resolution studies of the structure of the protein pIV will significantly increase understanding of how an important group of bacterial proteins work. Understanding the secretin gate will help combat bacterial diseases.

Massey University Research Fellows

Professor Klaus-Dieter Schewe receives his research fellowship for his project, Design and Development of Web Information Systems. These are database-backed information systems that are realised and distributed over the web. Professor Schewe says a WIS is a series of abstract locations between which users navigate in a 'story space.' Data can be manipulated by the user or adapted by the system. Web Information Systems have been a focus of an international research collaboration for Professor Schewe for many years. The research has led to a sophisticated methodology for the design and development of systems capturing various levels of abstraction, modelling techniques for each level, mathematical foundations of these models, and pragmatic guidelines for their use.

The research fellowship will enable Professor Schewe to focus on writing a 600-page research monograph on the project next year.

Massey University Research Fellowships provide up to $20,000 to the recipient's department, institute or school to free him or her from some normal teaching and administrative duties so that a current research programme can be completed or documented.

Massey University Women's Awards

Dr Karen Jillings is working on a research project that involves the translation, annotation and critical analysis of Scotland's earliest printed vernacular medical treatise, Ane Breve Descriptoun of the Pest. The treatise on the plague, by Aberdeen physician Gilbert Skene, was published during an outbreak in 1568.

Dr Jillings will make a research visit to Scotland where the only extant copy of the treatise is preserved in the National Library of Scotland. Her project will result in a book containing a reprint of the original manuscript, with annotations and a commentary.

This critical edition is expected to be of interest to historians of medicine, of Scotland and of early print culture. She says while the significance of Gilbert Skene's treatise has been acknowledged by historians of Scottish medicine, it has never been the subject of focused academic study.

Dr Jillings is a lecturer in the School of History, Philosophy and Politics, at Palmerston North.

Aiqun Li's PhD research is titled 'A Study of Chinese Students' Learning Strategies in English Language Learning in New Zealand and China'. She observes that for many Chinese students studying in New Zealand, their language competence and learning styles may affect their ability to achieve their learning goals.

Her longitudinal study focuses on the learning strategies of a group of seven students who enrolled in a project jointly operated by the Auckland University of Technology (AUT) and Harbin Institute of Technology (HIT) in Harbin, China. The students first study at HIT before transferring to AUT.

She says the propos of her research is to establish how these students prepare themselves for their overseas study and how they adapt after they arrive in New Zealand. Next year Aiqun Li will interview the participants in Auckland and will transcribe the interviews, translating from Chinese to English.

Aiqun Li is a lecturer in the School of Language Studies, in Wellington.

Dr Regina Scheyvens specialised in research on tourism, particularly as it relates to poverty issues. Her latest research project is the re-working of her 2002 book, *Tourism for Development: Empowering Communities*, following an approach by Stirling University in the United Kingdom. The book, published by Prentice-Hall, was part of a series titled Advances in Tourism Research.

She says her proposal would reorientate her earlier book to turn it into more of a research monograph by removing some case study material and providing a more comprehensive review of writing on tourism and development. This would require, in particular, drawing on recent writing on the relationship between tourism and poverty alleviation, sometimes described as "pro-poor tourism". She plans to work on her new book, to be titled *Progress in Tourism and Development*, during 2007.

Dr Scheyvens is a senior lecturer in the School of People, Environment and Planning at Palmerston North. Last year she won the Government's National Teaching Award for Sustained Excellence.

Dr Kimberley Powell recently completed a research project funded by the New Zealand Playcentre Federation titled the 'Effect of Adult Playcentre Participation on the Creation of Social Capital in Local Communities'. She intends to use her award funding to provide a break from teaching to write up the research for journal publication and conference submissions.

The research, for which Dr Powell was director, was an innovative project in New Zealand's early childhood research and took two years to complete. It involved two stages: A national survey that targeted all playcentres in New Zealand, and a case study phase which looked at the perspectives of playcentre members in two rural and two urban communities.

Her research report, released in March this year, received national and international attention.

Dr Powell is a lecturer with the School of Arts, Development and Health Studies in the College of Education and is based at Palmerston North.

Dr Penelope Shino's project arises from her PhD research on the poetry of Shotetsu, a Zen monk of medieval Japan. She has undertaken a fully annotated translation, with an interpretive introduction, of Shotetsu's travel diary *Nagusamegusa*.

She says *Nagusamegusa* is normally described as a travel work but in fact is an intriguing composite of travel diary, love story and literary treatise, the art of poetry, and aesthetics. "In addition, it is a vivid social and historical document of life in 15th century Japan."

Dr Shino says Shotetsu records the lives of the provincial military elite as well as the lives of the common people he saw on his travels. The book is also a first hand account of the process by which Japan was transformed in the medieval era, as artists and intellectuals began to instruct the military, allowing them to rule through the prestige of cultural refinement as well as by the sword.

Dr Shino is a lecturer in the School of Language Studies at Palmerston North.

Thomasin Smith's research project is titled 'Modelling Hydrothermal Eruptions'. Its aim is to use laboratory, field, conceptual and mathematical models, as well as numerical simulation, to contribute significant new knowledge to the field. In turn this will help provide a better assessment of the risk conditions so that they can be avoided to provide a safer environment.

She describes hydrothermal eruptions as naturally occurring violent events that are particularly common in New Zealand. Without warning, they can result in the eruption of large volumes of rock particles mixed with liquid water, water vapour and other gases. These events alter the immediate surroundings, sometimes felling trees, scorching foliage, damaging property and injuring or killing people.

She says the problem of understanding this hazard phenomenon has become an increasingly important one in view of the need to reduce the risks to lives and property.

Ms Smith is a lecturer in the Institute of Information Systems, at Palmerston North.

The University Women's Awards enable women researchers to take time from heavy administrative and teaching workloads to either write up research results for publication, or to collect and analyse further data.

Massey Māori Awards

Nick Roskruge (Te Ātiawa ki Taranaki, Ngāti Tama), a lecturer in horticulture and Māori resource studies in Palmerston North, has been granted a Māori award for his doctoral project 'Hokia ki te whenua'. His research aims to produce a decision-making model for the return to economic horticultural development of Māori land, based on tikanga Māori and modern technology.

"Hokia ki te whenua aims to empower Māori to utilise their own land in a fully economic sense. Tino rangatiratanga (self-determination) is an important part of the empowerment process. So issues such as ownership of the knowledge gathered and access to that knowledge and its continued management are key issues for this project," he says.

The project involves case studies with Māori groups including Wakatū Incorporation (Te Tau Ihu), Ngāti Parewahawaha (Bulls), Waioturi Marae (Patea), Tānehopuwai Marae (Te Kuiti) and Tui Tuia Trust (Te Tai Tokerau). Each group offers a unique approach to land assessment and utility that will contribute to the overall study.

Mr Roskruge has a long-term interest in assisting Māori who want to develop their lands economically. He led the Tūhoe Land Development project, including the assessment of the viability of horticulture on a block of land in Rūātoki. The project also included assessment of soil resources with Ngāti Tāwhaki and assessment of education and training opportunities in horticulture for Tūhoe. Similar projects have been undertaken with Ngā Rauru in South Taranaki and a range of trusts and Māori landowners throughout the country.

He has also led projects looking into the commercial production of taewa Māori (Māori potatoes) with the Māori vegetable growers collective Tahuri Whenua. The initial study looked at creating a seed bank for indigenous food crops and grew into agronomy work looking at best practice approaches for commercial and traditional Māori management practices.

Dr Fiona Te Momo (Ngāti Raukawa, Ngāti Konohi, Ngāti Porou, Ngāti Kahungunu) has received a Māori award to assist the university in understanding why there are low numbers of Māori enrolled in social work degrees.

"Māori have a high rate of participation in voluntary services such as the Māori Women's Welfare League and the Māori Wardens Association. In comparison, we have much lower numbers enrolled at Massey University in our social work programmes, or taking up social work as a career," she says.

Dr Te Momo's research among Māori in the North Shore and Waitakere will also focus on possible pathways to build a relationship between Māori communities working in social services and Massey University.

"The data gathered will highlight reasons for falling numbers of Māori enrolments in social work degrees and provide some recommendations for Massey. The research will also indicate ways to encourage whānau to pursue social services as a career pathway and help provide solutions to overcome barriers that are preventing entrance into university."

Dr Te Momo lectures in Māori development and social work at the Auckland campus. Her areas of interest include Māori volunteerism, community development, and development studies.

Her doctoral thesis focused on the development of practical research methodologies in Māori communities from a kaupapa Māori research perspective where the aim of the research and the methodology, embraces and reflects Māori values and aspirations.

Jhanitra Gavala (Ngāpuhi), lecturer and registered psychologist at the School of Psychology in Palmerston North has been granted a Māori award for his doctoral research aimed at identifying the tensions, problems and issues around the formation of contemporary Māori identity.

Mr Gavala says identity is an important issue for Māori because it is a cornerstone of psychological wellbeing and given the diversity of Māori lifestyles in today's world, an analysis is warranted.

"The research will initially focus on personal identity. I am interested in the factors and influences that shape the individual. The latter part of the research will examine social identity, place attachment, and identity formation."

His thesis entitled 'Ngā Take o Te Tuakiri Māori: Issues Surrounding Contemporary Identity Formation' will also assist Māori psychologists and practitioners to gain a better understanding about the tensions, problems and issues for Māori within contemporary society and how they affect Māori in their everyday lives.

"This research also contributes to the body of research on the need for a greater understanding of national identity, which the Government has identified as a priority," he says.

Mr Gavala is an academic psychologist with an interest in the application of mātauranga Māori (Māori knowledge) in the field of psychology, bi-cultural practice and cyber-psychology. He has worked with children and adolescents with severe behavioural and emotional difficulties. He also has clinical experience with adults experiencing severe psychological disturbances.

Kura Puke (Te Ati Awa), a Māori Visual Arts Masters student and lecturer, has been granted a Māori award to assist in the completion of a set of illuminating animated tukutuku panels.

'Muramura: Twinkling Mnemonics in the CBD' features a series of panels built from polished aluminium and acrylic. The main features are the animated patterns created by fibre optic points illuminated by software driven LEDs (light emitting diodes). Other features include variable timing, colour spectrum and intensity and pattern options that can be varied by a radio frequency remote control.

"In some ways, these works are a radical departure from customary tukutuku patterns we see in wharenui (meeting houses). While they are constructed from modern materials and have a commercial and contemporary appearance, the concepts draw on Māori knowledge and values. The panels revitalise customary knowledge and call for a reconfiguration of our changing perception of environment, time, space and notions of reality," says Ms Puke.

The panels can be displayed as individual pieces, as an integrated series within a wharenui, or as one large panel. This is made possible through variable pattern synchronisation of each panel. This project marks the beginning of a series of projects ranging from small sculptural works to major architectural features.

"I chose to undertake a master's in Māori Visual arts, under Professor Robert Jahnke at Te Pūtahi a Toi because of the expansive and exploratory theoretical foundations that underpin the programme within an arena of Māori visual culture. And because I was impressed by the standard of work and the integrity of the artists that come out of the school," says Ms Puke.

Ms Puke is in her final year of a master's in Māori Visual Arts. She also lectures at the Auckland School of Design.

Top Achiever Doctoral Scholarships

Four Massey PhD students have been awarded scholarships with a total value of more than $357,000.

Karl Shaffer: $90,537 A PhD student in the Institute of Fundamental Sciences, Mr Shaffer will investigate the potential of "proton sponges as binders for beryllium". Beryllium is an attractive metal in the aerospace, automotive, telecommunications and computer industries as it is lighter than aluminium and six times stiffer than steel when alloyed with metals such as copper. It is, however, one of the most toxic non-radioactive elements and its inhalation can cause the often-fatal lung disease berylliosis. One solution to reduce environmental contamination by industrial beryllium is to identify molecules that can bind and separate beryllium, such as a class of molecules called "proton sponges".

Susan Cunningham: $91,212. A PhD student in the Institute of Natural Resources, Ms Cunningham will investigate how native birds, and in particular the kiwi, detect prey with their bills. She will also investigate the degree of convergent evolution (the evolution of similar characteristics among unrelated species in separate ecosystems) in prey-detection mechanisms between species, and between species that share an ecological niche. Her PhD combines functional morphology and behavioural ecology, and aims to further researchers' understanding of the ecology of foraging and the morphology (the structure) of bird bills.

Sophie Pack: $89,658. A PhD student in the Institute of Fundamental Sciences, Ms Pack will construct "monotone, domain decomposition algorithms to solve linear and non-linear singularly perturbed convection-diffusion problems". These types of problems occur regularly in mathematical models describing processes in physics, chemical kinetics and mathematical biology. Most of these problems cannot be solved using standard analytical methods so they need to be solved numerically.

Qing Wang: $86,129 A PhD student in the Department of Information Systems, Ms Wang will investigate the "logical grounds of database transformations for complex value databases in which data is represented by trees". Research over the past few years has aimed to understand the expressiveness and complexity of query languages for such databases, and Ms Wang will extend this research in two directions. First, she will investigate general database transformations that encompass both queries and data updates. Second, she will examine the form of the trees.

From left: Susan Cunningham, Sophie Pack, Qing Wang, Karl Shaf-

Massey University Technicians Awards

Dr Armaz Aschrafi and **Dr Evelyn Sattegger**, Institute of Molecular BioSciences, are studying the role of protein synthesis regulators in the formation of long-term memory in the brain. In particular they will focus on the involvement of two translation regulators, IMPACT and GCN2, in the formation of memory. Drs Aschrafi and Sattegger are experts in protein synthesis and Dr Aschrafi has expertise in investigating protein synthesis in neurons. Their study requires a steady supply of neuronal cultures, which due to their short life span, will have to be generated freshly and regularly from rat embryos. Dissociated neurons prepared from the rat brains will exhibit mature neuronal architecture and physiological properties necessary for the experiments. The award will fund a technician who is specialised in brain tissue culture techniques – skills which could not be acquired by a PhD student while producing results within the three-year thesis period.

Professor Bob Hodgson, Institute of Information Sciences and Technology, aims to develop an intelligent digital microscope to be used in the automation of palynology – the process of pollen counting and recognition. Palynology is an important tool in areas such as climate change research and health related studies, and a recent European-centred register of palynologists listed 6000 practitioners. Professor Hodgson, an expert on digital image processing, has been part of a multidisciplinary group that has worked for more than six years towards an automated system. The other team members are: **Professor John Flenley**, an Oxford DSc who is internationally recognised for his applied palynology on Easter Island; **Dr David Fountain**, an expert on live pollen; **Dr Steve Marsland**, a 2005 Massey medallist and specialist in intelligent classifier design; **Greg Arnold**, an applied statistician, and **Gary Allen**, a masterate student. The award will fund a technician to refine the system and to run a number of research trials to demonstrate the effectiveness of the system and generate research results.

Dr Max Scott, Institute of Molecular BioSciences, leads a project supported by the Australian wool industry to study gene function in the Australian sheep blowfly. His team is developing a system for making transgenic or genetically modified blowflies, and collaborates with the University of Melbourne who are determining the DNA sequences of fragments of most of the blowfly genes. The genome project will underpin further new projects studying the unique biology of blowflies. Unlike microbes, blowflies cannot be stored frozen, and therefore all flies must be maintained in a labour-intensive regime of feeding (fresh water, protein-rich cookies and fresh liver). The award will fund a technician to assist with this project and with a proposed study of the genes expressed in the salivary glands of blowfly larvae. Sterile maggots are being increasingly used to treat inoperable wounds and stimulate wound healing in humans. The proposed project will determine which genes are most active in the larvae.

Lex Meek (Senior Lecturer and Head of the Wool Department 1957-1978), the Chairman of British Wool Marketing Board (name unknown), and Professor Al Rae.

DEDICATED TO LIVESTOCK IMPROVEMENT

Professor Al Rae's research and teaching have been of wide-ranging influence in New Zealand and internationally.

In 1993 Professor Al (Alexander) Rae received the rare honour of having a major symposium named for him, commemorating a career dedicated to the practical application of quantitative genetics and systematic breeding plans to livestock improvement. And that entire career from 1951 to 1988 was spent at Massey, recognised in 1990 by the award of the first Massey Medal.

Brought up on a Taranaki dairy farm, Professor Rae gained a BAgrSc at Massey Agricultural College, winning several prizes and acquiring from Dr FW Dry an interest in quantitative genetics. While working there as a junior lecturer he graduated MAgrSc with first class honours in 1947, with a thesis on the progeny testing of New Zealand Romney Marsh rams. Summer vacation employment collecting and analysing data from an animal nutrition experiment taught him the value of statistics, something he was later to emphasise to generations of students. During study for a PhD at Iowa State University (awarded 1950) he learned economics, which was of value in subsequent work on relative economic value. More importantly he had contact with some of the major US researchers in genetics and animal breeding, and extended his knowledge of the application of statistical models and techniques.

He was appointed to Massey's foundation Chair in Sheep Husbandry in 1951, at the unusually early age of 27, and under his leadership the department gained international acclaim for teaching and research in sheep and beef cattle husbandry. A major contribution to research was his testing on farm animals of hypotheses developed in laboratory species. His innovative trials helped convince breeders of the value of practical application of scientific theories. An early punch card system for recording animal data was developed at Massey from the systems used for the fleece-testing service, and this became the basis of a recording system used by some breeders of New Zealand Romney rams. Professor Rae has been in demand to advise on livestock breeding overseas, and the New Zealand National Sheep Improvement programme known as Animalplan (formerly Sheeplan) was based on Professor Rae's research. Thanks to him, New Zealand's sheep help the economy by producing tougher carpet-wool and leaner meat.

Professor Rae has published more than 150 scientific papers, and served on a multitude of committees and boards, including as Chairman of the World Congress on Sheep and Beef Cattle Breeding, 1980, as a member of the National Research Advisory Council Primary Production Committee, and as Advisory Director of the Drysdale Carpet Wool Co-operative Company Ltd. Recognition of his stature as a researcher and teacher has included an OBE, a CNZOM, and the Sir Ernest Marsden Medal for outstanding service to science. He was also the first Massey staff member to receive a Fellowship of the Royal Society of New Zealand.

To get somewhere...

As a researcher, there is no limit to how far you can take knowledge and discovery. But you need a great place to start. Massey University is ranked in the top 200 universities in the world by the UK-based Times Higher Education Supplement (2005) - there for our strengths in teaching, research and our reputation.

Massey University

Te Kunenga ki Pūrehuroa

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