The Buzz Behind Bee Addiction

Anti-speeding campaigns
The ecology of climate change
Tomb raiding
Drug dispensing robots
Educating Indigenous Australia
Rewarding innovation
IT HAS BEEN AN EXCITING couple of months for us at Macquarie as we’ve enjoyed the lead up to our annual Innovation Awards.

These awards recognise new developments in research and scholarship that have demonstrated a major impact on, or benefit to, the community. These activities are going on in all parts of the University, from science, technology and medicine to the social and behavioural sciences, arts and business.

Outstanding innovations conceived by talented individuals and teams of researchers are awarded across categories which include Innovation in Research, Research Students’ Innovation, Invention Disclosure, Innovation in Learning and Teaching, Innovation in Service, Innovation Toward Sustainability, Innovative Partnership and Commercial Innovation.

After great deliberation the judging panel selected winners whose innovations break new ground in their fields and which reflect the exceptional research being undertaken at Macquarie.

I personally wish to congratulate each and every applicant who entered this year. All were of the highest calibre.

You can read much more about Macquarie’s Innovation Awards in a special feature within the magazine.

Professor Jim Piper
Deputy Vice-Chancellor (Research)
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Macquarie researchers

Two Macquarie researchers have each received accolades of the highest kind, establishing them as leaders in their respective fields of science and history.

Professor Mark Westoby from the Department of Biological Sciences has received one of Australia’s top science honours, having been one of just 16 researchers to be elected to the Australian Academy of Science in 2009.

Westoby is best known for his work on ecology and evolution, and is currently studying how different plant species capture and process nutrients and energy.

He began working at Macquarie as a lecturer in 1975 and has since published hundreds of influential research papers. He has also received a number of other prestigious awards including a Gold Medal from the Ecological Society of Australia and the Clarke Medal from the Royal Society of NSW for distinguished research in the field of biological sciences.

Westoby says his most recent accolade from the Australian Academy of Science “means a great deal” but adds he is most proud of the achievements of his students.

“I've had the pleasure of working with many talented scientists who have been postgrads or postdocs in my lab,” he says. “Forty of them so far have gone on to research careers in universities or research agencies around the world.”

Associate Professor Marnie Hughes-Warrington was awarded the Australian Learning and Teaching Council’s most prestigious prize – the Prime Minister’s University Teacher of the Year award – in late 2008 in recognition of her exceptional record of advancing student learning, educational leadership and scholarly contribution to teaching and learning.

She says she will be spending some of her $50,000 prize money on a research project examining the way people vandalise, annotate or destroy history books – just one example of a unique approach to teaching and research that has appealed broadly to her students.

“You become a better researcher when you engage with students and they ask you questions and show you things you hadn’t thought about before”

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Originally trained as a historiographer, Hughes-Warrington completed an undergraduate degree that combined studies of history, philosophy and education. She was awarded a Rhodes scholarship to undertake postdoctoral research at Oxford University, before going on to lecture at the University of Washington in Seattle.

Since commencing at Macquarie in 1998, she has pursued a wider research agenda, writing on world history, historical films and historical revisionism.

“You become a better researcher when you engage with students and they ask you questions and show you things you hadn’t thought about before”

Decoding the Cattle Genome

An international team of 300 scientists have just completed sequencing the entire genome for cattle and two Macquarie researchers played a key part.

The project, which was published in the prestigious international journal Science in April, has implications not only for future genetic improvements to livestock quality, meat and milk production, but also to our understanding of the evolution of mammals. The genetic sequencing will also likely play a role in developing targeted medical treatments for human diseases.

Professor Shoba Ranganathan, Chair of Bioinformatics in the Department of Chemistry and Biomolecular Sciences, and PhD student Elsa Chacko were invited to join the team by the CSIRO, one of the institutions which provided funding for the project.

“We were part of the annotation team,” explains Ranganathan. “Genome annotation is the process of identifying and attaching biological information to the DNA sequences for each of the chromosomes in an organism.”

Ranganathan and Chacko began their part of the six-year project 18 months ago. With particular expertise in alternatively spliced (AS) genes, they worked on the manual annotation of AS genes and comparing them to human and mouse genomes.

The cattle genome contains almost 22,000 genes. Of that number, about 14,345 have counterparts in seven other mammalian species including humans, dogs and possums.
Macquarie University has received $40 million in funding from the Australian Government to build a world-class hearing research and teaching facility.

The facility will be the only one in the world that centralises hearing health and the only one based at a university. The Hearing Hub will bring together key Macquarie University research groups in hearing and cognitive sciences, neurosurgery, special education and electronic engineering to collaborate with Australian Hearing, the Australian Government hearing service provider; and Cochlear, the world leader in cochlear implants.

It will also eventually house, among others, satellite clinics for the Sydney Cochlear Implant Centre, the Shepherd Centre and the Royal Institute for Deaf and Blind Children.

“The new Hub builds on the work of the Hearing CRC [a collaborative network of hearing health researchers throughout Australia] of which Macquarie is a core party,” explains Dr Catherine McMahon, Head of Audiology in the Department of Linguistics. “The Hub will allow for a critical mass of researchers in this field to be housed in the one work space which will encourage a much greater level of collaboration.”

The Hearing Hub will map brain and hearing function and aims to better understand auditory processing in individuals with normal hearing and with hearing loss, further develop hearing aid and implant technologies, and improve strategies for learning to hear and rehabilitation.

When complete, Macquarie will have state-of-the-art facilities for audiology and speech and language pathology. The University’s two MEG brain imaging machines will also be moved to the Hub which will be the most extensive and capable facility of its kind in the world. There is planned development of a third MEG system that has the capability to assess individuals with cochlear implants which will be the first of its kind in the world.

“We’ve also had a lot of interest from research groups around the world who are most excited about the cross-disciplinary approach of the Hub,” says McMahon. “It will be very attractive to high calibre researchers.”

The Australian School of Advanced Medicine and the new Macquarie Private Hospital will be involved with the Hub. Ear, nose and throat specialists located at the Hospital, working on cochlear implantation, will undertake research, training and will provide clinical placements for students.

Due for completion in 2011, the Hub will be located adjacent to the new global headquarters of Cochlear on the Macquarie campus.
DR ANDREW BARRON has always been interested in animal behaviour. But when it came time to choose between the familiarity of mammals with their big brains, emotive faces and recognisable behaviour, and the complex and intriguing world of tiny-brained insects, insects won hands down.

While his early research concerned flies, today he focuses on how bees, with their small and supposedly simple brains, generate incredibly complex patterns of social behaviour. Particularly interested in how honeybees organise their division of labour, Barron also studies the neural mechanisms underlying the honeybees’ symbolic dance language, which forager bees use to communicate the location and value of food resources to nest mates. It is this line of research that has opened an unexpected window into the mechanisms of drug addiction in humans.

Bee behaviour, explains Barron, a member of Macquarie’s Animal Behaviour Concentration of Research Excellence, is motivated by an intrinsic desire to seek a reward for the colony. In the course of his research Barron found close parallels between the honeybees’ neurochemical reward system and that of humans, and wondered what would happen if that bee reward system was stimulated with a human drug of abuse – in this case cocaine.

To find out, he applied a tiny drop of cocaine solution to the study bees’ backs, and was surprised to find close similarities between the way bees and humans react to the drug: cocaine alters their judgement, stimulates their behaviour and makes them more enthusiastic about pollen and nectar. Even small doses cause the bees to dance harder when they return to the hive.

“The cocaine affected the reward processing part of the bees’ brains,” says Barron.
is producing surprising insight into the biochemistry of human drug addiction.
“triggering release of a brain chemical called octopamine, which is very similar to dopamine in humans.”

“This caused the bees to overestimate the value of the pollen and nectar they had collected and resulted in them dancing more vigorously than their finds warranted.”

Once the researchers had discovered that bees were responding to cocaine just like humans, they investigated whether withholding the drug would result in a withdrawal response. Sure enough, when the cocaine dependent bees stopped getting their ‘fix’, their ability to learn and distinguish between two scents (by associating an odor with sugar syrup) dropped dramatically.

“There was no impact on learning as long as the drug treatments continued, but if we stopped the treatment the bees struggled to learn, just like humans going into withdrawal,” he says.

Bees provide a simple tool to help us understand how brains react to drugs of abuse, he says, adding that although addiction is more complex in humans than honeybees, this work will help scientists understand its molecular basis.

The next stage of research will focus on the bees’ tolerance and sensitivity to the drug.

“Our early work in this area suggests that the bees are becoming tolerant very quickly,” he says. “We want to understand how this tolerance and adaptation to a particular drug changes gene activity in the bees’ brains.

“When we understand that, we may be able to stop a brain reacting to drugs of abuse, or to find new ways to prevent abuse in humans.”

Unsurprisingly, Barron’s research has attracted a lot of attention from the world’s media, which played up the cocaine angle. Barron says, however, that any perceptions he illicitly ‘scored’ the cocaine in some darkened alley couldn’t be further from the truth.

“Prior to undertaking research we had to get approval from the State Chief Pharmacist, then use special storage and inventory procedures,” he says, adding that while his bee-sized stash of one gram would probably last a human one night, it has lasted him almost three years. When not in use, the remainder is kept in a safe, in a locked cupboard in a locked room, in a locked building, and any withdrawals from the supply need to be supervised by a member of the ethics department.

“There is also a bit of a misconception that we are pouring bucketfuls of cocaine into beehives. That is not the case at all: we administer a tiny drop in a non-toxic dose, after all there is no point in killing the bee,” he emphasises. “We use the lowest possible dose to give the desired behavioural effect, without causing harmful consequences.”

Even though this research may result in bees being used as a more ethical alternative to rats and mice in drug-related experiments, Barron stresses that bee welfare matters a great deal to all of those involved in the project.

“Against a backdrop of bee populations disappearing worldwide, it is very important that we value and care for these fascinating, and critically important, insects.”

“We may be able to stop a brain reacting to drugs of abuse”
“DO YOU HAVE A PASSION FOR RESEARCH?”

CHRISTOPHER ANSTISS PhD CHEMISTRY

40 MACQUARIE UNIVERSITY RESEARCH EXCELLENCE SCHOLARSHIPS NOW AVAILABLE

Are you passionate about your field of research and study but need assistance funding your future? We have 40 Macquarie University Research Excellence Scholarship positions now available across all Faculties for Australian students. At Macquarie you can work with academics at the international forefront of their fields in a collaborative and supportive environment.

Applications will be accepted throughout 2009 for enrolment this year. For more information email: hdrschol@mq.edu.au or see: www.research.mq.edu.au/students/scholarships
New research being undertaken at Macquarie University has established that anti-speeding campaigns that disparage ‘hoonish’ driving behaviour appear to be hitting their mark.

THE MOST RECENT anti-speeding advertisement to grace televisions and cinemas in New South Wales showed speeding male drivers being mocked by onlookers who wiggled their pinkie finger. With hundreds of speed-related deaths taking place on our roads each year one would hope that ad campaigns such as these have an effect on those at which they are aimed, but do they actually work?

Bernice Plant, a research Masters student from the Department of Psychology, is seeking to find out by looking at the effects of anti-speeding campaigns on the simulated driving performance of youth drivers.

“I chose this area because speeding is an important social issue that I find topical,” says Plant. “Anti-speeding ads are one approach used to try and reduce speeding behaviour, so I thought that it would be valuable to evaluate them.”

According to the Roads and Traffic Authority (RTA) speeding is a factor in about 40 per cent of road deaths in New South Wales each year. This converts to more than 200 deaths each year due to speeding. In addition more than 4000 people are injured in speed-related crashes each year.

With the loss of lives combined with the estimated cost to the community of around $780 million a year, evaluating the efficacy of these advertisements is of vital importance.

Plant recruited around 100 drivers between the ages of 17 and 25 to participate in her study, as this is the age bracket that is over represented in the crash statistics, particularly so for males.

The study featured a number of elements. Participants were first asked to complete a questionnaire about their driving history before taking a drive in a driving simulator.

“I’ve created three different drives, which take participants through three speed zones – 50 kilometres per hour to 90 kilometres per hour then through another 50 kilometres-per-hour speed
zone,” she explains. "By doing this, we can compare the speeding behaviour of drivers before they enter a high-speed zone with their speeding behaviour after travelling through a high-speed zone."

After their drive, participants viewed one of five television advertisements. Three of these advertisements were RTA anti-speeding campaigns from 2004, 2006 and the ‘Pinkie’ advertisement from 2007, which is the campaign still being screened in New South Wales. Two were
control advertisements – one from Quitline and another from the Mental Illness Fellowship Victoria.

After viewing the advertisements, participants took another drive in the simulator to see if they had any immediate effect on their driving performance. They then returned a week later for a follow-up drive to see if any changes in driving patterns were maintained.

“At this stage my findings are preliminary, but to date there haven’t been many surprises,” says Plant. “I have found that males spend significantly more time speeding than females – males spent an average of 17 per cent of the time speeding while for females this figure was around six per cent.”

Other preliminary findings include evidence that two of the anti-speeding ads reduce drivers’ self-enhancement with respect to their driving ability. Importantly, the anti-speeding advertisements also appear to change driving behaviour.

“For males, the anti-speeding ads appear to reduce speeding, when compared to the control ads,” she says. “That is, the tendency for participants to increase their speeding behaviour with practice [on the driving simulator] is suppressed.”

Plant will be conducting further analysis of her research in the next few months.

“I will be incorporating driving experience, including years of driving experience and hours spent driving per week, crash history, speeding fine history, as well as whether or not the ads have been seen prior to the experiment, and whether the changes in self-enhancement are due to changes in the participants’ perceptions of themselves or of other drivers.”

Through her research Plant hopes to reveal whether viewing anti-speeding ads does change behaviour, but also to evaluate the bigger picture.

“We aim to establish whether, and if so how, changes in explicit attitudes towards speeding are reflected in changes in speeding behaviour,” she says. “This is something that has not been answered previously.”
Mapping the ecology of climate change

ARC Fellow Dr Linda Beaumont is helping to redefine how scientists worldwide study the potential impact of climate change on animals and plants.

Over the past couple of decades, a large amount of data has been collected detailing the direct and indirect effects of climate change on northern hemisphere species of plants and animals, including changes in species distributions, flight and migratory patterns, developmental rates, seasonal behaviour, consumption rates and morphology.

But there were few local studies into the impact and magnitude of climate change on Australia’s endemic flora and fauna, something Dr Linda Beaumont, an ecologist and expert in climatic and bioclimatic modelling, who is based in Macquarie’s Department of Biological Sciences, sought to redress in her PhD research. In the process she has helped change the way scientists use ecological models to predict how species will react to a warming world.

Initially her work focused on the potential effects of climate change on an Australian endemic butterfly, the Sword-grass Brown (Tisiphone abeona).

“With two subspecies of this butterfly we already knew that the colour of its wings change with latitude, but it was unknown whether this change was caused by climate, or if there were other factors at play,” she explains.

With plenty of museum specimens collected over more than 100 years available for analysis, the initial part of Beaumont’s project was straightforward, and seemed to indicate that while there is certainly latitudinal variation in wing
character, there was no evidence that it related to climate change. Then, just as she was preparing to start the fieldwork component of the research, she discovered she was pregnant with her first child.

“Suddenly chasing butterflies through the bush for weeks on end became a much harder prospect,” she laughs.

Unable to undertake the intensive fieldwork required she broadened the focus of her project to investigate changes in bird migration patterns.

Beaumont analysed 45 years of bird-watching records for 24 migratory bird species both from the northern hemisphere and within Australia, including channel-billed cuckoos, sacred kingfishers, rufous whistlers and white-throated needletails.

“The study showed that there have been significant changes in the arrival and departure times of a number of the species being studied: birds travelling shorter distances, such as from New Guinea or Indonesia, have gradually started arriving earlier and staying longer, while birds visiting from further afield arrive earlier, but leave earlier too,” she says. “This marks a significant shift in migratory patterns.”

Her attention then turned to predicting how species distributions would change under various climate change models. For this part of the work she looked at invasive plants from the genus Hieracium, which is a key threat to native biodiversity.

“Although these weeds are highly invasive in other parts of the world, in Australia they are regarded as ‘sleeper’ weeds, as they could be potentially devastating but are not causing much damage at this stage,” she says. “They tend to be confined to high-altitude regions, around Kosciusko and the Australian alps, where the ecology is very fragile.

“In a warming world, current modelling predicts that Hieraciums distribution will shift upwards, representing a greater threat to biodiversity, which is already clinging on fairly precariously in some areas.”

She comments that one of the things researchers need to consider when using the different models available is that end results vary widely, depending on what model is used.

“No one knows to what extent climate will change, and when modelling, we usually select one or two projections of future climate but because of the inherent shortcomings of the models used, the predictions are of limited value,” she explains.

Getting predictions right is critically important for planning effective species management strategies, and much of Beaumont’s postdoctoral work is focused on determining the best ways of integrating various climate change scenarios when modelling species distribution. Finding out what information scientists need to know about a species in order to predict its future is central to this project’s success.

“To do this, we can look at a species’ past distribution and see how it has changed because of issues like deforestation and encroachment of human settlements, then run this data through our models,” she says. “From there we are better able to understand their shortcomings and improve them.”

Meanwhile, her focus on the effects of climate change on both invasive weed species and native fauna and flora continues. Beaumont has just returned to Macquarie University from eight months’ work in Grenoble, France, where she has been collaborating on research into the effects of climate change on biodiversity in the Wet Tropics.

“The Wet Tropics is a biodiversity hotspot, with a high proportion of plants and animals that aren’t found anywhere else in the world. Based on what we know so far, climate change is likely to have far-reaching consequences on the distributions and life-cycles of these species,” she says. “This will have inevitable flow-on effects to other plant and animal species which will precipitate further changes.

“By developing a clear understanding of the potential for problematic changes, we can help direct resources to develop management strategies, and hopefully avoid some of the more extreme impacts.”
The 5th Macquarie University Innovation Awards were held on Wednesday 6 May, coinciding with the Australian Innovation Festival.

The awards recognise new developments in research and scholarship that have demonstrated a major impact on, or benefit to, the community.

Examples of this include research resulting in new products and/or processes; changes to government policy or processes; improvements in social or health services; value added to the outside community through learning and teaching programs; processes that can improve the environment; and successful commercialisation ventures.

The Innovation Awards are open to all University staff, including adjunct and emeritus staff provided work has been conducted primarily at Macquarie, and Higher Degree Research students at Macquarie, either for individual or team-based innovations. Teams may include external partners to the University.

Speaking about the Awards, Vice-Chancellor Professor Steven Schwartz says, “At Macquarie University we recognise that our investment today in research and innovation, and in creating a culture of support and recognition of new ideas, will lay the groundwork for future success.

“These awards celebrate the achievements of some of our brightest and most inventive people. “Along with the insight gained from deep study and specialisation, these innovators also demonstrate a willingness to take a risk, to back themselves and to not waver from a belief that things could be better, if only”.

Television and radio personality Adam Spencer was the evening’s master of ceremonies and Dr Gregory Smith, co-founder of the venture capital company SciVentures Investments Pty Ltd, was keynote speaker.

Awards

INNOVATION IN RESEARCH

The Innovation in Research award encourages and rewards innovation involved in the creation and application of research outcomes, the discovery of new knowledge, a new product or new service. Such innovations take the form of significant and novel research advantages with the potential to deliver major benefits to the community, including but not limited to educational, environmental, health, industrial, technological and commercial.

Winner:

**Quantum informatics on a chip**

*Dr Graham Marshall, Dr Martin Ams, Dr Peter Dekker and Associate Professor Michael Withford*

**Partner Institution:** University of Bristol, UK – Professor Jeremy O’Brien, Alberto Politi and Jonathan Matthews

Unparalleled computing power and ultra-sensitive measurement are just two of the capabilities offered by photonic quantum information science. Using innovative and cutting-edge fabrication techniques, Macquarie researchers have created a platform on which these frontier technologies will be able to realise their full potential. The team has developed a material-versatile 3D photonics platform and has demonstrated that its quantum ‘circuits’ are the superior platform for sophisticated quantum experiments. The platform opens new avenues in quantum information experimentation that have until now been impossible.

Highly Commended:

**Breconda – a novel health service delivery tool to facilitate surgical decision making in women with breast cancer**

*Dr Kerry Sherman*

**Partner Institutions:** University of the West of England, Bristol, UK – Dr Diana Harcourt; NSW Breast Cancer Institute – Associate Professor John Boyages and Dr Thomas Lam

Testing cognitive skills online: the Macquarie online test interface (MOTIf)

*Dr Genevieve McArthur and Professor Anne Castles*

Pre-release training for hatchery-reared fishes

*Dr Culum Brown*
A team of Macquarie researchers, in conjunction with a team from the University of Bristol in the UK, have married classic photonics with quantum science to develop a platform for building quantum optical circuits inside glass and have won the coveted Innovation in Research award in the process.

The partnership includes Dr Graham Marshall, Dr Martin Ams, Dr Peter Dekker and Associate Professor Michael Withford from Macquarie’s Department of Physics and Engineering, and Professor Jeremy O’Brien, Alberto Politi and Jonathan Matthews from the University of Bristol.

“Quantum information science is going to revolutionise diverse fields in technology ranging from how we do computing to how we communicate securely,” explains Marshall.

Adds Ams: “Here at Macquarie we have developed an innovative technique which uses high power lasers to create 3D optical circuits inside blocks of glass. A crucial application of this technology is in quantum information science, and together with collaborators at the University of Bristol in the United Kingdom we have been developing 3D quantum circuits that lie at the heart of incredible quantum technologies.”

Realising these systems requires the networking of thousands of components and this can only be achieved by miniaturising and integrating extremely high-quality optical circuits. This is where Macquarie plays its part. The team can fabricate hundreds of devices inside a single compact and stable glass ‘chip’. These 3D optical quantum circuits inside blocks of glass are revolutionising the future of information security in computing.

The University of Bristol was the first in the world to report on a photonic chip, but says Withford, it is Macquarie’s development of the new 3D fabrication technique that is allowing the two teams to break new ground in the field.

“The technique that Macquarie is using is different to what Bristol used in the past and is outperforming the work that was previously developed,” explains Withford. “Quantum groups from around the world are now knocking on the door to work with Macquarie.”

And so it’s only fitting that the research won a highly contested Innovation award.

“The award is great as the team get acknowledgement of their hard work,” says Withford. “It also gives us added motivation to develop further. I see a lot of scope for pursuing this line of research over the next five to ten years.”
RESEARCH STUDENTS’ INNOVATION
The Research Students’ Innovation award rewards Higher Degree Research innovation in the following areas: learning and teaching, research, innovative partnership or commercial innovation. Such innovations take the form of significant and novel research advantages with the potential to deliver major benefits to the community, including but not limited to educational, environmental, health, industrial, technological and commercial.

Winner:
Highly functional and robust, monolithic fibre laser systems
Nemanja Jovanovic, Dr Graham Marshall, Dr Alexander Fuerbach, Dr Michael Steel and Associate Professor Michael Withford
Partner Institution: Friedrich-Schiller Universitat – Jens Thomas, Stefan Nolte and Andreas Tunnermann

This innovation involves the realisation of highly simplified and robust lasers with maximum functionality for various applications ranging from airborne environments to medical procedures. The laser being developed is a fibre laser and consists of a laser operating within an optical fibre. The innovation comes when these lasers are combined with internal mirrors, known as fibre Bragg gratings. By using fibre Bragg gratings written via the point-by-point method which have properties favourable for lasers, it is possible to realise enhanced functionality from the lasers and therefore new applications.

Highly Commended:
Keeping the perspective: helping local councils respond to climate change
Supriya Mathew and Siri Veland
Glycospectrumscan: an intelligent program to help find new biomarkers of disease
Nandan Deshpande, Dr Daniel Kolarich, Dr Pia Honnerup Jensen and Professor Nicolle H Packer
Partner Institutions: Swiss Institute of Bioinformatics, Geneva, Switzerland – Dr Frederique Lisacek; University of New South Wales – Professor Marc Wilkins
Patient-professional interaction in clinical settings in audiology
Louise Collingridge and Professor Christopher Candlin

INVENTION DISCLOSURE
The Invention Disclosure award recognises and rewards the effort required to identify and disclose innovative ideas or concepts, through the use of formal invention disclosure documents and the invention disclosure process.

Winner:
Diamond laser system for precision ultra low collateral damage ablative surgery
Dr Richard Mildren

Practical and powerful lasers that specifically target protein have been a long-standing challenge in laser medicine. Preferential and strong absorption in protein has promise for enabling laser ablative surgery with the precision and specificity needed to address important challenges in neurosurgery and oncology. To date such surgery has only been carried out using large and expensive international laser facilities. This disclosure details an alternative for generating the required power and wavelength characteristics by utilising the outstanding optical laser properties of single-crystal diamond. The invention is aimed to create infrared lasers that are compact, lower cost and transportable, and compatible for use in research laboratories and hospitals.
PhD student Nemanja Jovanovic was presented with the Research Students’ Innovation award for his work in developing a novel type of laser. Known as a fibre laser, it consists of an optical fibre which is not only used to guide light from one point to another but can also absorb and emit light.

“Fibre lasers are not only compact but inherently environmentally stable and have therefore been successfully used in car manufacturing and keyhole surgery,” says Jovanovic. “However, most lasers require bulk optics such as mirrors and lenses and these are inherently incompatible technologies which reduce the overall robustness of the laser systems. In order to circumvent this we have put mirrors inside fibres known as fibre Bragg gratings, and these in-fibre mirrors are used to reflect a single frequency of light.

“The innovation comes when you apply mature fibre-based technologies to so-called point-by-point fibre Bragg gratings as it is possible to produce highly functional lasers with tailored properties.”

These fibre lasers could one day be used in a variety of applications due to their novel properties. Jovanovic has tested the lasers for a range of applications and plans to conduct some further experiments over the next couple of months. “These fibre lasers could successfully be used on aeroplanes, which are prone to high vibrations, as a result of their superior robustness. Also, the gratings have the potential to be exploited as sensors for the monitoring of temperature or testing the forces exerted on various panels of the plane during flight,” he explains. “It could also be used as a seed laser for dermatological skin treatments.”

Jovanovic and his team are just one of three groups in the world who have worked with these unique gratings. To date seven journal papers have been published on his research with three more in the pipeline. A number of post deadline conference papers have also been accepted which usually only happens when they contain outstanding innovations. He has also received an invited talk to the leading fibre optics conference in Australia.

Jovanovic says that receiving the Innovation Award was the icing on the cake after three years of research. “The award means a great deal, it recognises that I’ve done the hard yards and is a nice way to close out the last few months of my PhD at Macquarie. It’s a great reward.”
HIGHLY COMMENDED:

Distributor – document distribution and online meeting software
Chas Christodoulides

Efficient synthesis of a natural product and analogs with potential anti-cancer, anti-inflammatory and ophthalmic applications
Associate Professor Peter Karuso and Sudhir Shengule

A new vascular stent designed to reduce the risk of aneurysm rupture
Professor Michael Morgan and Dr Andrew Davidson

INNOVATION TOWARD SUSTAINABILITY

The Innovation Toward Sustainability award is designed to encourage and reward innovation involved in the creation and application of sustainability outcomes, which may include the discovery of new knowledge, a new product or new service. Such innovations take the form of significant and novel sustainability advantages with the potential to deliver major benefits to the community (Australian and international), including educational, environmental, health, industrial, technological and commercial benefits.

WINNER:

Environmental risk and sustainability in the energy and resource industries
Professor Peter Nelson

Environmental risk management in the energy and resource industries is essential in order to minimise impacts of emissions and waste on sustainability, and human and ecosystem health. This application is for research leadership in a range of projects, including the assessment of power station contributions to photochemical smog and fine particle formation in urban regions; improved techniques for the reporting of emissions to the national pollutant inventory; human health assessments of gas and particulate emissions from motor vehicles; and a comprehensive study of mercury sources, transport and fate.

HIGHLY COMMENDED:

Achieving sustainability through education
The Australian Research Institute in Education for Sustainability – Professor Suzanne Benn, Janelle Thomas, Robert Perey and Jessica North

INNOVATION IN LEARNING AND TEACHING

The Innovation in Learning and Teaching award recognises innovative practices, policies, or procedures which have delivered outstanding benefit to learning and teaching outcomes either within the University, or external organisations.

WINNER:

Termfinder: jargon-busting and concept building, an online learning tool for beginners in science and social science
Professor Pam Peters, Dr Claudia Oliveira, Dr Theresa Winchester-Seeto, Adam Smith, Yasmin Funk, Dr Alan Jones, Associate Professor Peter Petocz, Jenny Middledorp, Kehui Loui, Fred Wang, Dae Raftos, Alan Kilgore and Chris Searchfield

Partner Institutions: RMIT/UQ – Professor Philip Poronnik; National Institute of Accountants – Greg Tangey; King Mongkuts University, Bangkok – Associate Professor Jirapa Vitayampirak; Universidad Politecnica de Madrid – Dr Trinidad Fernandez

TermFinder is a new multimodal online learning tool, designed to help beginning and international students with technical
concepts and terminology that challenge them in many academic disciplines. For each discipline (e.g., statistics, biology, accountancy), a unit-specific termbank is built collaboratively by specialist academic staff and expert linguist-lexicographers. TermFinder users benefit by intelligent software which can respond to their queries both directly and laterally with related terms, and display them graphically in conceptual sets. For each headword the software supports audio files of its pronunciation, and a translation (into Chinese etc) to assist those whose first language is not English.

Highly Commended:
The science partnership
Professor Stephen Thurgate, Kathy Vozella, Professor Ian Gibson, Alan Rice and Frank Abas
Partner Institution: Peninsula School Education Director – Maurice Brunning; Principal Cromer Public School – Greg Jones.

Bringing deep space into the classroom
Professor Quentin Parker, Lesa Moore, Dr Milorad Stupar, Catherine Braiding and Professor John Hedberg
Partner Institution: Swinburne University – Professor Duncan Forbes and Dr Lisa Germany

INNOVATION IN SERVICES
The Innovation in Services award rewards a service innovation activity involving Macquarie University staff and individuals, or groups external to the University which have delivered outstanding benefits to the University, and/or external organisations including: industry and/or government, schools, community groups or other educational institutions.

Winner:
Distributor – a paperless document distribution system
Chas Christodoulides

Distributor is an innovative secure online solution used for the review of applications and the distribution of documents to committees with time, cost and environmental benefits. An initial roll-out in the Faculty of Human Sciences saw application turn-around times halved. The system will be rolled out to other Faculties later in the year.

INNOVATION IN PARTNERSHIP
The Innovative Partnership award recognises an innovative partnership, or outreach activity, between Macquarie University staff and individuals or groups external to the University which

PHOTOS: EFFY ALEXAKIS
has delivered outstanding benefits to the external community including: schools, community groups, industry, government or other educational institutions.

**Winner:**

**Understanding conflict of interest in the public sector**  
*Dr Cindy Davids and Gordon Boyce*  
**Partner Institution:** Ombudsman Victoria – John Taylor

This collaborative research project analysed the dimensions of conflict of interest in the Victorian public service which have been identified as a particular concern of the Victorian Ombudsman. This study utilised confidential public complaint files about various forms of conflict in all Victorian government departments. This required that the researchers be sworn in as Officers of the Victorian Ombudsman. Among the key outcomes of the project was a Special Report presented by the Ombudsman to the Parliament of Victoria. This report was produced by the Ombudsman on the (acknowledged) basis of the Macquarie research.

**Highly Commended:**

**Muradora digital repository**  
*Professor James Dalziel, Nishen Naidoo, Damien Chen, Cuong Hoang and Dr Chi Nguyen*  
**Partner Institutions:** Fedora Commons – Thornton Staples; CSIRO – John Morrissey; AWI – Ana Macario; University of Hull – Chris Awre; PARADISEC – Linda Barwick; Memorial Sloan-Kettering Cancer Centre/Mediashelf – Matt Zumwalt

**COMMERCIAL INNOVATION**

The Commercial Innovation award recognises and rewards successful commercialisation of an innovation, such as licensable technologies, internal commercially operated units or spin-off companies.

**Winner:**

**Commercialising innovations in enzyme development and production through applimex systems**  
*Dr Moreland Gibbs, Dr Junior Teo, Professor Peter Bergquist, Professor Helena Nevalainen and Dr Georgina Learmonth*
This team is recognised internationally as a leader in the development and production of enzymes for industrial applications. It has developed intellectual property (including three granted patents and two patent applications) covering libraries of enzymes, methods for enhancing enzymatic performance and methods for significantly improving the yields of difficult to-produce enzymes. This intellectual property is being commercialised through Applimex Systems Pty Ltd of which Macquarie is a 46 per cent shareholder. Applimex Systems is currently working with customers and strategic partners in Australia, the US, Europe and India across a wide variety of industries including oil and gas, biofuels, food, biotechnology applications and scientific research. Formed in 2005, Applimex currently employs eight people and has been operating profitably for the past two years.

Highly Commended:
Continuous wave yellow raman laser
Dr Helen Pask, Andrew Lee, Dr Peter Dekker, Dr David Spence, Professor Jim Piper and Ben Smith

Economically and environmentally sustainable land-based sea urchin aquaculture
Dr Jane Williamson
Partner Institution: AusUni Pty Ltd – Dr Devarajen Vaillington and Stuart Smith

The Macquarie University Innovation Awards were sponsored by Panasonic, Spruson & Ferguson Intellectual Property and Access MQ.

INNOVATORS’ HALL OF FAME
The Innovators’ Hall of Fame recognises Macquarie innovators who have a strong track record in innovating and whose innovations have a positive impact on the community and Macquarie University.

Professor Kevin Wheldall
Wheldall joined the Macquarie University Special Education Centre (MUSEC) as Director and Professor of Education in 1990. An expert in ‘Positive Teaching’ and tutoring for low-progress readers, he has developed highly successful programs of instruction for students with learning difficulties, the most notable being the Making Up Lost Time In Literacy (M uLTILIT) initiative, a highly successful intervention program for teaching low-progress readers. In collaboration with Aboriginal leader Noel Pearson of Cape York Partnerships, MULTILIT is now utilised in Indigenous communities in Cape York following a federally funded roll out. MULTILIT Pty Ltd was launched as a university spin-off company in 2006.

Wheldall is an elected Fellow of the Academy of Social Sciences in Australia and a Fellow of the International Academy for Research in Learning Disabilities. In 2008 he received the Mona Tobias Award of Learning Difficulties Australia in recognition of his outstanding contribution to the field.
Drug dispensing robots

Imagine this – miniature robots delivering drugs directly to the affected site of a person diagnosed with an illness. Sounds like science fiction? Well it’s not – it’s happening right now and Macquarie University scientists have a role in ensuring that the robot functions effectively.

Associate Professor Michael Withford from Macquarie’s Laser and Photonics Concentration of Research Excellence is part of a nationwide group of scientists, The Australian National Fabrication Facility (ANFF), who offer their expertise to the wider community. ANFF is an initiative of the Federal Government, which wanted to enable cutting-edge science across the country.

“The Government felt that if Australian science and engineering were to compete at an international level, we had to move from isolated pockets of expertise to larger multi-user facilities,” says Withford. “These facilities could be resourced and scaled up allowing them to provide services to researchers who have great ideas but don’t know how to enable them.”

Withford leads the OptoFab Node which offers specialist capabilities in 2D and 3D laser micro-machining, photolithography, lithium niobate device fabrication, and optical fibre fabrication.

“We are currently making, on behalf of an engineering team at Monash University, parts for miniature robots which cause the tail to spin, reproducing how bacteria moves around the bloodstream,” he explains.

“These parts were previously made in the United States and the good news is that we have been told that our micro-components are as good as, and in some cases better than, micro-components they have had made in the past.”

AGEING WISELY

A new program designed by Macquarie psychologists to tackle depression and anxiety among older people is, for the first time, offering a safer and potentially more effective course of treatment than currently available options.

One of the hidden issues of ageing is depression and anxiety. With older people expected to make up a quarter of the world’s population in the near future, effectively treating these conditions is becoming a health care priority.

Although estimates put the occurrence of anxiety and depression in older people at up to 47 per cent, Dr Viviana Wuthrich, a Research Fellow in the Department of Psychology, was concerned about the lack of research on alternative treatments for mental health issues in older adults.

“Depression and anxiety are known to increase the risk of illness and mortality, dementia and suicide in older adults,” she says. “Typically, mental health issues in the aged are managed by medication as the first line of treatment. But because this group of people tends to be on a range of medications for other health problems, they face the issue of different groups of drugs interacting negatively.”

Additionally, she adds, they frequently end up requiring extra support from general practitioners and other services, which places a heavy financial burden on the already overstretched health system.

So Wutherich set about designing a group treatment program that would reduce the symptoms of worry and low mood by teaching participants to use past experiences to challenge negative thinking.

“The program, called Ageing Wisely, is designed to teach people not to react to situations emotionally and to challenge unhelpful thinking by helping them to see that this way of thinking is not working and finding another that they know based on past experience will help them get through a situation,” she explains.

Participants are taught cognitive behavioural skills such as learning how to think realistically, solve problems, face their fears, be more assertive and communicate their wants and needs more effectively.

With the first trial complete she says all involved were pleased with the outcome.

“Further research is planned to finetune the program, but once we have proven its effectiveness we will develop a manual to help health practitioners and aged-care workers run the program in community settings all over the country.”
Since their introduction in the 1970s and ’80s, a lot of attention has focused on Australia’s sexual and racial discrimination laws. But according to Dr Jacob Campbell from the Macquarie Law School the promises of equality in these laws are not necessarily matched by reality in their implementation.

“As a society we have tended to assume ‘job done’ because we have anti-discrimination legislation, but the issue now is to avoid entrenching subtle disadvantage in society’s most marginalised sector,” he explains. “People with disabilities are under-represented in academia, so to date little attention has been paid to their experiences and their laws.”

During his PhD research project, which looked at the Disability Discrimination Act itself and at key cases applying parts of anti-discrimination legislation, he found that employers currently have no legal obligation to provide reasonable accommodation for disabled staff.

“There is no legal obligation placed on employers to make reasonable adjustments in the workplace, such as providing screen reader software, ramps, or lower desks that would allow people with disabilities to participate in work in the same way as able-bodied individuals.”

His study found that in order for any real progress to be made, society and the judicial system needs to recast disability as a concept, and stop seeing it as something inherently negative.

“For example, if someone can’t use the stairs, we just automatically assume there is something wrong with them, rather than with the underlying structure of the building,” he says. “But cities are not designed to let people with disabilities get around easily.”

He adds that society and the law need to recognise that human ability runs across a broad spectrum. When society has a better knowledge of the true nature of disability – that it may limit one sphere of activity but not another – then judges applying anti-discrimination law will have a better understanding of discriminatory situations.

“At the moment, there is a tendency to excuse potentially discriminatory behaviour too often, and for people to exploit loopholes in the legislation,” he continues.

His thesis is timely: the Federal Government is currently looking at amending the Act.

“A fact often overlooked by the media and government is that most of Australia’s Indigenous populations live in urban centres rather than remote outback areas. Seemingly because of this, their stories of disadvantage have largely gone untold.

PhD candidate Rebecca Reeve’s econometric analysis of the causes of Indigenous poverty in urban New South Wales may change that, however. Centrall to her thesis, her model analysed Australian Bureau of Statistics survey data relating to Aboriginal and Torres Strait Islander income, employment, health, education, incarceration and other indicators of disadvantage. She found that Indigenous people living in New South Wales’ major cities are significantly disadvantaged relative to the non-Indigenous population, contrary to the popular misperception that Indigenous poverty is only a problem in remote locations.

“The results of the analysis showed that there are a range of causes of Indigenous poverty and that they are interrelated,” she says. “Extreme stress, unemployment, drug and alcohol abuse contributes significantly to someone becoming a victim of abuse, such as domestic violence.”

“Indigenous children are more likely to leave school early, and with no post-Year 9 education, there is a much greater likelihood that they will be charged with crimes as a child, and make an early entry into the criminal justice system.”

Later in life, Reeve says that although they may be equally willing to be part of the labour force, disability issues, low levels of education and arrest records often affect their employment prospects and so the cycle starts again.

Reeve is currently analysing policy documents to find out whether they are addressing these key areas.

“We may need to rethink our policy approach so that we can better manage these issues, to help permanently break the cycle of disadvantage.”
(In)Ethical gambling

Investigating the evils of gambling has become an addiction of sorts for one Macquarie University researcher. PhD candidate and lecturer in the Department of Business, June Buchanan is examining ethical issues within corporations, with a particular focus on the gaming industry. During the course of her research she has visited casinos in the USA as well as in Australia.

“I am interested in exploring the extent to which we can evaluate the current practices of the gaming industry against the precepts of corporate social responsibility,” she says.

“Widespread community concern regarding the ‘evils’ of electronic gaming machines (EGMs) appears to exist. The ‘evils’ are double-edged: on the one hand, there is the potentially addictive nature of the EGMs themselves, which can lead to problem gamblers who, at the extreme, put all their weekly earnings into the pokies, lose their jobs, their homes and other assets and even their marriages and other close relationships.

“On the other hand, there is community perception that the New South Wales and operators offer a legal product in the form of EGMs, the potential harm caused to other State Governments are themselves addicted to gambling revenue in the form of taxes they receive from the operators of EGMs. It is felt by many that the State Governments are basically paying lip service to the ‘problem of problem gamblers’ and that, were it not for their refusal to forfeit any of their gambling taxes, the governments would get serious about implementing tough measures.”

Buchanan also notes that it is important to recognise that, although gaming operators offer a legal product in the form of EGMs, the potential harm caused to certain members of society through this product, along with negative publicity and community perception, means that adopting and practising the major principles of corporate social responsibility is paramount.

COMING TO AUSTRALIA

Do migrants get good jobs in Australia? Dr Stéphane Mahuteau is investigating the role of ethnic networks in job seeking.

Imagine you are a newly arrived migrant to Australia and trying to gain employment. With little to no English and few contacts or friends in your new homeland what challenges would you face in entering the workplace? It’s questions like these which are the focus of Mahuteau’s recent co-authored paper: Do Migrants Get Good Jobs in Australia? The Role of Ethnic Networks in Job Search.

Mahuteau examined data from the Department of Immigration and Citizenship to research three key factors related to migrant job seeking: the probabilities for migrants to find ‘good jobs’ (those which are equivalent to jobs held in their former country), whether or not the employment prospects of those who have migrated to Australia after the introduction of tougher selection criteria and welfare restrictions in 1996 are adversely affected, and how a migrant’s social network affects the quality of job they secure.

“Our research has found that migrants who have arrived in Australia since 1997 have a higher probability of finding a job and finding a good job,” he explains. “Interestingly we found that there are initial downward movements along the occupational ladder, followed by improvements, so we looked at whether the restrictions in welfare eligibility since 1997 increases the probability that new migrants accept ‘bad jobs’ quickly and then move onto better jobs over time. Holding employability constant, our results support this view.”

“With regard to the role of ethnic networks in job seeking, the results we obtained show that migrants who make use of more informal and ethnic networks have greater success in finding a job, however these jobs are of a lower average quality than those obtained via traditional native channels.”
ONE OF RONIKA POWER’S earliest memories was leafing through the Encyclopaedia Britannica as a child.

“I used to lie on the floor alongside my brother, fascinated by pages showing the wonders of the ancient world,” says Power, who is undertaking a PhD in the Department of Ancient History.

Today Power possesses the distinction of being one of only a handful of Australians qualified to excavate and analyse human remains from archaeological contexts following her attainment of a highly specialised degree. During 2006 and 2007, under the auspices of a Commonwealth scholarship, she was awarded a Master of Science in Human Osteology and Palaeopathology with High Distinction from the University of Bradford in the UK.

“Without a doubt, the excellence of my Macquarie qualification enabled me to secure the scholarship – the quality of the degree and broadness of the program is unique,” says Power, who describes Macquarie’s Centre for Egyptology as “absolutely exceptional”.

As a young adult Power suffered from chronic fatigue syndrome, which, at the time, prevented her from continuing high school. Undeterred by the setback however, she entered Macquarie as a mature aged student some years later. And the rest, as they say, is history. In 2004 she graduated with a Bachelor of Arts in Ancient History with First Class Honours and the University Medal. From these illustrious beginnings she has continued to forge a successful academic career, which has included tutoring in Egyptian archaeology as well as undertaking breakthrough research.

Of particular note is her PhD research examining child and infant burials in the Egyptian record, which is being supervised by internationally renowned Macquarie-based Egyptologist Associate Professor Christiana Köhler.

“My project includes data from the beginning of the Early Dynastic period (ca 3250 BC) until the end of the Middle Kingdom (ca 1650 BC) from approximately 220 cemetery and settlement sites within the borders of Egypt,” she explains.

“Surprisingly, the mortuary data from this demographic segment of the ancient community has not yet been pursued as a subject worthy of independent study within Egyptology. It is my aim to carry out such an interdisciplinary exercise, combining the fields of Egyptology, archaeology, physical anthropology and philosophy to gain novel, credible insights into the lives of this much-marginalised demographic segment of the ancient Egyptian population.”

In addition to her research, Power is involved in initiatives which revolve around mentorship and leadership.

“As the director and founding member of the Telemachus (Tele’s Angels) Ancient History Mentor Program at Macquarie, I am devoted to ensuring that all our first-year students enjoy a seamless and successful transition from secondary school or the workforce to the challenges of university,” she says.

The program has received two awards for excellence from Macquarie, and has dedicated all monies from the awards to creating academic prizes for first-year ancient history students.”
To tax, or not to tax?

Do Australians pay too much tax? Sociologists like Dr Shaun Wilson, Dr Ben Spies-Butcher and Adam Stebbing, are increasingly turning their heads to taxation and questioning its efficiency on a social policy level.

Sociologists usually leave taxation policy to economists, who are interested in the efficiency of taxes or the ‘deadweight losses’ created by taxation regimes. But sociologists are increasingly paying attention to taxes, viewing taxation as a product of historical forces, compromises wrought by competing economic interests, and the complex mechanisms through which some services, products, and even groups of people, are valued over others. We use this approach to address three questions.

Do Australians pay high taxes? A 2007 survey of 30 OECD countries suggests that Australians are lightly taxed – well down the list in 23rd place. But these statistics include social security contributions collected in European states that are separate from tax revenues. When these contributions are excluded, Australia moves up the list – into the top ten! So the answer is it depends what we count as tax, but the statistics do explain why Australians see themselves as overtaxed. Because Australia funds social programs through visible and unpopular taxes (like income tax) rather than through European-style contributions, which are similar to super payments, we certainly notice what we pay out.

Have Australians changed their minds about lowering taxes? Polls say voters now prefer more spending. In the 1980s, voters wanted tax cuts, leading governments to confine welfare to the needy. But more recently, middle income voters have wanted better services. The Howard Government’s response was to create tax breaks for private services – in health care, childcare and pensions – paid for by record company tax revenues. When we receive tax breaks for purchasing services or use tax loopholes to reduce tax liabilities, we become recipients of ‘tax expenditures’.

Do tax expenditures make good social policy? We should be skeptical. Expanding in number and cost, tax expenditures put pressure on the budget. Because they offer legislators a ‘backdoor’ way of spending, tax expenditures also reduce public accountability over policy change. And, tax breaks benefit high-income earners most. For critics, tax expenditures are new holes in an already leaky fiscal bucket.

Labor’s budget offers more generous public programs – higher pensions and a maternity scheme – paid for by trimming tax expenditures favouring the better off. Still, it remains unclear whether the government will embrace higher taxes to pay for better services while the public mood favours exactly that.

A 2007 survey of 30 OECD countries suggests that Australians are lightly taxed.


Dr Ben Spies-Butcher, Adam Stebbing and Dr Shaun Wilson research social policy in the Department of Sociology.
Educating Indigenous Australia

ADDRESSING THE CHRONIC SHORTAGE

of university-qualified teachers from Aboriginal and Torres Strait Islander backgrounds is the driving force behind vital new research by Macquarie University education researchers.

Led by Associate Professor Alma Fleet from Macquarie’s Institute of Early Childhood, the umbrella of research projects is constructing an evidence-base to assist policy makers and program coordinators with decision-making related to Indigenous early childhood teacher education.

It is also looking at the professional pathways of Aboriginal and Torres Strait Islander early childhood teachers, with a particular interest in the fostering of a nationally recognised Bachelor of Teaching program for this group, an issue Fleet considers of pressing concern.

“We know from research that Aboriginal and Torres Strait Islander children thrive when nurtured and challenged by Indigenous teachers,” she says. “However, traditional mainstream tertiary organisational and instructional strategies are not optimal for encouraging engagement by Aboriginal and Torres Strait Islander peoples in higher education.

“So we are undertaking a number of projects that we hope will inform on the issue of what we believe is the urgent need for university-qualified Indigenous early childhood teachers. It extends on previous research which investigated factors that support and constrain the development of Aboriginal and Torres Strait Islander teachers.”

In addition to its primary focus, Fleet notes that the research has an important secondary purpose which is to provide ongoing networking and support opportunities for Indigenous graduates.

“As well as supporting the aspirations of Indigenous early childhood educators, involvement of these graduates as researchers and associates within this project develops research skills amongst educators who are able to influence strongly their respective communities,” she says. ●