THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

DISCOVERY AT UQ 2013

CONTENTS

EXECUTIVE OVERVIEW

HIGHER AIMS, DEEPER IMPACT

FROM THE PRESIDENT AND VICE-CHANCELLOR, AND DEPUTY VICE-CHANCELLOR (RESEARCH)

Emboldened by a record of success and the prospect of contributing to answering some of the toughest questions facing humanity, UQ people are aiming ever higher to deliver benefits to global society and the environment.

Our ambitions in so doing are underpinned by research excellence – a quality manifest in the rising number of high-quality peer-reviewed publications from UQ researchers.

And it is a quality endorsed by all four major global university rankings, which in the past 12 months have shown UQ improving our positions in the top 100 of the world's institutions.

As well, the Australian government has measured national university research calibre through Excellence in Research for Australia (ERA), which rates all UQ fields of research as at world standard or above, and more than 80 per cent at well above or above world standard (rated at 4 and 5).

Outside research and academic circles, there is growing awareness of the impact of robust peer-reviewed discovery, and the advantages arising from partnerships with strong higher education institutions.

These partnerships can take many forms, including joint research and development centres, licensing deals, scholarships, internships, graduate employment programs, and philanthropic foundations.

Whatever their shape, these linkages have a multitude of beneficiaries, because they help ensure that the outcomes of great research are used by people locally, nationally and internationally. This is sometimes called "research translation" or, as we like to say, "excellence-plus", because it takes exemplary discovery and turns it into products or services that have meaning and value, in any language.

We are determined to augment UQ's "excellence-plus" factor, in order to strengthen our positive worldwide impact, support Australia to address societal challenges, and help bolster the "four pillars" of Queensland's economy. Such improvements in output will give better returns to people who already invest in UQ

To optimise performance, we must expand the quality and scale of mutually beneficial engagement with the private and public sectors.

So, we have developed a new industry engagement strategy featuring a list of UQ's top 30 research strengths. Informed by indices such as ERA and global rankings, the list will make it more efficient for business, government and not-for-profit groups to identify the expertise that will help them reach their objectives.

As well, we have set the seven-year target of doubling research funding from non-government sources, which was more than $100 million in 2012.

Our partners will share the benefits not only of leading talent and facilities, but also of UQ's improving academic reputation. The latter is reflected in the reputation-weighted QS World University Subject Rankings, which in 2013 placed five UQ subject areas in the global top 15 for the first time.

Awareness of how our own institution can share in the prestige of partners helped motivate UQ to seek entry to a new higher education consortium, edX, founded by Harvard University and the Massachusetts Institute of Technology.

In May we became a member of this group, which includes a number of institutions ranked in the global top 20 – and even the top five. edX is promulgating a new learning technology, known as Massive Open Online Courses (MOOCs) that has potential to revolutionise how people learn, share knowledge, and solve problems.

Being part of the prestigious edX could benefit UQ's research in many ways. Among them are improved calibre and scope of our networks; greater insights into the science of learning, assisted by big data; and expansion of the range of cultural and disciplinary perspectives applied to complex questions.

We thank all UQ researchers, support staff, partners and supporters for helping deliver the fruits of outstanding discovery to people throughout our shared global environment.

In the years ahead, we commit to working more effectively to build on UQ's inherent excellence, to continue nurturing and supporting talent, and to intensify UQ's positive impacts for humanity.

Professor Peter Høj, President and Vice-Chancellor, and Professor Max Lu, Deputy Vice-Chancellor (Research), The University of Queensland

A WORLD-CLASS RESEARCH INSTITUTION

UQ is ranked in the top 100 universities worldwide in four key global university rankings: the Shanghai Jiao Tong *Academic Ranking of World Universities*; QS World University Rankings; *Times Higher Education* World University Rankings; and Performance Ranking of Scientific Papers for World Universities.

RESEARCH QUALITY

The Australian Government's ERA 2012 National Report confirmed that research at UQ is above world standard in more specialised fields of research than any other Australian university.

- 100 per cent of UQ research is at world standard or above
- 35 specialised fields of research at UQ received the highest possible rating of five
- UQ was the only Australian university to achieve the maximum rating of five in education, statistics, numerical and computation mathematics, environmental engineering, environmental biotechnology, industrial biotechnology, and specialist studies in education.

UQ REVENUE 2012

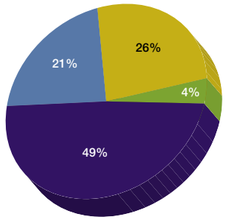
Total Operating Revenue	$1.58 billion
Total Research Support	$521.6 million

Please note all funding represented in AU$.
Data/figures current as at 30 June 2013.

RESEARCH FUNDING 2012

$368.02 million total sponsored grants and contracts including:

	$ million
Australian competitive grants	180.3
Other public sector research funding	79.0
Industry and other funding	95.0
Cooperative Research Centre	13.7



Research Funding in 2012

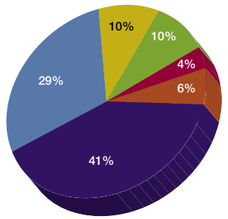
- *Australian competitive grants*
- *Other public sector research funding*
- *Industry and other funding for research*
- *Cooperative Research Centre funding*

COMMONWEALTH RESEARCH BLOCK GRANTS 2012

	$ million
Joint Research Engagement	30.4
JRE Engineering Cadetships (25 new places)	0.1
Research Infrastructure Block Grant	24.9
Sustainable Research Excellence	17.8
Research Training Scheme	57.7
Australian Postgraduate Awards (310 new places)	20.9
International Postgraduate Research Scholarships (29 new places)	1.8

SOURCES OF UQ RESEARCH SUPPORT 2012

	$ million
Commonwealth Government Research funding	212.5
Commonwealth Government Research Block grants	153.6
State/local government	49.3
Australian industry and other contract/grants	54.4
All Australian donations, bequests, trusts, foundations	21.4
All international funding	30.4



Sources of UQ Research Support 2012

- *Commonwealth Government Research funding*
- *Commonwealth Government Research Block grants*
- *State/local government*
- *Australian industry and other contract/grants*
- *All Australian donations, bequests, trusts and foundations*
- *All international funding*

EDUCATION IMPACT AND TRAINING 2012

Research Higher Degree students enrolled			4330
PhDs awarded	Domestic	377	547
	International	170	
MPhils awarded	Domestic	54	67
	International	13	

UQ FELLOWSHIP HONOURS 2012

Australian Research Council (ARC) Federation Fellows	2
Australian Research Council (ARC) Laureate Fellows	7
National Health and Medical Research Centre (NHMRC) Australia Fellows	4
Fellows of the Academy of Social Sciences in Australia	40
Fellows of the Australian Academy of Science	28
Fellows of the Australian Academy of Technological Sciences and Engineering	27
Fellows of the Australian Academy of the Humanities	28

RESEARCH AT THE UNIVERSITY OF QUEENSLAND

The University of Queensland is one of Australia's premier research institutions, receiving $368.02 million in research grants in 2012.

RESEARCH STRENGTHS

- Agriculture and Food Sciences
- Applied and Theoretical Economics
- Biological Sciences
- Business, Management and Finance
- Cancer Studies
- Chemical Engineering
- Chemical Sciences and Materials Engineering
- Clinical Sciences and Experimental Medicine
- Communication, Media and Cultural Studies
- Ecology and Environmental Science
- Education
- Environmental Engineering and Water Management
- Genetics and Genomics
- Human Movement and Sports Science
- Immunology and Infectious Diseases
- Information Systems and Data Management
- Law
- Literary Studies
- Mathematics and Statistics
- Mechanical Engineering
- Medicinal Chemistry and Pharmaceutical Sciences
- Mining, Mineral Resources and Processing
- Molecular and Cellular Biosciences
- Nanotechnology and Bioengineering
- Neurosciences
- Performing Arts and Creative Writing
- Physics
- Psychology and Cognitive Science
- Public Health and Health Services
- Social and Political Sciences.

RESEARCH FUNDING HIGHLIGHTS

- $40.3 million from the Australian Research Council in 2012 for Discovery Projects, Discovery Early Career Researcher Awards (DECRA), and Linkage Infrastructure, Equipment and Facilities (LIEF) funding. UQ received more awarded projects and funding across these three schemes than any other Australian university and achieved number one placement in the DECRA scheme.
- $51 million from the National Health and Medical Research Council to fund research projects investigating health issues such as cystic fibrosis, respiratory illness in Indigenous children, and chronic kidney disease.
- $14.7 million from the Australian Research Council to support 19 Future Fellowships from 2012. Nationally, UQ received the second highest amount of awarded funding.
- $9 million from the Queensland Government to boost dementia and Alzheimer's disease research in the Clem Jones Centre for Ageing Dementia Research at UQ.
- $2 million from the estate of Clem Jones, former Lord Mayor of Brisbane, for ageing dementia research.
- $24.5 million from the Australian Research Council to support 40 Linkage Project grants in 2012 and 30 Linkage Project grants in 2013. Industry, business and community partners will contribute an additional $46.6 million to these collaborative research projects.
- $6.9 million from the Australian Government and $2 million from the Queensland Government to fund the Therapeutic Innovation Australia (TIA) Queensland Node. The Node will provide a testing model to accelerate the translation of Australian research discoveries into commercial therapeutic products.
- $4 million from the Australian Cancer Research Foundation for targeted cancer detection and treatment programs.
- US$4 million from the American National Institute of Arthritis and Musculoskeletal and Skin Diseases to identify further genetics associated with ankylosing spondylitis.
- $3 million from the TB Sailors', Soldiers' and Airmen's Association of Queensland (TB Association) to boost tuberculosis research.
- $2.7 million from the Australian Research Council under the Industrial Transformation Training Centres scheme, to train future scientists to lead food industry transformation and innovation.
- $3 million Australian Research Council Laureate Fellowship in 2012 to Professor Ove Hoegh-Guldberg to develop his work on coral reef metabolism in a rapidly changing climate.
- $1.25 million Premier's Science Fellowship to Professor Matt Brown, UQ Diamantina Institute, a key partner in the Translational Research Institute, to develop his work on the diagnosis and treatment of rheumatoid arthritis and tuberculosis.

FACULTIES, RESEARCH INSTITUTES AND CENTRES

In partnership with government, industry and donors, UQ has developed globally recognised research institutes to complement the teaching and research activity in its faculties. The University also has more than 100 research centres and major University-wide research initiatives that support the critical mass that enables UQ to tackle significant global challenges. Centres and Institutes work in a range of disciplines from the biosciences and nanotechnology to sustainable development and social science.

RESEARCH AT THE UNIVERSITY OF QUEENSLAND

The University of Queensland is one of Australia's premier research institutions, receiving $368.02 million in research grants in 2012.

UQ LIBRARY

The Library assists researchers through all stages of the research lifecycle, from discovery to gathering, creating and sharing the output.

Research data: UQ eSpace

- central to the Higher Education Research Data Collection reporting, **Excellence in Research for Australia (ERA)** reporting and access, submission and final deposit of UQ Research Higher Degree theses, and the source of publications data feeding into **UQ Researchers** and ***Q-Index***
- improved visibility of UQ research data, with **Research Data Australia** now harvesting data collection records from UQ eSpace.

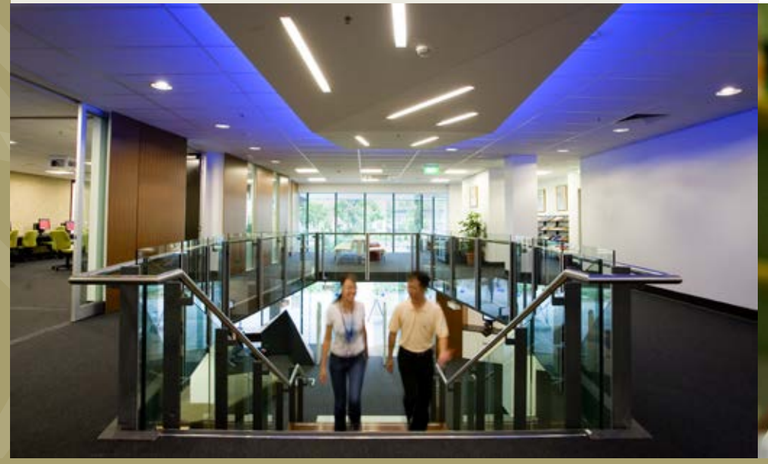
Web: www.library.uq.edu.au/research-support

Multimedia: Going for gold and greener pastures: Open Access explained

Scholarly publishing series: Good research – Dr Tamara Davis

Scholarly publishing series: Where to publish? – Professor Tom O'Regan

Open Access gold vs green – Professor Matt Brown



UQ RESEARCHERS

FIND AN EXPERT

Whether you are from industry or business, the academic or general community, or are a current or prospective research student, you can find an expert through UQ Researchers: **http://uqresearchers.app.uq.edu.au**

UNIQUEST

UniQuest is the main commercialisation company of The University of Queensland (UQ), specialising in the commercialisation of intellectual property, research outcomes and expertise. UniQuest delivers commercialisation outcomes that are valuable for UQ, and profound for business, the environment, global communities, and society as a whole: **www.uniquest.com.au**

RESEARCH SUPPORT

UQ SUPPORTERS

Thank you to all organisations and individuals who provide support for research at UQ. Special thanks to those listed here who contributed more than $100,000 in 2012.

AbbVie
ACTEW Water
Adenoid Cystic Carcinoma Research Foundation
Agrichem
Alchemia
Agilent Technologies Australia
Alzheimer's Australia Dementia Research Foundation
Ambre Energy
Amgen
AMIRA International
Anglican Church Grammar School
Anglo American
Anindilyakwa Land Council
Anonymous (six donors)
ANZ Trustees
Aquafin
Archdiocese of Brisbane Catholic Education
Aroma New Zealand
Arrow Energy
Arthritis Foundation of Australia
Arthritis Queensland
Asian Office of Aerospace Research and Development
Association for International Cancer Research
Australian Agency for International Development
Australian Antarctic Division
Australian Cancer Research Foundation
Australian Centre for Health Services Innovation
Australian Centre for International Agricultural Research
Australian Centre for Plant Functional Genomics
Australian Coal Association Low Emissions Technology
Australian Coal Research Limited
Australian Egg Corporation Limited
Australian Food and Grocery Council
Australian Genetics Testing
Australian Housing and Urban Research Institute
Australian Institute of Nuclear Science and Engineering
Australian Liver Foundation
Australian National Low Emissions Coal Research and Development
Australian Red Cross Blood Service
Australian Renewable Energy Agency
Australian Research Council
Australian Sports Commission
Australian Wagyu Association
Australian Water Recycling Centre of Excellence
Autism Queensland
Baker IDI Heart and Diabetes Institute
Baosteel Group Corporation
Bayer BioScience
Beijing General Research Institute of Mining and Metallurgy
BHP Billiton
Bill & Melinda Gates Foundation
Bioenergy Plantations Australia
Biomatters
Bioplatforms Australia
Bioproton
Boehringer Ingelheim International
Boeing Defence Australia
Andrew Brice, AM, and Jennifer Brice
Bristol-Myers Squibb
Bruker BioSpin
Bupa Health Foundation
Cynthia F Burnett
Burnett Mary Regional Group for Natural Resource Management
Canadian Institute for Advanced Research
Cancer Australia
Cancer Council Queensland
Carbon Synergy
CAST CRC
Catlin Group
Centennial Coal
Christopher Y Chen
Children's Health Foundation Queensland
CITT Technologies
Colgate-Palmolive
Colonial Foundation Limited
Comcare
Commonwealth Scientific and Industrial Research Organisation
Cotton CRC
Cotton Research and Development Corporation
CRC Beef
CRC for Advanced Composite Structures
CRC for Contamination Assessment and Remediation of the Environment
CRC for Greenhouse Gas Technologies
CRC for Optimising Resource Extraction
CRC for Polymers
CRC for Rail Innovation
CRC for Water Sensitive Cities
CRCMining
CSL
Dairy Innovation Australia
Danisco
Robert W Day
Dendright
Department of Agriculture, Fisheries and Forestry (QLD)
Department of Communities, Child Safety and Disability Services (QLD)
Department of Defence (Federal)
Department of Education, Training and Employment (QLD)
Department of Energy (US)
Department of Energy and Water Supply (QLD)
Department of Environment and Heritage Protection (QLD)
Department of Families, Housing, Community Services and Indigenous Affairs (Federal)
Department of Health and Ageing (Federal)
Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education (Federal)
Department of Justice and Attorney-General (QLD)
Department of Natural Resources and Mines (QLD)
Department of Planning and Community Development (VIC)
Department of the Premier and Cabinet (QLD)
Department of Primary Industries (NSW)
Department of Resources, Energy and Tourism (Federal)
Department of Science, Information Technology, Innovation and the Arts (QLD)
Department of Sustainability and Environment (VIC)
Department of Sustainability, Environment, Water, Population and Communities (Federal)
Department of Transport (VIC)
Department of Veterans' Affairs (Federal)
Diabetes Australia Research Trust
District of Columbia Water and Sewer Authority
Diversionary Therapy Technologies
DMTC
The Dow Chemical Company
Dyno Nobel Asia-Pacific
Ecobiotics
Elanco
Eli Lilly Australia
Energex
EnGeneIC
Environmental Biotechnology CRC
Epilepsy Research Foundation
European Molecular Biology Organization
The Faraday Institute for Science and Religion
Florey Institute for Neuroscience and Mental Health
Ian H Frazer, FRS, AC, and Caroline Frazer
Gallipoli Research Foundation
Garnett Passe and Rodney Williams Memorial Foundation
Garvan Institute of Medical Research

The Geriatric Medical Foundation of Queensland
Gladstone Ports Corporation
Glencore Xstrata
Gold Coast City Council
Golder
Grains Research and Development Corporation
Great Barrier Reef Marine Park Authority
Great Barrier Reef Foundation
Group of Eight
Health Workforce Australia
Healthy Waterways
Robyn Hilton
Kin-Man Ho
Horticulture Australia Limited
International Association of Oil and Gas Producers
International Human Frontier Science Program Organization
International Livestock Research Institute
International Maize and Wheat Improvement Center
Ipswich Hospital Foundation
James S McDonnell Foundation
JDRF
JEM Research Foundation Trust
John D and Catherine T MacArthur Foundation
Johnson & Johnson
KBR
King Abdulaziz City for Science and Technology
Hugh E Kunze
LEO Foundation
LEO Pharma
Leukaemia Foundation of Queensland
Lions Medical Research Foundation
Lowitja Institute
Magnetica
Mater Health Services
Mater Medical Research Institute
Mayne Bequest Fund
Meat and Livestock Australia
Medigen
Medtronic Australasia
Melbourne Water Corporation
Merchant Charitable Foundation, managed by Perpetual
Metabolix
Metso Minerals (Australia) Limited
Minerals Council of Australia
MMG
Molnlycke Health Care
Monsanto
Motor Accident Insurance Commission
Motor Accidents Authority of NSW
Motor Neurone Disease Research Institute of Australia
MS Queensland
Multiple Sclerosis Research Australia
Murdoch Childrens Research Institute
National Breast Cancer Foundation
National Climate Change Adaptation Research Facility
National Health and Medical Research Council
National Heart Foundation of Australia
National Institutes of Health
National Oceanic and Atmospheric Administration
National Stroke Foundation
Nature Conservancy
Newcrest
Newmont
Nihon Superior
NuNerve
Office for Learning and Teaching (Federal)
Oncology Children's Foundation
P&H Mining Equipment
PA Research Foundation
Pacific Seeds
Papua New Guinea Institute of Medical Research
Parker CRC for Integrated Hydrometallurgy Solutions
Pfizer Australia
Pioneer Hi-Bred
Plant Biosecurity CRC
Plantic
Polymers CRC
Pork CRC
Poultry CRC
Powerlink Queensland
Prince Charles Hospital Foundation Trust
Prostate Cancer Foundation of Australia
Protagonist
Provectus Pharmaceuticals
Q-Sera
QGC
QMI Solutions
Queensland Cyber Infrastructure Foundation
Queensland Emergency Medicine Research Foundation
Queensland Health
Queensland Institute of Medical Research
Queensland Schizophrenia Research Foundation
Queensland Skin and Cancer Foundation
Queensland Urban Utilities
Ramaciotti Foundation
RATCH-Australia
Reef and Rainforest Research Centre
Reserve Bank of Australia
Rio Tinto
Robert Wood Johnson Foundation
Roche Organ Transplantation Research Foundation
Royal Adelaide Hospital
Royal Brisbane and Women's Hospital Foundation
Royal Childrens Hospital Foundation
Rural Industries Research and Development Corporation
Sanofi-Aventis Australia
Santos
Science and Industry Endowment Fund
Sea World Research and Rescue Foundation
Seqwater
Shandong Fangyuan Nonferrous Metals Group
Shell
Shire
Sibelco
Rosamond M Siemon
Sir Robert Menzies Memorial Foundation
Snowy Hydro
South Australian Water Corporation
South East Water
SpinalCure Australia
St Andrews War Memorial Hospital
Trevor and Judith St Baker
Stanwell
Nicholas and Alison Stump
Sugar Research and Development Corporation
Sumitomo Chemical Company
Sydney Water Corporation
TB Sailors', Soldiers' and Airmen's Association of Queensland
Technological Resources Pty Ltd
Templeton World Charity Foundation
TenasiTech
The Arterial Compliance Project Trust
The Bryan Foundation
The Estate of Olive Jean Donaldson
The Estate of Walter Alexander Easterling
The Estate of Reginald Ferguson
The Estate of Kelvin David Garland
The Estate of Peter Goodenough
The Estate of Irene P Hunt
The Estate of Clem Jones, AO
The Estate of John and Sharnee Lillback
The Estate of Sir Edward Tooth
The Garvan Institute of Medical Research
The Helpful Foundation
The Historical Society, Boston
The RBWH District Innovation Fund
Therapeutic Innovation Australia
Alan Thiess
Toogoolawa Schools
Toowong Private Hospital
Translational Research Institute
UnitingCare Health
University of Queensland Endowment Fund
US Air Force
Vale
Vaxxas
Vestas Australian Wind Technology
Victor Chang Cardiac Research Institute
Visiting Medical Officer Liaison Committee
Water Research Foundation
WateReuse Research Foundation
Wellcome Trust
Wesley Research Institute
The JO and JR Wicking Trust
WIN Semiconductors
Graeme Wood, AM, and Annette Olle
Workplace Health and Safety Queensland
World Bank
Wound Management Innovation CRC
X Radiology Australia
Yarra Valley Water
Zafgen

SUPPORTING UQ

If you would like to make a gift (of any amount) to The University of Queensland to help fund facilities, programs, research or scholarships, please visit **www.alumni.uq.edu.au/giving** or contact UQ's Advancement Office at **advancement.office@uq.edu.au** or +61 7 3346 3900. You can designate your gift to a particular school or program, or leave it unrestricted to be used for emerging needs, such as the construction of new facilities, scholarships, innovative new programs, research or technology.

UQ SUPPORTERS

ARTS AND INNOVATION

SEEKING ASYLUM

IN THE PUBLIC EYE

SCIENCE “FACTION”

BECOMING MUSICAL

SEEKING ASYLUM

The donation of two large archives of letters and belongings of asylum-seekers to UQ's Fryer Library has inspired UQ researchers to interpret the collection and use the insights to question representations of asylum-seekers in the Australian media.

Professor Gillian Whitlock, from the School of English, Media Studies and Art History, says the asylum-seeker archives represent one of the few major collections available to researchers because other materials – for example in the National Library in Canberra – are not publicly accessible.

"As principal researcher, I have been working in the archives to interpret these materials as new resources for life narrative, most particularly how humanitarian activism reaches out to asylum-seekers and how their stories are told as a result," Professor Whitlock said.

"Images and accounts of asylum-seekers are carefully proscribed in the mass media, and these archives give insights into life in detention from the perspective of the asylum-seekers themselves."

Professor Whitlock is assisted by UQ Women's Postdoctoral Research Fellow Dr Leili Golafshani whose research focuses particularly on gender and the place of women in the Nauru centre.

She has spoken on these issues at a series of conferences overseas and is able to read letters in Dari that are an important part of the collection – and to connect UQ researchers with the local community of asylum-seekers and activists.

"To date, the project has provided new insights into asylum – in the detention centre and from the perspective of the asylum-seekers themselves. Articles that focus on items in the collection tell a story we may not expect – for example, an exquisite embroidery turns out to be the work of a 20-year-old Muslim man, 'Daoud', and a hand-drawn map of the Nauru detention centre allows detainees and activists to communicate about everyday life in detention despite cultural differences," Professor Whitlock said.

"The detention centres are closed worlds to which we have little access; however, the limited opportunities that asylum-seekers have to represent themselves are important and deserve attention.

"More generally, the project contributes to research on representations of asylum seekers and refugees internationally.

"The research feeds into work on humanitarianism and human rights, and into fields such as research on life narrative in art history, museum studies and literature. Internationally, there is very little attention to representations of refugees and asylum-seekers. In this way, the project connects to diverse fields of research in the humanities and social sciences.

"Speaking and publishing about asylum-seekers internationally (in the US and the UK) at conferences and in publications has been important for both of us as a way of including these Australian resources in the international field that is called migration studies.

"A new element in the project occurs with the reopening of the Nauru Centre last year, and we are now working on how a Facebook page organised by the asylum seekers adds to the hard copy archive we have – i.e. what difference social media makes now."

The Fryer Library archives were donated by Julian Burnside and Kate Durham, and Elaine Smith, all of whom campaigned on behalf of asylum-seekers held at Nauru in the first iteration of the *Pacific Solution* from 2002–2007.

The archives consist of letters, photographs, cards, small gifts made by the asylum-seekers, and some artwork.

"The Burnside/Durham collection also has one of the most significant contemporary artworks of human rights activism in Australia: Kate Durham's *SIEV X*, which has more than 100 small panels to commemorate the drowning of hundreds of asylum-seekers in the SIEV X tragedy," Professor Whitlock said.

In mid-2011, in association with the project, UQ's Fryer Library hosted a symposium to recognise the donors, and members of the asylum-seeker community who participated.

A new artwork, *Protection* by Ross Gibson and Carl Warner, was commissioned by the UQ Art Museum and featured in a special exhibition of images of asylum-seekers held between June and August 2011.

Recognition of the donors and the production of new artwork generated by the collection were important ways UQ had been a good host to these major archives for research, Professor Whitlock said.

SEEKING ASYLUM

REPRESENTING ASYLUM-SEEKERS

UQ researchers: Professor Gillian Whitlock, Dr Leili Golafshani (School of English, Media Studies and Art History)

Funding source: Australian Research Council Professorial Fellowship

Email: g.whitlock@uq.edu.au

Web: www.emsah.uq.edu.au

IN THE PUBLIC EYE

In an era where technology for capturing personal information continues to develop at a rapid pace, how to handle this information is an increasingly pressing issue.

Dr Mark Andrejevic, ARC QEII Fellow and Deputy Director of UQ's Centre for Critical and Cultural Studies, says the issue is particularly important given organisations' growing ability to use the data for their own purposes.

"Increasingly, we carry with us and interact with a range of devices that create a detailed digital portrait of the activities of our daily lives, our communication with others, our movements through the course of the day, and our online wanderings and musings," he said.

"This data trove is fast becoming both an economic asset for companies like Facebook and Google, and a resource for marketers and law enforcement.

"It's not just the large amount of data that changes the rules of the game; it's also new techniques for making it useful – that is, for storing, sorting and mining it.

"Up until relatively recently, organisations could collect large amounts of information, but could not do much with it. All that is changing dramatically."

To address this, Dr Andrejevic has launched the Personal Information Project: the first in-depth look at Australian attitudes toward the collection and use of their personal information in the digital era.

Thanks to a QEII Research Fellowship from the Australian Research Council, the project currently hosts a five-year study that is examining consumers' understanding of the monitoring process, their information management practices, and the controls they would like to have over the use of their information.

Initial findings from the nation-wide survey indicate a high level of support for public policies strengthening people's control over how their information is collected and used.

"The results so far indicate a growing awareness about information collection practices and a combination of concern and frustration directed toward increasingly pervasive forms of data collection and monitoring," Dr Andrejevic said.

"The research has attracted the interest of privacy commissioners at the state and federal levels, as well as the international academic community, where research on surveillance and data mining is a growing research area."

Dr Andrejevic plans to expand the research to include collaborations that explore attitudes toward data collection and tracking in schools, and the development of new sensor technology for uses ranging from security and policing, to disaster management and journalism.

"As the technology changes and new practices emerge, we need our understanding of public attitudes and preferences to keep pace so public policy and information technology is developed in accordance with Australia's democratic values and commitments," he said.

IN THE PUBLIC EYE

THE MONITORED AUDIENCE: PROTECTING PERSONAL INFORMATION IN THE DIGITAL AGE

UQ researcher: Dr Mark Andrejevic (Centre for Critical and Cultural Studies)

Funding source: Australian Research Council Discovery Project

Email: m.andrejevic@uq.edu.au

Web: http://cccs.uq.edu.au/personal-information-project

SCIENCE "FACTION"

Science facts that looked like science fiction: this is what Australian newspaper readers enjoyed between 1961 and 1979.

Created by Professor Stuart Butler from the University of Sydney's School of Physics in collaboration with ABC documentary-maker Robert Raymond and cartoonist Andrea Bresciani, *Frontiers of Science* was published every weekday as a three- to four-panel illustrated strip that explained scientific principles and theories – such as radiation and relativity – to a general newspaper audience.

The comic-strip was syndicated to more than 200 newspapers worldwide.

According to Drs Joan Leach and Maureen Burns from the School of English, Media Studies and Art History, this may make it the most widely distributed science popularisation ever. For this reason, they are using it to map international networks of science and scientists, and to determine how current issues such as climate change and water scarcity became problems for science during the '60s and '70s.

"In the 1960s, man went to the moon, birth control became possible for women, and we were becoming aware of our environmental impact. It was a very exciting time and all these big science discoveries had to be sold to the public somehow. Comics became a deceptively simple solution, as they can seem straightforward but can be interpreted in complex ways," says Dr Leach.

"It might sound quirky, but *Frontiers of Science* has a lot to tell us about how audiences are produced for science."

Drs Burns and Leach are currently looking through the archive to identify key themes and the projects that most captured the public imagination.

"*Frontiers of Science* reminds us of more speculative projects that began with a lot of hype and never went anywhere – like the Mohole project, where we were going to dig inside the earth's mantle and dump all our rubbish down there, or Terraforming, where we were going to take the earth apart and orbit in space," says Dr Leach.

"While some of those kinds of ideas were interesting and fun, some were also a little sinister and worrisome. We are still dealing with the legacy of that," she says.

Drs Burns and Leach are producing a book that demonstrates how scientists have sold their ideas in the past, and hope to explain some of the economic and political contingencies of post-WWII scientific research when science could no longer justify its expenditure as essential to wartime activities.

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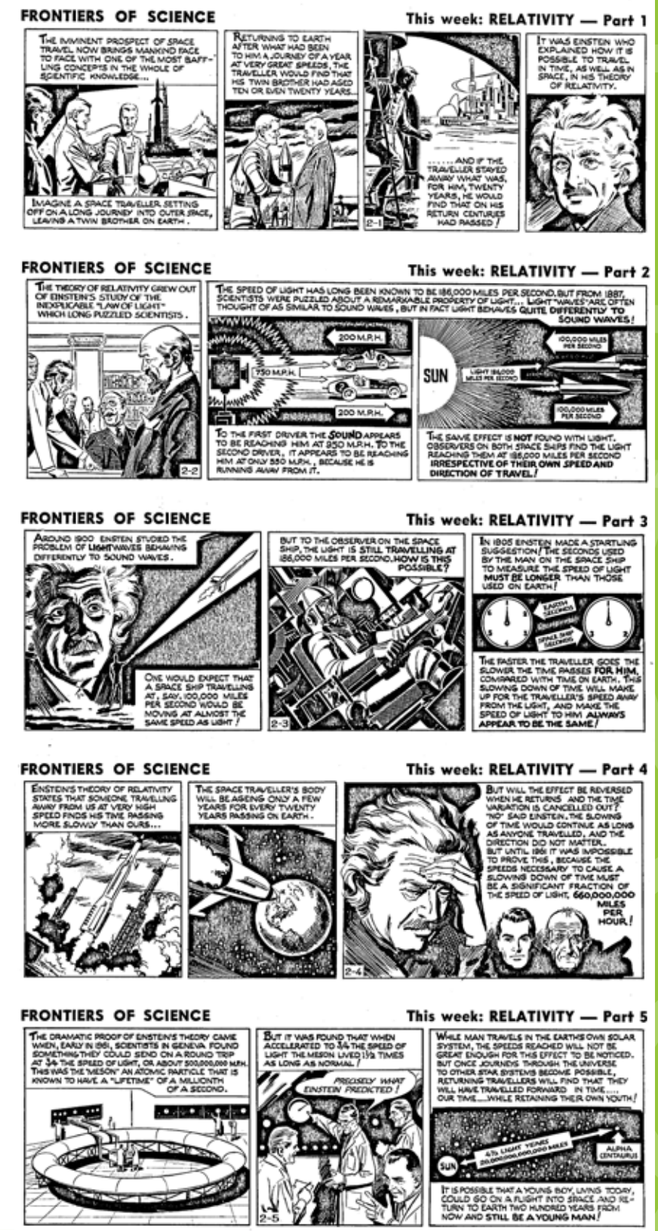

SCIENCE "FACTION"

FRONTIERS OF AUSTRALIAN SCIENCE POPULARISATION

UQ researchers: Dr Maureen Burns, Dr Joan Leach (School of English, Media Studies and Art History)

Funding source: Australian Research Council Linkage and Discovery grant

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BECOMING MUSICAL

According to legendary musician Bono, “Music can change the world because it can change people”, and nowhere is this more obvious than when watching children at play.

Early childhood is a period of rapid growth in which pathways for learning and life are mapped out through experiences in culture and community. Studies have shown that music has the power to shape human thought and activity; yet, surprisingly, there has been little formal research about young children’s early learning in and through music.

Professor Margaret Barrett from the School of Music wants to address this gap.

“My previous investigations in this field have demonstrated that, not only do children develop as musicians, but also that they use music as a way of engaging with their worlds,” she says.

Professor Barrett’s previous work has focused on children between 18 months and seven years of age.

“From quite a young age, children invent highly sophisticated compositions that demonstrate an understanding of music and song-making. Children use songs to express thoughts and feelings, to establish relationships with others, and to explore their identities in and through music.

“I want to find out what facilitates and constrains this early music-making and use.

“The current research will build upon my previous learnings to understand the role of family and communities in young children’s early music engagement,” she says.

“The development of a cultural ecological model of early music development will assist in identifying the ways we might draw on this unique human resource to foster human growth and development.”

“Play” may take on a whole new meaning...

BECOMING MUSICAL

BEING AND BECOMING MUSICAL: TOWARDS A CULTURAL ECOLOGICAL MODEL OF EARLY MUSICAL DEVELOPMENT

UQ researcher: Professor Margaret Barrett (School of Music)

Funding source: Australian Research Council Linkage Project grant

Partner organisation: Institute of Education, University of London

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HEALTHY PEOPLE

HEALTH ONLINE

Telehealth is the way of the future for delivering health services to far-flung communities, and UQ's Centre for Online Health (COH) is at the forefront of designing and trialling such services.

Established in 1999 as part of UQ's School of Medicine, the Centre has been recognised internationally for its work in the research, service delivery, education and training in the fields of telemedicine, telehealth and e-healthcare; and has recently received major federal funding to continue its research.

Three recent projects demonstrate the Centre's commitment to pioneering ways of delivering health services to people living in regional and remote areas – to reduce both the logistical difficulties and physical discomfort of the often vast distances they must travel to receive health care that city-dwellers take for granted.

Paediatric Intensive Care Unit (PICU)

In this world-first trial, telemedicine will be trialled as a way to attend to critically ill children in regional and remote areas before emergency evacuations.

The researchers will measure whether telemedicine consultations improve a child's condition before emergency teams arrive and whether the team spends less time stabilising the patient at the referring hospital before evacuation to the Royal Children's Hospital (RCH).

The multi-centre randomised controlled trial involves the RCH as well as selected hospitals that transfer the most critically ill children to the RCH in Brisbane each year – Redcliffe, Caboolture, Nambour, Bundaberg and Rockhampton.

Project leader Dr Nigel Armfield from the COH said the research grew out of a previous, award-winning study that examined the potential of telemedicine for distant consultations for critically ill newborns in Queensland.

"We hope to provide new evidence relating to the use of telemedicine for this vulnerable patient group. This evidence will be useful for both clinicians and health policy makers in Queensland and beyond," Dr Armfield said.

Princess Alexandra Hospital Online Outreach Services (PAH Online)

This project has involved the establishment of the PAH Telehealth Centre (based at the Hospital), enabling patients from regional and remote areas to engage in face-to-face consultations with specialists and clinicians.

The Centre, established as part of the $5.1 million Princess Alexandra Hospital Online Outreach Services project (PAH Online), saves patients the discomfort and logistical difficulty of travel to the nearest hospital or other treatment facility.

COH Director Professor Len Gray said that the Centre also strengthened existing partnerships between UQ and the PAH, allowing researchers to access medical expertise and utilise the Centre to conduct telehealth research.

"Systems and protocols have already been devised to enable consultations to operate on a regular, weekly basis," Professor Gray said.

"A formal evaluation has, to date, returned positive results in terms of patient satisfaction, remote hospital staff satisfaction and PAH consultant satisfaction.

"The goal is to have a fully fledged PA Telehealth Centre running at full capacity – in other words, providing around 8000 telehealth consultations a year – within five years."

Health-e-Regions

This project involves the establishment of a telehealth service for patients living in the Western Downs region of Queensland, in particular Dalby, Chinchilla and Miles.

As with other telehealth services, the project will help save people the cost burden and logistical difficulties involved in travelling long distances to visit specialists or attend hospital consultations.

A comprehensive range of telehealth services will be developed for a variety of specialties including general paediatrics, dermatology, endocrinology and geriatric medicine.

Project leader and Deputy Director of the COH Associate Professor Anthony Smith said that the current project had evolved from a 2012 scoping study which identified a range of opportunities to expand telehealth.

"Telehealth services improve access to specialist services which otherwise would not be readily available, saving patients the stress and cost of time away from home," Associate Professor Smith said.

"We are developing a 'whole-of-community' telehealth service which facilitates interactions between public hospitals, general practice and aged care facilities. The service models developed through our project will have potential value in other regional and remote communities throughout the country."

HEALTH ONLINE

HEALTH-E-REGIONS

UQ researchers: Associate Professor Anthony Smith, Professor Len Gray (Centre for Online Health, School of Medicine)

Funding source: QGC Health-e-Regions grant

Partner organisations: Queensland Government Department of Health, Darling Downs Hospital and Health Service, Darling Downs South West Medicare Local, Western Downs Regional Council

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PICU

UQ researchers: Dr Nigel Armfield, Associate Professor Anthony Smith, (Centre for Online Health, School of Medicine)

Funding source: Queensland Children's Medical Research Institute; Children's Hospital Foundation, Queensland

Partner organisation: Children's Health Queensland Hospital and Health Service

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Web: www.uq.edu.au/coh/paediatric-intensive-care-unit-project

PAH ONLINE

UQ researchers: Professor Len Gray, Associate Professor Anthony Smith (Centre for Online Health, School of Medicine)

Funding source: Australian Government Department of Broadband, Communications and the Digital Economy, Australian Government; Queensland Government Department of Health

Partner organisation: Metro South Hospital and Health Service

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HOPING FOR THE BEST

What do you do if your child has a mystery illness that has no name, no discernible cause and no cure? Call geneticist Dr Ryan Taft, that's what.

At least that's what Mr Stephen Damiani from Melbourne did when he discovered his young son had an unknown condition that was affecting his ability to walk.

Mr Damiani had been told by doctors that his son, Massimo *(pictured at right)*, was suffering from a leukodystrophy, a broad group of diseases that cause loss of particular cells in the brain and often premature death, but they had no specific diagnosis. And, without knowing the cause of Massimo's illness, they were unable to start devising a treatment.

Through a chance meeting via his local GP, Mr Damiani asked Dr Taft at the Institute for Molecular Bioscience to conduct a full genome sequence analysis of himself, his wife, and Massimo. He wanted Dr Taft to find out whether or not his son's condition was genetic and how it could be cured.

"Leukodystrophies – which mostly affect children – are caused by the loss of myelin around nerve cells and, in Massimo's case, they were hindering his development and causing spasticity in his legs," says Dr Taft.

"By charting billions of bases DNA, we discovered that a mutation in the DARS gene was responsible. We now hope to start work on a cure for this previously unknown condition."

Dr Taft and his team have named Massimo's disease HBSL (Hypomyelination in the Brain stem and Spinal cord leading to Leg spasticity) and plan to use similar methods to determine the causes of other rare diseases. They have already identified the genetic mutation behind another leukodystrophy, H-ABC, which is caused by mutations in the TUBB4A gene.

"Rare diseases affect up to half a million people in Australia, and 80 per cent are genetic in origin," he says.

"If we can find the cause, we can then begin work on modifying cells with damaged DNA and design tailored therapeutics.

"We want to bring hope to the thousands of children facing unresolved cases of rare genetic diseases, and see large-scale genome sequencing employed in the clinic as soon as possible.

"Where there's life, there's hope, and we hope to reduce the number of mystery diseases that cut short young lives."

HOPING FOR THE BEST

RARE GENETIC DISEASES IN CHILDREN

UQ researchers: Dr Ryan Taft, Dr Sean Grimmond, Cas Simons (Institute for Molecular Bioscience)

Funding source: UQ Foundation Research Excellence Award

Partner organisations: Children's National Medical Center, USA; Illumina, Institute of Metabolic Disease, Baylor Research Institute, USA; Mission Massimo Foundation; Royal Children's Hospital and Murdoch Children's Research Institute, Melbourne; VU University Medical Center, the Netherlands

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Multimedia:

Dr Ryan Taft

SLIP-SLIDING AWAY

Sugar, salt, fat, and secret chemicals: all the no-nos that make us say "yes-yes" to those not-so-healthy processed foods...

So what makes us crave those foods, and how can food manufacturers create equally tasty treats that are healthier? This is what Associate Professor Jason Stokes and his team in the School of Chemical Engineering are trying to find out.

Apparently, it's not just taste: it's all about rheology (the flow of matter) and tribology (friction, lubrication and wear). In other words, how food feels in the mouth – whether it crunches or sloshes, how it slides over the tongue, and what the actual sensation is both during and after the process of eating – is what makes it appealing or not.

"We are pulling apart the whole eating process to capture the physics of what happens at each stage," says Associate Professor Stokes.

"We are also investigating the role of saliva, and how the physical aspects of processed food translate to a sensory perception, particularly texture and mouth-feel. It seems that ingredients that are bad for you are the ones that provide the most pleasant mouth-feel – even minor reductions in fat and sugar content can have major impacts on consumer acceptance of a product!"

As well as wanting to help food manufacturers produce healthier food, Associate Professor Stokes and his team were inspired to conduct their research through previous experiments with skin cream.

"We discovered that by adding small amounts of oil to a cream and rubbing it down to a thin film, the whole 'feel' could be transformed from 'rough' to 'silky'," he says. "We are now engineering foods to behave in much the same way by controlling structure at the micron scale."

The team receives extensive industry support, and believes that major opportunities will arise in future as, currently, there are no techniques available that provide relevant information on texture and mouth-feel when food formulations are altered.

"We have found that the saliva coating on oral surfaces and its interaction with food has a substantial effect on mouth-feel and texture perception," says Associate Professor Stokes.

"For example, sour foods can boost the production of saliva whereas astringent foods (such as tea and wine, which contain lots of phytonutrients) and some mineral waters can make the mouth feel dry; and fat enables food to be swallowed more easily. If we can objectively measure the extent that such factors affect perception, we may be able to tailor foods for specific consumers."

So it would seem that eating is not simply a matter of taste, it's a scientific "slip-sliding-away" experiment in progress too.

SLIP-SLIDING AWAY

TOWARDS RATIONAL DESIGN OF HEALTHIER FOODS

UQ researchers: Associate Professor Jason Stokes, Dr Michael Boehm, Dr Gleb Yakubov, Nichola Selway, Aarti Tobin, Kiki Fibrianto, Heather Shewan, Marjan Javanmard, Dr Polly Burey (School of Chemical Engineering)

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GETTING BODIES MOVING

Find it hard to fit exercise into your day? Feel chained to your desk? Research from the School of Human Movement Studies may provide the answer to a healthier you.

Professor Jeff Coombes and his team are collaborating with world leaders in Norway to understand a new way of exercising that takes less time and provides maximum benefits.

High-intensity interval training (HIIT) involves alternating short periods of intense exercise with less intense exercise. These workouts can provide improved fitness, metabolic benefits and fat burning, with sessions taking as little as 30 minutes, two to three times a week.

Professor Coombes says HIIT can provide the same or better health benefits as the current recommendation of 30 minutes of continuous moderate-intensity exercise five to seven days a week.

"As a lack of time is the most commonly reported barrier to exercise, scientists have been working to develop a type of exercise that requires a small amount of time, yet still provides large health benefits," he said.

"Preliminary results suggest that high intensity interval training three times a week for 16 weeks can reverse high levels of blood pressure, blood glucose and cholesterol. We are working to confirm these exciting initial findings through a multi-centre international trial with 750 individuals."

Professor Coombes and his team are also looking at the benefits for people with chronic diseases such as metabolic syndrome, kidney disease and obesity. This follows recent findings that show HIIT could reverse diseases such as diabetes.

"So far, we have found that patients with metabolic syndrome and kidney disease can do high-intensity interval training: they enjoy it and it is safe," he said.

"We hope our research will provide more exercise options for people who want to prevent or manage their chronic disease."

An innovative device developed by another group of researchers from the School of Human Movement Studies may also help those who spend long periods of their work day sitting.

The "Sitting Pad" – designed and tested by PhD student Gemma Ryde as part of her thesis – easily fits onto office chairs to provide a real-time assessment of how long employees have been sitting uninterrupted at their desks, and prompts to get them off their seats.

This is important because research has shown that prolonged uninterrupted sitting at work increases the risk of chronic diseases and musculoskeletal problems, and may also reduce productivity.

Dr Nicholas Gilson – one of the researchers involved in the Sitting Pad project – says office employees, the largest occupational group in Australia, are particularly at risk due to the large proportion of time they spend sitting at their desks completing computer-related work tasks.

"Our work with the Sitting Pad has shown that Australian office workers spend close to six hours each day sitting at their desks, and that those who sit at their desk the most are three times more likely to be at risk of having a high waist circumference than those who sit at their desk the least."

But this sedentary behaviour could soon be a thing of the past, with the next phase of UQ's pioneering research focusing on the use of the Sitting Pad to provide timely interruptions, based on real-time data.

Dr Gilson believes the effectiveness of such interruptions could lead to widespread adoption of the Sitting Pad by companies whose employees are required to sit for long, uninterrupted periods each day.

"We hope to make the Sitting Pad widely available as a practical and cost-effective tool through which prolonged occupational sitting can be measured and self-managed in large groups of sedentary workers," he said.

"This could ultimately lead to improved health of employees, reduced costs for employers, and improved productivity and wellbeing in the workforce."

GETTING BODIES MOVING

HIGH INTENSITY INTERVAL TRAINING (HIIT) IN PATIENTS WITH CHRONIC DISEASES

UQ researchers: Professor Jeff Coombes, Dr Tina Skinner (School of Human Movement Studies)

Funding source: Norwegian Ministry for Health

Partner organisations: Norwegian University of Science and Technology, Translational Research Institute, Queensland Government Department of Health

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THE SITTING PAD

UQ researchers: Dr Nicholas Gilson, Gemma Ryde, Professor Wendy Brown (School of Human Movement Studies)

Funding source: National Health and Medical Research Council, UQ

Partner organisations: ChemCentre of Western Australia (CCWA), CRC Contamination Assessment and Remediation of the Environment (CRC-CARE)

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AGEING WELL

"Old age is like everything else: to make a success of it, you've got to start young!"

While Fred Astaire's view may not necessarily be true, it could well be the inspiration for several UQ researchers investigating different aspects of our ageing population.

In the Schools of Human Movement Studies and Psychology, Dr Nicola Burton and Professors Wendy Brown and Nancy Pachana are involved in the HABITAT project, a 10-year study examining the lifestyle, health and wellbeing of 10,000 people aged over 40 in 200 Brisbane suburbs, and detailing the local facilities and services available. The UQ team is responsible for the wellbeing, physical activity, sedentary behaviour and physical functioning components of the project.

"We are investigating how people change over time, and the individual and area-level factors associated with these changes," says Dr Burton.

"We are particularly keen to find out if physical activity can delay the onset of functional decline and disability in old age: we want to study people in everyday life so that we can recommend prevention strategies," she says.

The next stage of the project will focus on health outcomes – what predicts patterns of change, poor or healthy ageing, and positive or negative wellbeing.

Besides her work on HABITAT, School of Psychology's Professor Nancy Pachana is also co-creator – with Professor Gerard Byrne from the School of Medicine – of the Geriatric Assessment Inventory (GAI), a simple question-and-answer test designed to gauge how anxious older patients are.

"Anxiety is very common in older people – much more common than depression," says Dr Pachana, "but there has been little research on treatments, and even less on measuring it.

"Professor Byrne and I were inspired to develop the GAI out of sheer frustration: with no purpose-built, clinically useful and empirically validated anxiety-measure for older adults, it was very difficult for clinicians to distinguish other age-related processes from the physical and cognitive symptoms of an anxiety disorder," she says.

The inventory has clearly been a great success, having been translated into approximately 30 languages, and used in clinical trials and research studies across the globe where its sensitivity and specificity have been remarkably consistent.

Studying a cognitive age-related condition of a different kind are researchers in the newly established Clem Jones Centre for Ageing Dementia Research (CADR).

"We need radical new approaches to confront the tsunami of brain disorders that our society is facing," says Director of the Queensland Brain Institute, Professor Perry Bartlett, "and with Professor Jürgen Götz at CADR's helm, I believe we are on track to finding a cure for the disease that is the third leading cause of death in Australia."

CADR is Australia's first and only facility focused entirely on research into the prevention and treatment of dementia – a range of conditions characterised by impairment of brain functions including language, memory, perception, personality and cognitive skills. Alzheimer's disease is the most common, accounting for approximately 70 per cent of cases.

"Based on previous research, I am optimistic that we can find a cure for this devastating condition. We have already determined how the two key players, amyloid-beta and tau, pathologically interact, causing brain cells to die," says Professor Götz.

"The next step is to develop compounds for anti-Alzheimer's drugs, now that we have discovered the human brain is actually accessible to vaccination strategies."

While a cure for dementia is still in development, Professor Bartlett says there are a number of ways we can stave off Alzheimer's.

"Just as the HABITAT survey is uncovering, QBI's research also highlights the importance of physical exercise when it comes to maintaining a healthy brain," he says.

A study conducted by scientists in the Bartlett laboratory has found the mechanism by which exercise increases the number of stem cells that are actively generating new nerve cells in the brain and reverses the decline normally observed during the ageing process.

So perhaps Mr Astaire is right in starting young: with vaccinations, inventories and lifestyle assessments, we may all look forward to a "successful", healthy old age.

AGEING WELL

PHYSICAL ACTIVITY IS A KEY COMPONENT OF HEALTHY AGEING

UQ researchers: Dr Nicola Burton, Professor Wendy Brown, Professor Nancy Pachana (School of Human Movement Studies/ School of Psychology)

Funding source: National Health and Medical Research Council

Partner organisations: Queensland University of Technology, University of Melbourne

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GERIATRIC ANXIETY INVENTORY

UQ researchers: Professor Gerard Byrne, Professor Nancy Pachana (School of Medicine/ School of Psychology)

Funding source:
UQ new staff start-up grant

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CLEM JONES CENTRE FOR AGEING DEMENTIA RESEARCH

Director: Professor Jürgen Götz

Funding source: Clem Jones Estate, John T Reid Charitable Trusts, Helpful Foundation, G James Australia Pty Ltd, Queensland Government

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DEPRESSING NEWS

Depression has emerged as a red flag for a doubled risk of stroke among Australia's middle-aged women, according to a UQ study.

School of Population Health researchers Dr Caroline Jackson and Professor Gita Mishra have authored a study urging better and more targeted approaches for middle-aged women experiencing depression because of this increased stroke risk.

Dr Jackson discovered that, even after accounting for other risk factors such as high blood pressure and diabetes, middle-aged women suffering from depression were 1.9 times more likely to have a stroke than women who were not depressed.

"We need to raise awareness of depression to ensure there is adequate access to treatment and care across all age groups, and to encourage greater uptake of available treatment options," she said.

Drawing upon the Australian Longitudinal Study on Women's Health (ALSWH), a 12-year study of more than 10,000 Australian women aged between 47 and 52, Dr Jackson said her findings highlighted the serious impact poor mental health could have on physical health.

Funded by the then Australian Government Department of Health and Ageing, the ALSWH began with more than 40,000 women randomly selected from the Medicare database in 1996.

The women have been surveyed numerous times over the years, providing a large amount of data on their lifestyles, use of health services and health outcomes.

Dr Jackson said it was unclear why depression was so strongly linked to stroke in this age group, but it was thought the body's inflammatory and immunological processes and their effects on blood vessels may play a part.

"Current guidelines for stroke prevention tend to overlook the potential role of depression," she said.

This research is the first large-scale study to examine the association between depression and stroke in women aged in their 40s and 50s, but younger women could also be impacted by the results.

"The absolute risk of stroke for middle-aged women is still very low – about two per cent – but these results do suggest the impact of depression may be stronger on younger women," Dr Jackson said.

About a quarter of study participants were reported as being depressed, based on their responses to a standardised depression scale and recent use of medication for depression.

Dr Jackson said the research was driven by a need to further investigate the role of depression as a possible risk factor for stroke, particularly in middle-aged women.

"Further research is needed on women of different ages within the same population to help us identify how depression impacts their risk of stroke at different stages in life," she said.

The next step would be to use wider, international datasets to explore the age and gender differences in more detail.

The study was published in *Stroke: Journal of the American Heart Association* in May 2013.

DEPRESSING NEWS

LINKING DEPRESSION AND STROKE

UQ researchers: Dr Caroline Jackson, Professor Gita Mishra (School of Population Health)

Funding source: National Health and Medical Research Council

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A PAINLESS PUNCH

UQ researchers have developed a novel device that's taking the pain out of skin biopsies – and could lead to more efficient skin cancer diagnosis.

Currently, diagnosing skin cancer involves analysing a sample of the patient's suspicious mole or skin region. This sample or "biopsy" is taken using a biopsy punch, which is painful and often leaves scarring.

To address this, researchers from UQ's School of Medicine have designed an innovative microbiopsy device that can take a small sample of skin tissue about 0.3 mm across, compared to the usual sample of 3 mm or more. The procedure is quick, virtually painless, and does not require anaesthetic nor leave a scar.

The tiny tissue sample is then sent for genetic analysis, which is faster than traditional light microscopy methods and can diagnose cancer by detecting certain genetic mutations.

Dr Tarl Prow – one of the principal researchers and Chair and Director of UQ's Dermatology Research Centre – says dermatologists could use the device to monitor suspect skin regions across large skin areas, such as an entire back or forearm.

"The problem with traditional biopsy tools is that they can only be used to assess a few lesions per visit," Dr Prow said.

"In comparison, the microbiopsy technology enables the collection of multiple samples for molecular analysis, without the need for sutures or local anaesthetic. The very small punch size also enables precise targeting and makes it possible to study the molecular changes in a single lesion over time."

"Our vision is that microbiopsy devices will become routine clinical and research devices, improving the capacity for multiple lesion assessment without dramatically increasing healthcare costs."

As part of their research, Dr Prow and colleague Professor H Peter Soyer are collaborating with Associate Professor Marcel Dinger from the Garvan Institute and Associate Professor Rick Sturm from UQ's Institute for Molecular Bioscience.

Dr Prow says this collaborative approach aims to bring the technology to clinics with the broadest possible scope.

"By working with partners who have complementary technologies, we hope to identify core applications for this technology and ultimately enable commercialisation on a world scale."

A clinical setting isn't the only place Dr Prow envisages the microbiopsy device.

"We envision the device as an at-home diagnostic kit that can be sent in the mail and applied at home by consumers. The samples can then be mailed back to a centralised laboratory for analysis," he said.

"This will enable patients to have low-cost, personalised, point-of-care diagnostics within their own homes and at their own convenience."

"The device could also be used by clinicians to determine the efficiency of various skin cancer therapies," he said.

A PAINLESS PUNCH

MICRO-MEDICAL DEVICE DEVELOPMENT

UQ researchers: Dr Tarl Prow, Professor H Peter Soyer, Associate Professor Rick Sturm (School of Medicine/ Institute for Molecular Bioscience)

Funding source: Epiderm, Australian Research Council

Partner organisation: Garvan Institute

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BACKGROUND CHECK

"I want to see genetics make a difference in clinical practice: if we can diagnose and predict disease early, we can begin treatment early and so limit its effects – or even prevent it altogether."

These are the words of 2013 Premier's Science Fellow Professor Matthew Brown from the UQ Diamantina Institute (UQDI), a key partner in the Translational Research Institute, who researches the genetics of human diseases – both common and rare – to find out how genes cause disease and how they can be remedied.

So what inspired him to enter the field of clinical research in the first place?

"When I was training in rheumatology in the 1980s, there was significant debate about whether the best medications actually had any long-term benefit: patients clearly needed advances in treatment," Professor Brown says.

"I decided that my career would be better spent doing research rather than just being a full-time clinician. I had already seen the hope brought to families with cystic fibrosis when the genetic link was discovered and they were able to have antenatal diagnosis."

As a practising rheumatologist, Professor Brown focuses on bone and joint disease, particularly ankylosing spondylitis, a type of inflammatory arthritis that targets the joints of the spine and causes back pain and stiffness.

However, he and his team at UQDI within the Translational Research Institute have also studied many other diseases, including rheumatoid arthritis and tuberculosis, both of which share susceptibility factors.

"We use modern genetic technology (microarray SNP genotyping and massive parallel sequencing) to study the entirety of a person's hereditary information (genome) and so identify any disease-associated genetic variants. We then work on the molecular and cellular mechanisms by which those variants cause disease, and develop drugs to target them," he says.

One of his greatest achievements has been leading the team that identified 40 of the 41 true genetic associations with ankylosing spondylitis. This discovery completely changed how the medical profession thinks about the causes of the disease and has led to treatments going into trial that look to be highly effective.

And what does the future hold?

Naturally, Professor Brown would like to see a cure for ankylosing spondylitis. However, he also has a grander vision.

"Within the next five to ten years, I would like to see all babies having their genome sequenced at birth, rather than the current Guthrie (heel-prick) test that only checks for specific genetic conditions such as PKU and hypothyroidism.

"Armed with a full hereditary analysis, people could make informed decisions about their medical management for life."

BACKGROUND CHECK

GENETICS OF HUMAN DISEASES, PARTICULARLY ANKYLOSING SPONDYLITIS

UQ researchers: Professor Matthew Brown, Dr Nitish Agarwal, Linda Bradbury, Dr Brooke Gardiner, Dr Tony Kenna, Dr Paul Leo, Dr Gethin Thomas (UQ Diamantina Institute)

Funding source: Australian Research Council; Australian Government Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education; National Institute of Arthritis and Musculoskeletal Sciences; National Health and Medical Research Council; Wellcome Trust

Partner organisations: Royal Brisbane and Women's Hospital, Second Military Medical University, University of Oxford, University of Texas

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SOCIAL IMPACT

LEARNING THE WAY

SHINING BRIGHTLY

NETWORKING OPPORTUNITIES

SOCIALLY ACTIVE

JUSTICE FOR ALL

LEARNING THE WAY

"You learn something every day." How many times have we heard that? And if it's true, how does our brain actually cope?

UQ is a pioneer in the science of learning – an emerging discipline that unites researchers from education, cognitive psychology and neuroscience to provide a better understanding of how humans learn – and leads the recently launched ARC Science of Learning Research Centre.

"We are currently in the process of establishing an experimental classroom in which we examine the neuroscience of learning," says Professor Ottmar Lipp from the School of Psychology.

"By using brain imaging technology, we hope to identify how learning leads to changes in the brain, how experts differ from novices in the manner in which they solve problems, and how human behaviour is ultimately affected.

"We plan to identify effective learning strategies across a range of settings – from secondary school to massive open online courses – and discover what helps and what hinders the learning process," he says.

Based on a similar model in the US, the Centre was initiated as a key recommendation of the Prime Minister's Science, Engineering and Innovation Council Expert Working Group report *Transforming Learning and the Transmission of Knowledge (2009)*. The Centre will also involve a second experimental classroom at the University of Melbourne to investigate the social factors that facilitate learning.

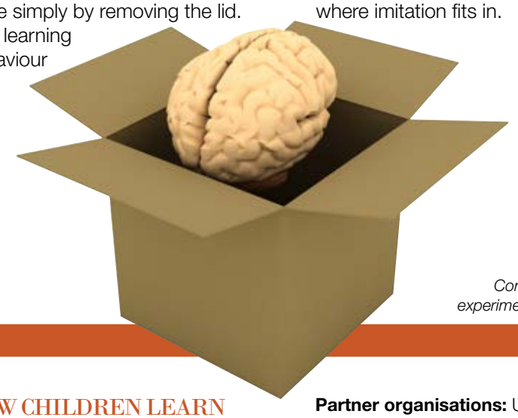
Another project that illustrates UQ's leading role in the science of learning is that of Dr Mark Nielsen from the School of Psychology and Dr Ilana Mushin from the School of Languages and Comparative Cultural Studies, who are observing learning behaviour in the field – literally.

"We have been studying three- to five-year-old children in Brisbane, in Borroloola (a remote Aboriginal community in the Northern Territory), and in San Bushman communities in southern Africa, to determine whether they learn better by imitation or innovation," says Dr Nielsen.

They found that children learn more rapidly when copying someone else, and will absorb the learning more deeply than if they learn through trial-and-error, even if they know the actions being demonstrated are redundant.

"We have discovered that children 'overimitate' as a social response: they want to be liked by others and to show that they are like others," continues Dr Nielsen.

"For example, if an adult deliberately wipes a stick along the side of a box before opening it, children will do the same, even if they are familiar with the box and know it can be opened more simply by removing the lid. This learning behaviour applies to all three cultures we have studied, which suggests that environment is not a factor."



The discovery is surprising because humans have become the dominant world species partly because of our capacity for cumulative culture, i.e. the ability to progressively incorporate innovations into society. "Copycat" behaviour would appear to be contrary to this, although may be considered highly adaptive when children are faced with a vast array of tools to be mastered.

Drs Nielsen and Mushin and their colleagues are now working on how tool innovation emerges and where imitation fits in.

Dr Mark Neilsen with a San Bushman child

Conducting the learning experiment in southern Africa

SCIENCE OF LEARNING RESEARCH CENTRE

UQ researchers: Professor Ottmar Lipp, Professor Pankaj Sah (School of Psychology/ Queensland Brain Institute)
Funding source: Australian Research Council
Partner organisations: Australian Council for Education Research; Charles Darwin, Deakin, Flinders, and Macquarie Universities; the Universities of Melbourne and New England

Collaborators: Benevolent Society, Carnegie Mellon University, Institute of Education (London), North Carolina State University, Queensland Department of Education and Training, Questacon, South Australian Department of Education and Child Development, University College London, Victorian Department of Education and Early Childhood Development

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HOW CHILDREN LEARN

UQ researchers: Dr Mark Nielsen, Dr Ilana Mushin (School of Psychology/ School of Languages and Comparative Cultural Studies)

Funding source: Australian Research Council Discovery grant

Partner organisations: University of KwaZulu-Natal, South Africa; University of St Andrews, Scotland

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SHINING BRIGHTLY

Like people, careers come in all shapes and sizes, and matching one to the other can be quite a challenge – particularly for those with an intellectual disability.

How do you plan for the future? How do you decide what and whether to study? Where do you find work? Should you volunteer? What hobbies can you take up?

Finding answers to these questions and more is the focus of *Constructing futures: an investigation into the aspirations of young adults with intellectual disability and their parents* research being conducted by the School of Education.

"In Australia, most people change jobs several times in a lifetime," says Associate Professor Monica Cuskelly.

"We want to find out whether acquiring the skills, knowledge and attitudes to be able to manage these career changes should be learned from an early age. We can then make recommendations to young adults with an intellectual disability, and their parents, to help them construct the best possible futures."

The team will be gathering data to analyse the supports and barriers for these adults aged between 16 and 30 when engaging in employment, volunteering and leisure activities over the long term, and how they are affected by personal, family and environmental factors.

"We are working with Endeavour Foundation – the largest provider of services for people with an intellectual disability in Queensland – and our aim is to help it and other support organisations to create services that reflect the goals of these young adults and their parents," says Associate Professor Karen Moni.

"Both parents and service organisations have expressed interest in supporting careers and life-long learning for these people and, at present, we just don't know how either group make decisions."

Currently, the team is in the first phase of a three-year project that has seen the launch of a **national online survey** for parents.

"This is a very exciting project that offers much hope for a shining, productive future," says Associate Professor Cuskelly.

SHINING BRIGHTLY

CONSTRUCTING FUTURES

UQ researchers: Associate Professor Monica Cuskelly, Associate Professor Karen Moni, Dr Mary McMahon, Dr Anne Jobling (School of Education)

Funding source: Australian Research Council Linkage grant

Partner organisations: Endeavour Foundation

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NETWORKING OPPORTUNITIES

Before transportation scheduling software is released for public use, it is vital that it has been thoroughly tested, but testing such software on real public transportation data sets is time-consuming, expensive and not necessarily thorough.

Virtual data sets can help with this testing process, but only if they realistically model actual transportation networks.

The enormous size and scope of real-life transportation networks, and the fact that they are constantly changing, create difficulties in using them to test software. A virtual transportation network, which guarantees the existence of particular configurations, would allow for less expensive and more thorough testing of journey-planning software.

Dr Barbara Maenhaut from the School of Mathematics and Physics specialises in graph theory, the study of mathematical structures used to model relationships between sets of objects. Graphs themselves are usually represented in drawing form as numbered dots *(nodes)* linked by lines or curves *(edges)*.

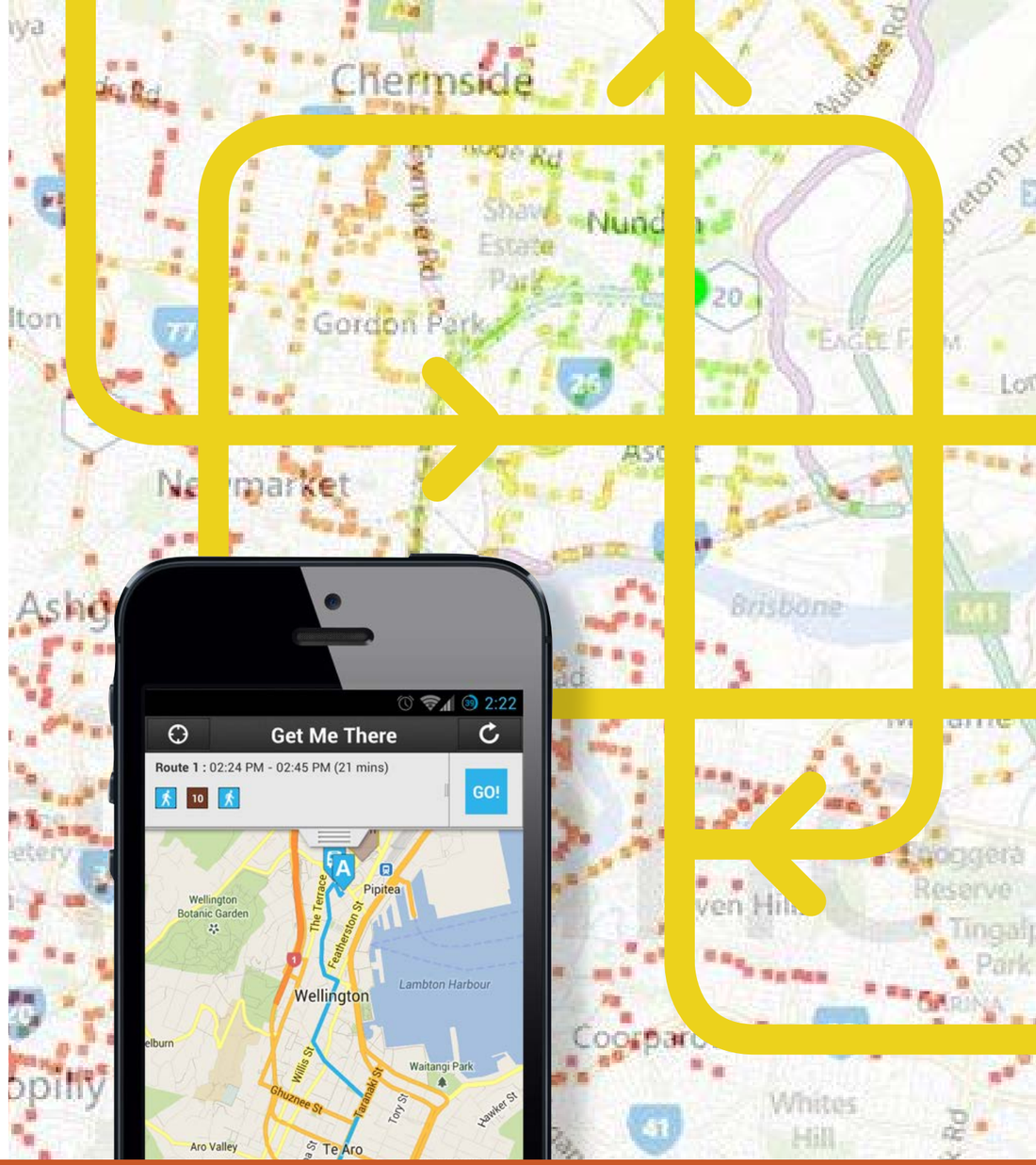
This makes her the perfect candidate to design virtual networks, such as for public transport and production-distribution, as she can use results from graph theory to analyse real-life networks and then build accurate models.

Drawing on her own networks, Dr Maenhaut is collaborating with former UQ colleague Dr Maithili Mehta at Jeppesen Australia.

"Jeppesen was struggling with the time required to test software changes because of the huge scale of the time-dependent data sets used in the testing process. When Dr Mehta suggested a graph theory solution, she called me," Dr Maenhaut says.

Dr Maenhaut is now happily devising algorithms to analyse the factors *(nodes, edges* and *subgraphs* in "maths-speak") particular to public transportation networks, and so make accurate models of transportation networks that are smaller and more manageable.

"The project is still in its infancy, but I am glad of the opportunity to help improve the maintainability and testability of Jeppesen's software products."



NETWORKING OPPORTUNITIES

DEVELOPING MATHEMATICAL MODELS OF PUBLIC TRANSPORTATION NETWORKS

UQ researcher: Dr Barbara Maenhaut (School of Mathematics and Physics)

Funding source: Australian Research Council Linkage Project grant

Partner organisations: Jeppesen Australia (Brisbane Office)
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SOCIALLY ACTIVE

Aristotle once said, "Man is by nature a social animal... anyone who does not partake of society is either a beast or a god".

In fact, according to Australian Laureate Fellow in the School of Psychology, Professor Alex Haslam, human sociability has been our chief evolutionary advantage.

"We have evolved to live in groups, to collaborate and cooperate," he says. "This is how we achieve great things. In many ways, the very meaning of life centres on the group – since life has no purpose if we are divorced from other people."

And the evidence supports him.

"We have conducted studies on older Australians showing how the simple act of joining a social group can substantially reduce the chance of a person becoming depressed.

"Indeed, in a recent study of several thousand participants conducted by Dr Tegan Cruwys, a postdoctoral research fellow in my team, we found that joining just one group reduced the risk of depression by 31 per cent – and that when people were in six groups, not one of them was depressed. No drug can ever be that cheap or that effective."

In other words, we can help avoid the "beastliness" of depression if we have strong links with others.

"But the groups must be ones you identify with," continues Professor Haslam.

"Whether joining a book-club, doing volunteer work, or even becoming involved in church activities (which in itself opens many social doors), being socially integrated appears to have major positive health implications, both physically and mentally.

"Interacting with others gives us a reason to engage cognitively. At the individual level, this can reduce the onset of dementia and, in the group context, social activity can provide meaning and purpose to life."

Professor Haslam believes his work – and that of his team – can answer some very important questions about humanity and help improve the world's wellbeing.

"We need to slay a few dragons. We need to understand things as diverse as how social factors affect health, why giving foreign aid is frowned upon, why women in leadership positions are vilified, and why people commit atrocities in the name of their group. This is not an easy task, but is very exciting and worthwhile."

In essence, Professor Haslam's work centres on questions of social identity: if we feel a sense of belonging, we will be more likely to support the causes of a particular group, as demonstrated through his recent analysis of Australian federal elections with postdoctoral research fellow Dr Nik Steffens.

"Our findings show that in the past 42 elections, 33 of the winners had candidates who spoke more in terms of 'we' than 'I'. This implies that, in cases of success, political leaders and the voting public had a sense of being joined together in a shared endeavour.

"This is a powerful message for those in the leadership training field: leaders need to represent and champion the group, as well as create and embed a sense of shared identity."

By using archival data and conducting controlled experiments with rigorous scientific methods, Professor Haslam hopes to continue developing the theory and its application to the challenges of social identity and groups. Exploiting such evidence-based "proof", he also plans to work more closely with health professionals in order to help improve patient wellbeing.

"I want to challenge the conventional wisdom of mainstream models of health and leadership, and make organisations healthier places in which to work, and society a better place in which to live," he says.

"Technology is not the key driver of life's positive experiences: we also need the joy of face-to-face interaction and the sense of being part of a community.

"I moved to The University of Queensland from the UK to collaborate with highly esteemed colleagues who share my passion for this work, and am enjoying the experience immensely.

"I am excited because I know we are in a position to make a real difference."

SOCIAL IDENTITY

The notion of a shared (social) identity is a recurring theme in all of Professor Haslam's work. Some of his major research includes:

1 THE BBC PRISON STUDY
(showing that individuals do not conform blindly or mindlessly to a role, but do so only when they have internalised it as a result of social identification)

www.bbcprisonstudy.org

2 THE NEW PSYCHOLOGY OF LEADERSHIP
(showing that leaders need to be seen as "one of us" and to be "doing it for us" in order to influence followers)

www.uni-kiel.de/psychologie/ispp/doc_upload/Reicher_leadership.pdf

3 THE GLASS CLIFF
(showing that women may break through the "glass ceiling" but once there, are often put in precarious management roles)

http://papers.ssrn.com/sol3/papers.cfm?abstract_id=734677

4 SOCIAL CURE
(showing that groups have a central role to play in health and wellbeing)

http://dcp.bps.org.uk/dcp/dcp-publications/clinical-psychology-forum/book-reviews/jetson-haslam-%26-haslam-the-social-cure$.cfm

SOCIALLY ACTIVE

SOCIAL CURE

UQ researchers: Professor Alex Haslam, Professor Jolanda Jetten, Professor Catherine Haslam, Dr Genevieve Dingle, Dr Tegan Cruwys, Dr Nik Steffens, Dr Katie Greenaway (School of Psychology)

Funding source: Australian Research Council, Canadian Institute for Advanced Research

Partner organisations: Canadian Institute for Advanced Research

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Web: www.psy.uq.edu.au/activity/researcher.html?rid=41

MULTIMEDIA:

You are the groups you belong to

Voices on Antisemitism – a podcast series

The Experiment – Critical Social Psychology

JUSTICE FOR ALL

"Fetal Alcohol Spectrum Disorder (FASD) is entirely preventable: we hope that through education and information-sharing there will be no FASD in the future."

Such strong sentiments can only be inspired by seeing the impact of such a disorder, and this is exactly what happened to Law School's Professor Heather Douglas.

"I was motivated to conduct my research after becoming aware of a legal case that involved the rape of a 10-year-old girl by nine males aged between 13 and 25 years," says Professor Douglas.

"The males were all convicted and many given prison terms, yet at no time during the case was it considered that the victim and several of the boys either had or probably had FASD. It seemed to me that by failing to consider this important issue, both the victim and the perpetrators had suffered an injustice."

FASD refers to a range of cognitive and physical impairments caused by exposure to alcohol before birth. It has been described as a "hidden" disorder because, while those affected usually look much the same as anyone else and often have similar IQs, they can have severe developmental disabilities – such as poor memory, low impulse control, and inability to link actions with consequences – and are highly likely to become enmeshed in the criminal justice and child protection systems.

Their diminished capacity to plead to offences and poor response to sentencing – in that deterrence is rarely useful and rehabilitation, in the usual sense, impossible – compound the problem.

"US and Canadian court systems acknowledge the vulnerability of FASD sufferers but that is usually not the case here," says Professor Douglas.

"We want to change that."

Having already surveyed lawyers and judicial officers to discover their limited awareness of FASD, Professor Douglas and her team are now investigating the outcomes of drinking during pregnancy, and tracking the relationships between FASD, child development and child protection interventions. She has also helped to establish a UQ interdisciplinary group, the Collaboration for Alcohol Related Developmental Disorders (CARDD).

"Our work is already helping to improve the justice system," says Professor Douglas.

"We have informed a number of **government enquiries** and are now recommending a "model of care" for Indigenous Community Justice Groups.

"Ultimately though, we would like our work to be unnecessary – that would be real justice."

JUSTICE FOR ALL

FETAL ALCOHOL SPECTRUM DISORDERS (FASD) AND THE JUSTICE SYSTEM

UQ researcher: Professor Heather Douglas, Professor Wayne Hall, Dr Jan Hammill, Associate Professor Richard Brown, Professor John Mangan, Dr Peter Billings (School of Law/UQ Centre for Clinical Research/School of Economics/Business School)

Funding source: Foundation for Alcohol Research and Education (FARE), UQ Collaboration and Industry Engagement Fund

Partner organisations: FARE, Russell Family Fetal Alcohol Disorders Association

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SUSTAINABLE AUSTRALIA

VIRTUAL BOTANICAL

A bush on the screen is worth two in the book...

When rehabilitating land after mining, it pays to know what plants are native to a local area. Unfortunately, when working in the field, actual or pictorial samples may not always be available for botanists to compare – which is where virtual specimens can be more valuable than the proverbial bird in the bush.

Working with SilverBiology and using advanced digital processing techniques, scientists at UQ's Centre for Mined Land Rehabilitation are developing a comprehensive collection of digital plant images that can be used for ecological purposes: a digital herbarium that allows easy access to fragile plants, no matter the location.

Below: Vulnerable shrub Prostanthera stricta from NSW showing flowers on left, detail of petal on right

VIRTUAL BOTANICAL

DIGITAL HERBARIUM

UQ researchers: Nic McCaffrey, Dr Peter Erskine, Dr Andrew Fletcher (Sustainable Minerals Institute)

Funding source: Centennial Coal Company Ltd

Partner organisation: SilverBiology

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CRUSTY DISPOSITION

Just as microbes transform the surface of our skin, so too can they transmute the Earth's crust: the only difference is scale.

Welcome to the exciting world of geomicrobiology, an emerging science dealing with the microbial transformation of the Earth's surface – oceans, seas, lakes, sediments, soils, mineral deposits, rocks – and its geological impact.

The beauty of this science – and transmutations can indeed be beautiful – is the potential to solve some of the mining lifecycle "challenges", such as the development of new exploration methods, the recovery of metals from low-grade ores without using large-scale mining (preventing the production of waste itself), and land rehabilitation. For example, living organisms can be used to extract metals from ores without the use of cyanide, a toxic chemical used to recover metals from minerals.

"Although bacteria (microbes) may be tiny individually, when massed together they can have a profound effect on the Earth's systems, as we can see in weathering environments, underground mineral seams, and their contribution to the formation of ancient 'biogenic' rocks," says Professor Gordon Southam, Vale-UQ Geomicrobiology Chair in the School of Earth Sciences.

"We can use this knowledge to our advantage and make a real difference in the energy-production industry," says Professor Sue Golding from the School of Earth Sciences.

"At the moment, we are investigating the possibility of producing gas from low-quality coal that would otherwise be economically and technically unfeasible," she says.

"Microorganisms can create methane from coal, making energy generation from coal cleaner and more sustainable, and essentially transforming unusable coal into a renewable resource."

The team is also developing innovative methods for gold exploration.

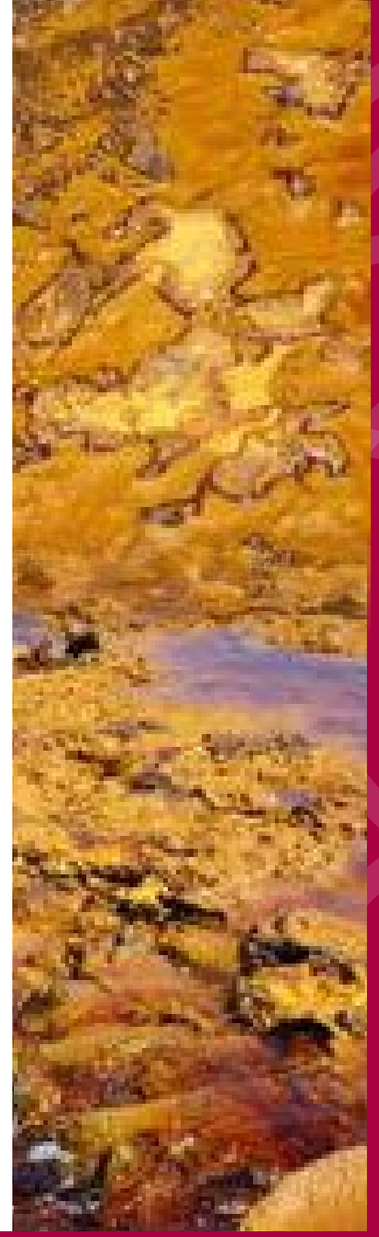
"By observing the microbial weathering of gold-bearing sulphides and gold grains, we will improve our understanding of how gold is dispersed in the 'halo' around its source," says Professor Southam.

"We can then recommend improved ways of sampling soils and sediments that will be less expensive, less invasive and more reliable."

UQ is fortunate to be working in partnership with one the world's largest mining companies, Vale, to help realise its goal of harvesting microbial processes.

According to Professor Paulo Vasconcelos, Head of the School of Earth Sciences, "We can now advance our discoveries in technology and development to the pilot stage using Vale's global sites, conducting experiments at scales that just aren't possible in university laboratories.

"This benefits both industry and research, and helps us formulate the most economically viable and sustainable processes for the mining sector."



CRUSTY DISPOSITION

GEOMICROBIOLOGY

UQ researchers: Professor Gordon Southam, Professor Paulo Vasconcelos, Professor Sue Golding, Professor Joan Esterle, Professor Gregory Webb, Dr Gene Tyson, Dr Huilin Xing, Professor Victor Rudolph (School of Earth Sciences/ Australian Centre for Ecogenomics/ School of Chemical Engineering)

Funding source: Vale Brazil, Vale Australia, Queensland Government Science Investment funding, Australian Research Council Discovery grant, Carbon Management Canada

Partner organisation: Vale

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Web: www.earth.uq.edu.au/node/4884/463

GREEN POWER

By 2050, the global population is set to increase to nine billion people who, collectively, will need 70 per cent more food, and 50 per cent more fuel and water than we do currently. Microalgae can help provide this.

According to Director of the Solar Biofuels Research Centre Professor Ben Hankamer, microalgae – single cell green algae – offer one of the most promising ways to provide for a fuel and food future, and address current food versus fuel concerns as they can be produced on non-arable land. Clean water is a valuable by-product.

"The Solar Biofuels Consortium and its industry partners, KBR, Neste Oil, Siemens and Cement Australia, have brought together biologists and engineers to produce algae biomass that consists of proteins, carbohydrates and oils," he says.

"The harvested algae biomass can be used to produce food, fuel, chemicals, and other high-value products: it can be fed directly to animals; can be converted into high-value compounds such as neutraceuticals and medicinally active products; and can be used in the production of aviation fuels, biodiesel, ethanol and hydrogen.

"Algae systems can also be used to treat waste water and for bioremediation (using micro-organisms to remove pollutants).

"The production of clean and renewable 'solar fuels' is one of the most urgent challenges society faces to reduce CO_2 emissions, increase energy security, and provide a sustainable basis for economic development.

"We need energy for everything that we do," he says, "so without long-term sustainable energy supply we cannot support our global economy."

Professor Hankamer's team is focused on optimising algae strains and production systems to maximise production yields and quality – and minimise costs.

"Working with several partners, we are developing advanced strains and systems that maximise our solar energy to chemical energy conversion efficiency," he says,

"We have already spent many years in the lab determining which microalgae are the most prolific biomass and fuel-producers, and have worked extensively on defining the principle for high-efficiency systems design. Our pilot-scale trials allow us to validate and improve systems before scaling up towards economic, demonstration-scale facilities capable of supplying increasing renewable-fuel demand for major consumers such as airline companies."

With more than 80 per cent of the world's energy demand being in the form of fuels, this green solution could literally help to power the future – and reduce our dependency on petroleum-based fuels.

A "bio-massive" bonus for all!

GREEN POWER

SOLAR BIOFUELS

UQ researchers: Professor Ben Hankamer, Dr Evan Stephens, Dr Ian Ross, Gisela Jakob, Juliane Wolf (Institute for Molecular Bioscience)

Funding source/Research partners: Queensland Government, KBR, Neste Oil, Siemens, Cement Australia, University of Bielefeld, Karlsruhe Institute of Technology, UQ

Email: enquiries@solarbiofuels.org

Web: www.imb.uq.edu.au, www.solarbiofuels.org, www.solarbiofuels.org/sbrc

Multimedia:

www.imb.uq.edu.au/algae-to-fuel-a-renewable-future

MARVELLOUS MELANIN

When we hear the term "melanin", we immediately think of skin pigment or eye colour, but UQ scientists have another take on the word.

According to Professor Paul Meredith from the School of Mathematics and Physics, melanin has the intriguing quality of being able to produce electrical current when exposed to light. It also conducts electricity – but only when wet!

This naturally occurring electrical material offers much potential as an environmentally friendly and biocompatible "bioelectronic interface", particularly in the area of medical sensors and devices.

Says Professor Meredith, "We used to think that melanin could be a good organic semiconductor. However, we have since found this is not the case and that the real truth is much stranger.

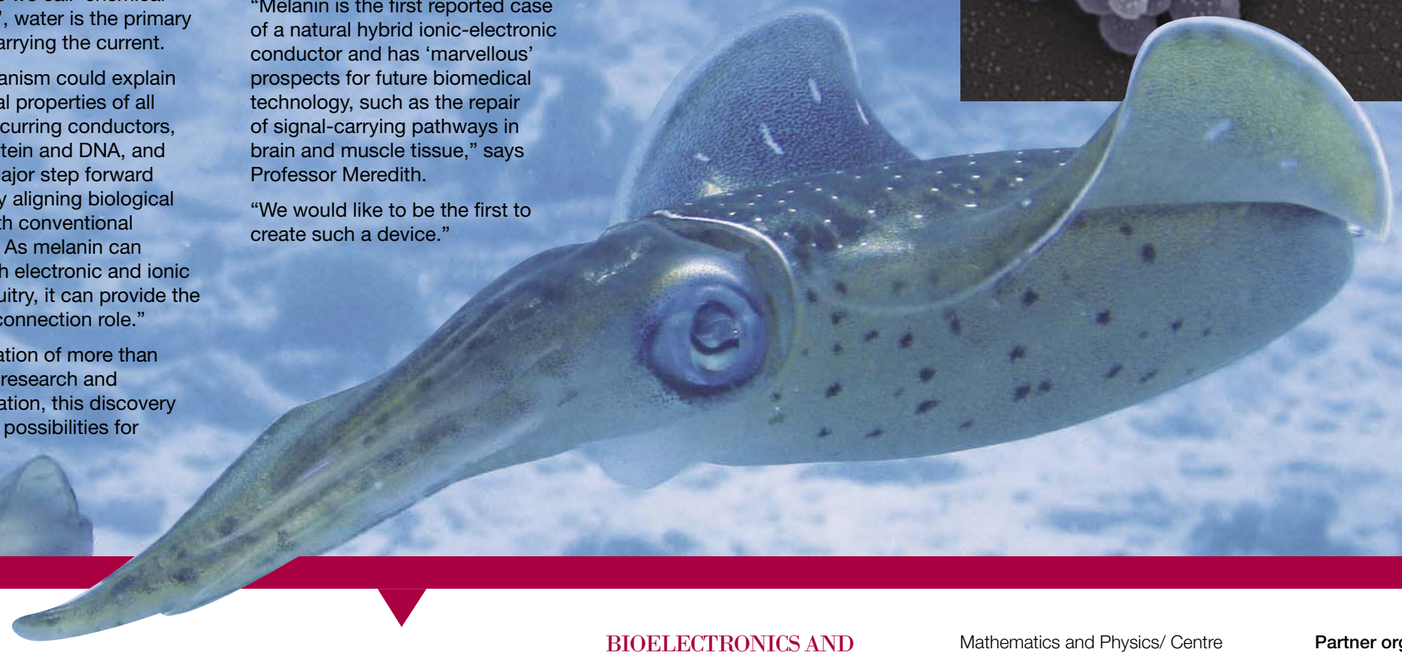
"Melanin derives its electrical properties from a chemical reaction with absorbed water that causes it to create protons and free electrons capable of producing an electrical charge. In a process we call 'chemical self-doping', water is the primary means of carrying the current.

"This mechanism could explain the electrical properties of all naturally occurring conductors, such as protein and DNA, and may be a major step forward in effectively aligning biological systems with conventional electronics. As melanin can 'talk' to both electronic and ionic control circuitry, it can provide the necessary connection role."

The culmination of more than 10 years of research and experimentation, this discovery is "igniting" possibilities for Professor Meredith and his team who now hope to test melanin's interface characteristics, and then develop bioelectronic devices.

"Melanin is the first reported case of a natural hybrid ionic-electronic conductor and has 'marvellous' prospects for future biomedical technology, such as the repair of signal-carrying pathways in brain and muscle tissue," says Professor Meredith.

"We would like to be the first to create such a device."



MARVELLOUS MELANIN

BIOELECTRONICS AND NATURALLY OCCURRING ELECTRICAL MATERIALS

UQ researchers: Professor Paul Meredith, Associate Professor Ben Powell, Professor Graeme Hanson, Professor Ian Gentle (School of Mathematics and Physics/ Centre for Advanced Imaging/ School of Chemistry and Molecular Bioscience)

Funding source: Australian Research Council Discovery and Linkage grant, Queensland Government Science Investment funding

Partner organisations: Jagiellonian University, Cracow; Lancaster University; Rutherford Appleton Laboratory Oxford

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WASTE NOT, WANT NOT

It's the ultimate in reverse garbage: biologically transforming waste into an entirely new product.

And it will reduce our carbon footprint in the long-term.

What we are talking about is the work of the School of Chemical Engineering in developing PHA bioplastics from material that would normally be thrown away.

Says Professor Peter Halley from the School of Chemical Engineering/Australian Institute of Bioengineering and Nanotechnology, "Polyhydroxyalkanoate (or PHA) bioplastics are plastics manufactured by using microbes to break down complex carbohydrates into simple sugars and fatty acids that are then consumed by bacteria to produce polymers that the bacteria store as an energy and carbon store for themselves.

"'Fermenting' a renewable energy source – such as waste from food- or sewage-processing plants – makes bioplastics a much better option for the environment than traditional petroleum-based plastics: they solve the problem of getting rid of unwanted waste, they clean up the environment, and they create less greenhouse gas."

Another advantage of breaking down unwanted organic matter for creating industrially relevant polymers is the money-making potential for its producers.

"Instead of having to purchase costly and dwindling 'new' carbon sources like petroleum, plastics producers can grow their own, or even be paid to retrieve waste material from other manufacturers," says Professor Paul Lant from the School of Chemical Engineering, "particularly as we have been able to produce a highly marketable new biopolymer.

"Our high-performance 'blocky' polymer has a unique macro-scale architecture that has a ten-fold increase in flexibility without any decrease in quality.

"We believe this will be of great value to a sustainable plastics industry."

What else makes UQ's discoveries so exciting?

"Unlike many other commercially produced biomaterials, the bioplastics we are generating will be both water-resistant and UV stable, which means they will be able to be used as a substitute for polypropylene and PET plastic products: water-bottles, packaging and stationery," says Professor Halley.

"Once certain performance issues have been resolved, our discovery has the potential to replace a wide range of current fuel-derived polymers," he continues.

A case of micro-engineering for major benefit...

WASTE NOT, WANT NOT

NEXT GENERATION BIOPLASTICS: PRODUCTION OF PHA BIOPLASTICS FROM ORGANIC WASTE

UQ researchers: Professor Paul Lant, Dr Stephen Pratt, Dr Bronwyn Laycock, Professor Peter Halley (School of Chemical Engineering/ Australian Institute for Bioengineering and Nanotechnology)

Funding source: Australian Research Council Linkage Project grant

Partner organisations: AnoxKaldnes, Sweden; Veolia Water

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HARNESSING HYDROGEN

Hydrogen is an attractive fuel source and is often considered a clean alternative to conventional fuels, but what is the best way to safely store and distribute it?

Finding the answer to this question are Associate Professor Kazuhiro Nogita and Dr Stuart McDonald, from the Nihon Superior Centre for the Manufacture of Electronic Materials (NS CMEM) in the School of Mechanical and Mining Engineering, who are working on overcoming the technical barriers involved in efficiently and safely storing hydrogen.

"Hydrogen is a highly flammable gas," says Associate Professor Nogita, "but it can be stored safely in solid form at room temperature to remain accessible when needed."

The challenge has been doing this in a way that is not cost-prohibitive.

"Our research has led to the development of a metallic alloy that can be easily manufactured and processed to store large quantities of hydrogen," he says.

Associate Professor Nogita and his team have discovered that by adding a range of elements (such as nickel or sodium) to magnesium alloys, they can engineer an effective, low-cost hydrogen storage material. The metallic alloy, which is solid at room temperature, releases hydrogen upon heating.

The team has also established that, in the event of accidental exposure to air, the storage alloy prevents uncontrolled hydrogen release through the spontaneous creation of protective oxidation.

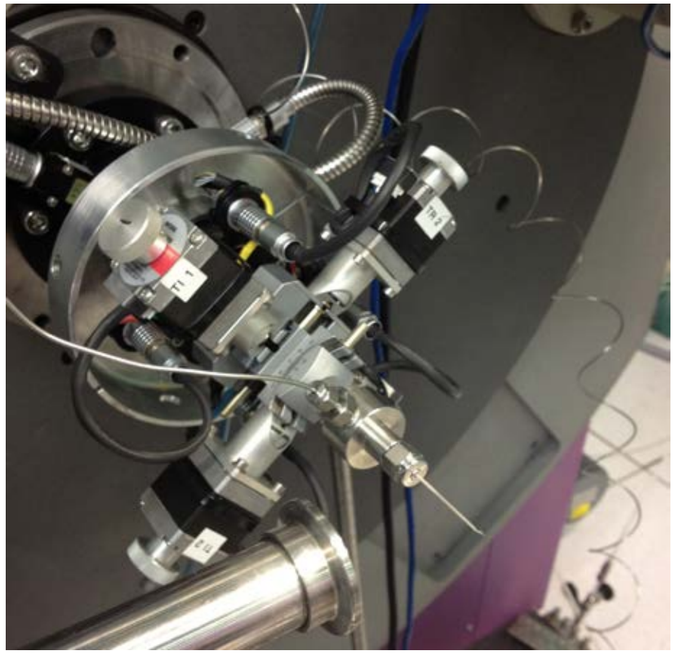
"We still need to improve our understanding of the relationship between alloy composition and storage properties so that we can develop better alloys. This can be done using analysis techniques such as high-voltage electron microscopy and **synchrotron** radiation," says Dr McDonald.

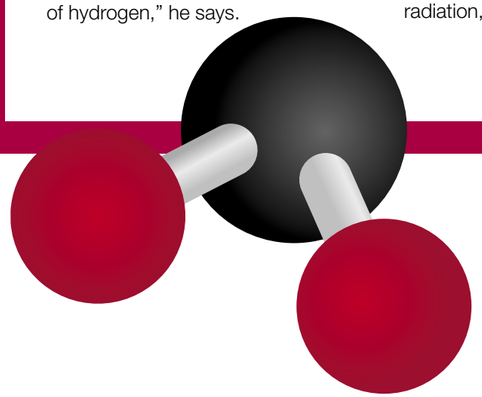
"We are currently looking at the alloy's microstructure to enhance its uniformity and so improve the hydrogen's transport capabilities to make it more commercially attractive."

Their research led to the launch of Hydrexia Pty Ltd (**http://hydrexia.com**), a spin-off company that uses novel hydride materials to make low-pressure hydrogen storage systems with high-storage densities that are safer and cost less than existing compressed gas systems.

"The next step is to produce recipes for a range of alloys that commercial foundries can manufacture with minimal further investment," says Associate Professor Nogita.

Both researchers hope their work will see the wider acceptance of hydrogen as a viable fuel source in future, for a range of consumer and industrial applications.





HARNESSING HYDROGEN

DEVELOPMENT OF HYDROGEN STORAGE MAGNESIUM ALLOYS

UQ researchers: Associate Professor Kazuhiro Nogita, Dr Stuart McDonald (School of Mechanical and Mining Engineering)

Funding source: Queensland Government Science Investment funding, UniQuest

Partner organisations: Australian Synchrotron, Hydrexia Pty Ltd, Kyushu University

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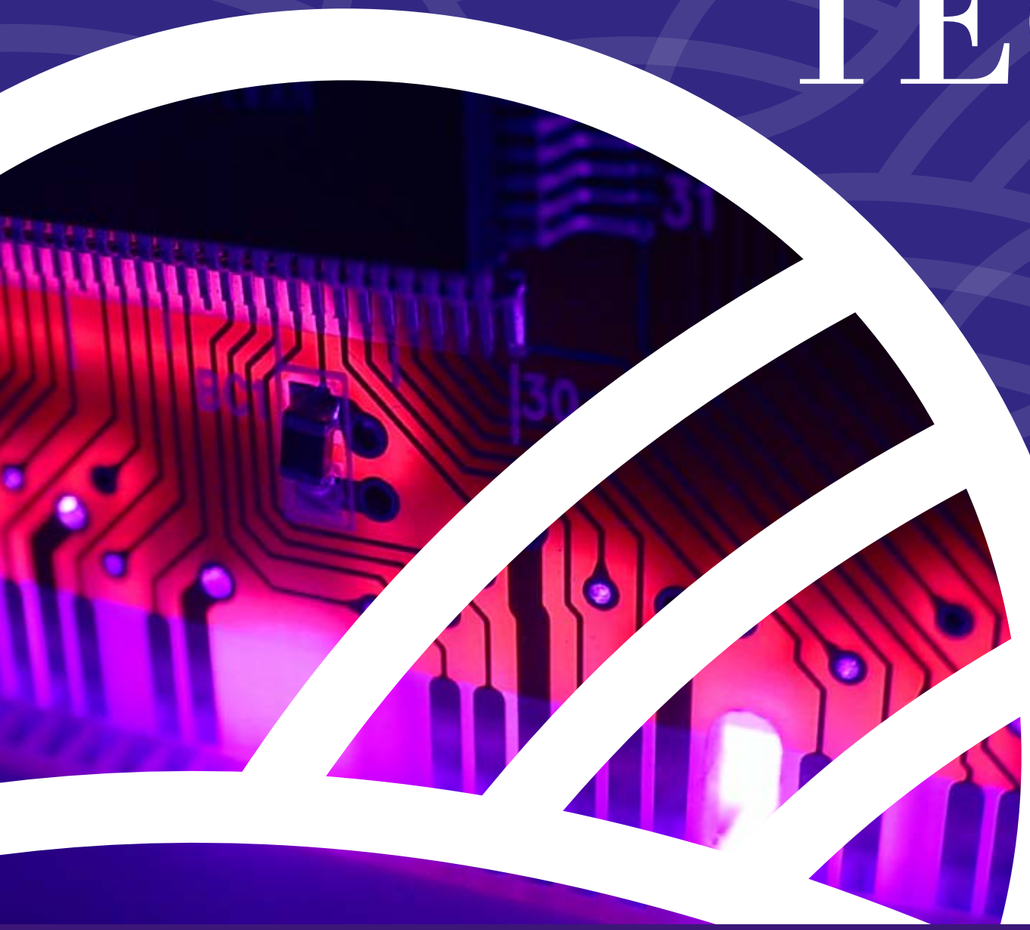
Web: www.mechmining.uq.edu.au/research-nihon-superior

TECHNOLOGY AND AGRICULTURE



KNOT A PROBLEM

Can unravelling the mysteries of knots help answer questions on the meaning of life? According to two senior mathematicians from the School of Mathematics and Physics, yes it can.

"Our ultimate goal is to produce practical software tools that can simplify research in geometry and, from there, DNA structure, microbiology, fluid flow and astrophysics – or, how the Universe itself is constructed," says Associate Professor Benjamin Burton.

"Mathematicians can then use these tools for large-scale exploration of spaces in higher dimensions, study billions of examples on supercomputers to find hidden patterns or unexpected departures from what is 'normal', and determine how best to proceed."

Despite great theoretical advances in the past 50 years, computational problems for knots remain extremely difficult for computers to solve.

Associate Professor Burton and his team study problems such as deciding whether a loop of string is tangled, or whether one knot can be morphed into another without cutting the string. These relate to two of the seven famous Clay Millennium Prize Problems in mathematics, and use techniques from a range of areas across pure and applied mathematics, computer science and engineering.

"Many of the most famous results in the area of understanding knots are in theory only and have never been coded on a computer," says Dr Jonathan Spreer.

"Indeed, the results are so complex that we could not code them even if we wanted to or, if we could code them, the resulting code would be so slow that we could never use it.

"We want to change that."

Combining pen-and-paper solutions with advanced computational programming, the team has already achieved great success.

"We resolved the famous Weber-Seifert dodecahedral space problem that had eluded mathematicians for 30 years, we have developed a practical method for testing 'knottedness', and we have for the first time identified what aspects of shape and space geometry (topology) determine how difficult a problem actually is," says Associate Professor Burton.

"We have developed significant practical breakthroughs for these computational problems and have high hopes for their future 'real-world' application: researchers across the spectrum will be able to use our software to access powerful mathematical machinery that has until now been inaccessible to them."

And perhaps these researchers will then be able to explain to all of us how the Universe really works…?

KNOT A PROBLEM

KNOTS AND SUPERCOMPUTERS: UNRAVELLING MYSTERIES IN DNA STRUCTURES, FLUID FLOW AND THE UNIVERSE

UQ researchers: Associate Professor Benjamin Burton, Dr Jonathan Spreer (School of Mathematics and Physics)

Funding source: Australian Research Council Discovery grant

Partner organisations: ENS Ulm, Oklahoma State University, PUC Rio de Janeiro, Royal Melbourne Institute of Technology, TU Berlin, TU Darmstadt, University of Melbourne, University of Sydney

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LEARNING THE LINGO

Imagine being a child and meeting another child who doesn't speak your language, but you still manage to chat because you invent your own words while playing "chasey"...

This scenario is exactly what scientists at the School of Information Technology and Electrical Engineering are exploring, except that the "children" are actually small robots programmed to play games and share language.

"We have built robots capable of inventing their own words for space and time through structured conversations," says lead researcher Professor Janet Wiles.

These Lingodroids, as they are called, trundle around the floor, navigating the terrain through inbuilt sonar combined with either a camera or a laser range finder, and "speak" via microphones using an alphabet of beeps that correspond with syllables.

"When two of them meet, they begin a conversation about where they are/have been/would like to go, and make arrangements for getting together later – even if they have never been to a particular place before," says PhD student Scott Heath.

"Using *Where-are-we?* as a starter, they plot their location and 'chat' about other places: *How-far?* or *What-direction?* And if they don't have the right word for a place, they invent one."

By sharing new words with each other, the vocabulary of both robots expands.

The Lingodroids invent place names by combining random two-letter syllables such as "ko" and "bu" (= "kobu") and thus can differentiate between different locations. They also have language for time, such as *What-time-is-it?* or *When-did-we-last-meet?*

"It may sound simple," says Professor Wiles, "but talking about spatial information is incredibly complex. Our aim one day is that Lingodroids will be able to learn words for space and time in any language."

And why is it important for droids to "learn the lingo"?

"Like people, Lingodroids will only improve if they share their invented words and communicate with others," says Professor Wiles.

"The social skills they require to understand these conversations has been the surprise finding of our research.

"Hopefully, one day this 'surprise' will see robots sharing with humans directly, understanding a range of languages, and being able to act in a diversity of roles such as carers, companions and butlers."

PhD student Scott Heath in the "Ozmap"

LEARNING THE LINGO

LINGODROIDS

UQ researchers:
Professor Janet Wiles, Scott Heath (School of Information Technology and Electrical Engineering)

Funding source: Australian Research Council Discovery Project and Linkage grant

Partner organisation:
Queensland University of Technology

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MULTIMEDIA:

Lingodroids at TEDxUQ presentation

SWEET DREAMS

To grow good crops, we need good soil... plus a lot of fertiliser, it seems.

Since the introduction of nitrogen fertilisers over a century ago, the world's food output per hectare has more than doubled, thanks to the boost in soil quality it provides.

The downside, however, is the excess nitrogen that gets converted into greenhouse gases or swept into waterways, upsetting ecosystems such as the Great Barrier Reef where it promotes outbreaks of the coral-killing Crown of Thorn starfish: a pervasive problem for crop production, including the world's largest, sugarcane.

Because low nitrogen levels equal low yield, sugarcane growers tend to add more fertiliser than is strictly necessary. Additionally, as sugarcane only absorbs on average around 50 per cent of the available nitrogen, much excess can ensue.

"As one of the world's fast-growing plants, sugarcane is a major food source and has enormous potential as a bioenergy and biomaterials crop, but to be sustainable it needs to use nitrogen more efficiently," says Professor Susanne Schmidt from the School of Agriculture and Food Sciences.

Working with industry collaborators, the UQ team is leading the way in the field of sugarcane nitrogen-use efficiency and is adopting a three-pronged approach to solving the pollution problems:

- identify sugarcane varieties that thrive with minimal nitrogen input
- investigate whether synthetic fertiliser can be replaced with organic waste matter
- evaluate the role of soil microbes for enhancing soil and crop health.

They have already discovered that sugarcane types differ markedly in their nitrogen efficiency, which affects how quickly they grow. And, in a world first, the team is currently evaluating how 64 commercial and ancestral sugarcane varieties perform with "recommended" and "much lower than recommended" nitrogen fertiliser rates, to identify which genotypes are the most efficient.

"Because sugarcane behaves more like a wild grass than a grain crop, we have also discovered that current fertiliser practices result in a nitrogen cycle that is out of synergy with the crop's physiology. Sugarcane discriminates against nitrate, a main form of nitrogen generated in fertilised sugarcane soils, which exacerbates pollution and greenhouse gas emission," says Professor Schmidt.

"We are now testing whether agricultural waste material such as sugar mill waste can be used to improve the soil's ability to deliver nitrogen."

Enhancing the soil from within is another area under investigation, with the team evaluating the complex microbial communities that drive soil processes and impact on plant growth.

"We want to discover whether manipulating microbial communities can improve soil function and crop yield," says Professor Schmidt. "We are lucky to have research leaders Professors Mark Ragan and Philip Hugenholtz contributing extensive knowledge and cutting-edge ecogenomics to this quest."

With an industry worth $2 billion per annum in Queensland alone, the economic benefits from this agricultural research are immense, but the ecological rewards for the planet are even more significant.

The dream for the future would be for farmers to be able to grow good crops in good soil needing only minimal fertiliser input: that would be sweet...

SWEET DREAMS

NEXT-GENERATION SUGARCANE PRODUCTION

UQ researchers: Professor Susanne Schmidt, Professor Philip Hugenholtz, Professor Mark Ragan, Dr Chanyarat Paungfoo-Lonhienne, Dr Nicole Robinson, Richard Brackin, Marin Westermann, Yun Kit Yeoh (School of Agriculture and Food Sciences/ Institute for Molecular Bioscience/ Australian Centre for Ecogenomics)

Funding source: Sugar Research and Development Corporation; James S McDonnell Foundation-UQ; Queensland Government; Australian Genome Research Facility; Bioplatforms; Australian Government Department of Agriculture, Fisheries and Forestry

Collaborators: BSES, Sucrogen, AGRF, Bioplatforms

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BUMPER HARVEST

With the world's population predicted to reach nine billion in just over 25 years, and land and water resources in decline, the United Nations recently estimated that more than 870 million people go hungry each day.

Addressing this issue are numerous UQ researchers who are working with groups across the globe to help boost food supplies by designing sustainable agricultural and food solutions for the future.

One such collaboration is between scientists from UQ's Queensland Alliance for Agriculture and Food Innovation (QAAFI), the Queensland Department of Agriculture, Fisheries and Forestry (DAFF), and the Ethiopian Government focused on improving the yield, quality and drought-resistance of sorghum.

Sorghum is a key part of the diets of more than half a billion people in some of the world's poorest areas, particularly in sub-Saharan African regions as well as in India.

Sorghum bicolour is a multi-purpose crop relied upon by disadvantaged communities, not only for food as either a grain or syrup, but also for fodder, construction material and cooking fuels.

Sorghum originated in Africa and is the fifth-most important cereal crop in the world today. Increasing interest is being shown in the crop because of its heat and drought tolerance.

Leading the research team are Associate Professor David Jordan, one of the world's foremost sorghum breeders, and sorghum crop physiology/modelling authority Professor Graeme Hammer, both from QAAFI.

"Sorghum is a very important crop but unfortunately it has not had the degree of investment other cereal crops such as wheat, maize and rice have had," Associate Professor Jordan said.

"This is most probably because it is grown as a food crop in more marginal agricultural areas in the developing world and used mainly as an animal feed in developed countries."

Funded by a $4 million grant from the Bill & Melinda Gates Foundation and in-kind resources from the Ethiopian Government, the UQ-led collaboration involves training Ethiopian scientists in plant-breeding better sorghum varieties and providing them with the systems and processes to continue the work in their own country.

"A further dimension of the research is understanding the drought-resistant mechanisms of sorghum such as root architecture so as to eventually benefit sorghum growers across the world," Associate Professor Jordan said.

This was of great importance because a sorghum crop failure due to drought in these regions often resulted in dire consequences for local populations including famine, he said.

The project was officially launched by Premier Campbell Newman in March this year at an event also attended by UQ's President and Vice-Chancellor Professor Peter Høj.

"UQ is very pleased to lend its strength as a global leader in agricultural research to a partnership targeting high-impact, practical outcomes for people internationally and at home," Professor Peter Høj said.

"The Gates Foundation's commission is testament to the outstanding combined expertise of UQ and DAFF researchers, especially those who focus on agriculture and sustainable food production."

BUMPER HARVEST

DEVELOPING DROUGHT-RESISTANT SORGHUM

UQ researchers: Associate Professor David Jordan, Professor Graeme Hammer (Queensland Alliance for Agriculture and Food Innovation*)

Funding source: Bill & Melinda Gates Foundation, Grains Research & Development Commission, Queensland and Ethiopian Government grants

Partner organisation: Queensland Department of Agriculture, Fisheries and Forestry

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PRIME BEEF

"Our target is to double Queensland's food production by 2040."

With world populations projected to possibly quadruple* in the next century, this recent statement by Queensland Premier Campbell Newman is no throwaway line. He means business.

However, with fewer farmers in the field, increased competition from overseas producers and diminishing returns from the land, this is no easy task.

Enter the Northern Beef Research Alliance (NBRA).

"The Queensland beef industry, worth around $4.5 billion annually, is the State's largest agricultural industry," says NBRA chief Professor Stephen Moore.

"The northern herd supplies 50 per cent of the nation's beef, three-quarters of Australia's live export cattle, and this year record exports of beef passed through the Port of Brisbane. Any improvements to the industry would have a major impact on the world's beef supply."

The aim of the NBRA is to bring together in a coordinated way the research expertise of three key institutions involved in animal-based agriculture, The University of Queensland, CSIRO, and the Queensland Department of Agriculture, Fisheries and Forestry.

Funded by research grants from state and federal government and industry, the NBRA coalesces leaders in beef cattle genetics, reproduction, nutrition, health, welfare and husbandry, and grazing land management, rural economics and business.

"The first Alliance area of activity will focus on beef genetics and genomic techniques," continues Professor Moore.

"We plan to dramatically improve the genetic merit of northern beef cattle by selecting for higher reproductive performance, as well as for other genetic traits such as the poll gene (which results in cattle without horns), through new breeding strategies and DNA testing."

The genetics and genomics work is just the first step of an integrated approach to address the beef industry's declining investment in research and development (R&D) which is affecting its productivity and profitability.

Step Two and beyond will focus on four of the seven components of the **National Beef Production R&D Strategy**:

- increasing natural resource use efficiency and sustainability, and reducing environmental impacts
- increasing cost efficiency and productivity (including adaptability and risk management)
- developing new and existing beef value chains leading to new and diversified markets
- aligning animal welfare practices with consumer and community expectations.

This will include research into cattle welfare, beef cattle nutrition, mitigation of greenhouse gas emissions, pest and disease management, and meat science.

So, with an increased focus on R&D investment – and the combined research strength of more than 100 NBRA scientists working in unison – the inevitable boost in beef output will certainly go a long way to "hitting the bull's eye" of the State Government's food production target.

**** United Nations Department of Economics and Social Affairs, Population Division, Population Estimates and Projection Section, World Population Prospects, the 2010 Revision***

*** Co-funded by the Queensland Government*

PRIME BEEF

NORTHERN BEEF RESEARCH ALLIANCE

UQ lead researcher: Professor Stephen Moore (Queensland Alliance for Agriculture and Food Innovation**)

Partner lead researchers: Dr Andrew Ash (CSIRO), Peter Johnston (Queensland Department of Agriculture, Fisheries and Forestry)

Funding source: Queensland and Australian Government, and industry sources

Partner organisations: CSIRO; Queensland Department of Agriculture, Fisheries and Forestry

Other collaborators: Animal Genetics and Breeding Unit (NSW DPI); Northern Territory Department of Primary Industries; James Cook University; Meat and Livestock Australia; Victorian Department of Primary Industries; University of New England; The University of Vicosa, Minas Gerais State, Brazil; The University of Alberta, Canada; Colorado State University, USA

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RESEARCH TRAINING

SCRAMSPACE GETS REAL

Three seconds of data may not seem like a significant return for three years of intensive research but, for UQ PhD student Philippe Lorrain, it is critical in Australia's quest to take control of its aerospace future and may alter the way we travel.

Mr Lorrain is a member of the internationally renowned SCRAMSPACE project that will launch a scramjet-powered vehicle 340 kilometres into space before returning it through the atmosphere at approximately eight times the speed of sound.

In contrast to conventional engines that are limited to approximately three to four times the speed of sound, hypersonic scramjets are capable of far greater velocity that may eventually exceed Mach 10.

In the future, the use of this technology could lead to significantly faster international travel – a flight between Australia and South Africa could take as little as 45 minutes, for example – and a globally respected Australian space program.

UQ is a lead partner in the SCRAMSPACE project that includes 13 organisations and institutions in Australia, the United States, Germany, Japan and Italy, and is funded by the Australian Space Research Program.

Mr Lorrain says that data the SCRAMSPACE team members receive before the vehicle's planned self-destruction is critical to their understanding of hypersonic flight and the future of the program.

"While we have some of the best ground-testing resources in the world here at UQ's Centre for Hypersonics, we don't know how accurate the testing is until we get data from a flight," Mr Lorrain says.

"We will be able to compare data from this flight with what we recorded in our shock tunnel here at UQ to see how accurately they match.

"If they do match, this will give us the confidence to use our ground-test facilities to design scramjets knowing that they will behave the same way in flight.

"This is far more cost-effective than having to rely on flights to keep the project progressing."

Mr Lorrain's research focuses on the combustion processes, and in particular how flow field structures that are dynamically produced within the engine can be used to develop greater efficiency.

"The successful operation of scramjets for access-to-space application will strongly depend on its capability to sustain efficient supersonic combustion while accelerating to greater speeds," Mr Lorrain says.

Australia is an internationally recognised leader in hypersonics research and Mr Lorrain says that, apart from faster travel, a domestic space industry would have a significant impact on the everyday lives of locals.

"Things we do every day, such as making phone calls or transferring money in the bank, often rely on satellites. At the moment, Australia relies on other countries for launching this technology and there is a push to take greater control of this.

"Using scramjets as part of rocket-based launch systems for satellites would reduce the cost significantly."

SCRAMSPACE GETS REAL

UQ GRADUATE SCHOOL

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UP-SELLING PHD

The ability to sell is not something a PhD student would normally think to include in their vast skill set, but respected industry consultant Edwin Trevor-Roberts says it is critical to pursuing a career outside of science and academia.

The CEO of the national Outplacement and Career Development consultancy **Trevor-Roberts** and a UQ PhD graduate, Dr Trevor-Roberts said PhD graduates possess important and transferable skills but often don't know how to pitch their worth to industry employers.

"PhD graduates have important skills that are in demand in business. They possess absolute tenacity and perseverance, and they have incredible determination and doggedness to finish what they have started," Dr Trevor-Roberts says.

"In addition, they also have higher order thinking, the ability to weave complex ideas together with abstract reasoning. Research graduates also don't make assumptions: they question how conclusions are reached. It is harder to pull the wool over their eyes."

While those skills are in high demand by industry employers, Dr Trevor-Roberts said several issues had resulted in few research degree graduates heading into business.

"There are business people who think PhD students only study philosophy because of the name of the degree, and don't realise these students are at the cutting-edge of research in a wide range of fields including their own," Dr Trevor-Roberts, who selectively uses the title 'Doctor' to avoid this type of misunderstanding, says.

"There are employers who feel threatened if they hire someone with a PhD, but there is also a real issue on the student side with many not understanding their own worth and how to properly sell their skills to employers.

"That is why the Career Advantage PhD Program at UQ is so important: it is teaching those critical skills around how to understand and communicate that value."

Dr Trevor-Roberts said institutions such as The University of Queensland were taking important steps to bridge the gap between research and industry.

"It is very important that UQ and the commercial world continue to integrate and partner together.

"The joint ventures, partnerships and research projects are critical as they foster a communication channel between those who don't quite understand what research is all about and those who do.

"The more those communication channels open up, the better it will be for both sides."

UP-SELLING PHD

UQ GRADUATE SCHOOL

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BOEING BACKS RESEARCH

Boeing is recognised around the world for its cutting-edge innovation and development, and the executive in charge of its Australian research portfolio says the important work undertaken by research higher degree students is integral to the company's performance.

Michael Edwards is Boeing's General Manager of **Research and Technology** in Australia, and says PhD students, including many from UQ, are a key part of his department.

"Boeing works closely with a number of universities across Australia, including The University of Queensland, because of their strong aerospace programs," Mr Edwards says.

"A quarter of the research staff in my area have PhDs and are a powerhouse of skills driving us towards our goals and achievements.

"Alongside other higher degree researchers, they work in fields as diverse as chemistry and material science, structural and mechanical engineering, autonomous systems, robotics, systems and software engineering, human factors, as well as mathematics and statistics."

Mr Edwards, who has a long history working alongside research higher degree students – having spent 11 years with CSIRO prior to joining Boeing in 2011 – says PhD graduates bring many tangible benefits to commercially driven organisations such as Boeing.

"When we recruit, we look for people who possess deep knowledge in their area of expertise and that is what you get with someone who has completed a PhD," Mr Edwards says.

"They are clearly well trained, very disciplined, and bring to the position a rigorous scientific approach – which is important, as we pride ourselves on the work we are doing.

"Importantly, they are skilled at value-adding to conclusions to see where technologies can be more broadly applied, are generally self-managing even with complex projects, and are insightful about the next set of boundaries that can be pushed."

Mr Edwards says it is important that institutions such as UQ continue to provide world-class training of research higher degree students, and that Boeing was also committed to this process.

"We want to invest in the next generation of aerospace scientists and engineers in Australia," he says.

"That is the talent pool our company draws upon, both domestically and internationally, so it is incumbent on us to invest and build the numbers of researchers here in Australia.

"This, in turn, drives us in our targets for collaboration."

BOEING BACKS RESEARCH

UQ GRADUATE SCHOOL

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CHRONICALLY CREEPY

Chronic pain costs the Australian economy more than $34 million each year – affecting more than one in three people – but help may soon be coming from an unlikely source: spider venom.

UQ PhD student Julie Klint says the unique nature of spider venom should allow researchers to target the source of chronic pain with greater accuracy than current treatments available.

"The problem with existing treatments is that patients can develop tolerance over time, and their dosage cannot be increased to effective levels because of the substantial side-effects," Ms Klint says, adding that her approach is different.

"We isolate peptides from spider venom and then study their effects on sodium channels, which are like a gate that opens up and allows ions to pass through to generate a pain signal in the body.

"If we can block the gate, then we can block the pain signal. This method doesn't require the patient to increase their dosage over time to be effective, and will have far fewer side-effects than existing medicines."

Ms Klint, who studies under the guidance of Professor Glenn King at UQ's Institute for Molecular Bioscience, says there are challenges that need to be overcome before a breakthrough can be achieved.

"Of the nine sodium channels spread throughout our bodies, we are trying to affect just one of them, and it is important that the others remain untouched.

"One of the other sodium channels is in our heart, so if we block it then we block our heart function – which we obviously want to avoid.

"That is where spider peptides are unique as they are very good at hitting the specific channel we are aiming for. Most chronic pain relief drugs don't have the ability to distinguish between those channels, but spider peptides do."

The inspiration for the team's research came from studies of a family in Pakistan who used to travel the country performing dangerous tricks due to their inability to feel any pain.

"Researchers who studied them found that just one mutation within their nervous system stopped a sodium channel from functioning.

"The family was otherwise healthy, but could not feel any physical pain, and this was the rationale behind our approach," says Ms Klint.

CHRONICALLY CREEPY

UQ GRADUATE SCHOOL
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TOMORROW'S RESEARCH LEADERS

Undergraduate students at UQ have many opportunities to contribute to research discoveries, build global networks, and explore a research career through UQ's Office of Undergraduate Education (OUE).

OUE Director Dr Jessica Gallagher says, "UQ is committed to fostering a culture of curiosity, discovery and innovation. To support this goal, students at all levels are provided with access to research programs that will extend their academic studies and enhance their professional development.

"Our summer and winter research programs have attracted more than 1800 participants since their inception in 2008/09, and a further 180 students have presented their research findings at UQ's multidisciplinary **Undergraduate Research Conference**.

"Student outcomes speak for themselves, with many particip ants taking advantage of the opportunity to publish their findings or present at international conferences, and more than 20 per cent of our summer and winter research scholars having pursued honours or a research higher degree after research experience."

Suzanne Scott, a Bachelor of Science (Hons) student, says access to UQ's dynamic research community has enriched her university experience.

"Through networks I developed at the Queensland Brain Institute as part of the **Advanced Study Program in Science (ASPinS)**, I visited **University College London (UCL)** for a short research project and was supported by a UQ Advantage Grant," Ms Scott said.

"UCL has a great reputation for neuroscience research, and my research project gave me an insight into what it is really like to be a researcher.

"When I got back from London, I was really excited about my results and thought that the Undergraduate Research Conference would be a good way to share them.

"Presenting my results was a challenging experience, but I believe communication is a fundamental part of science – if nobody knows about the amazing research you're doing, you may as well not have done it."

Before commencing honours, Ms Scott also participated in a UQ Summer Research Project with the Institute for Molecular Bioscience to "try something a little different" and gain experience outside of neuroscience.

While Ms Scott admits that she is still considering her options after graduation, her future certainly looks bright.

"Being involved in a range of research projects has exposed me to a wide variety of experimental techniques and I have developed my presentation and communication abilities – transferable skills that will help me in the future if I progress in research or choose another career," she said.

"I feel privileged to have had these opportunities. Being immersed in a research environment is really the best way to learn and I have been able to do this at UQ and abroad: this is what the UQ Advantage means to me."

TOMORROW'S RESEARCH LEADERS

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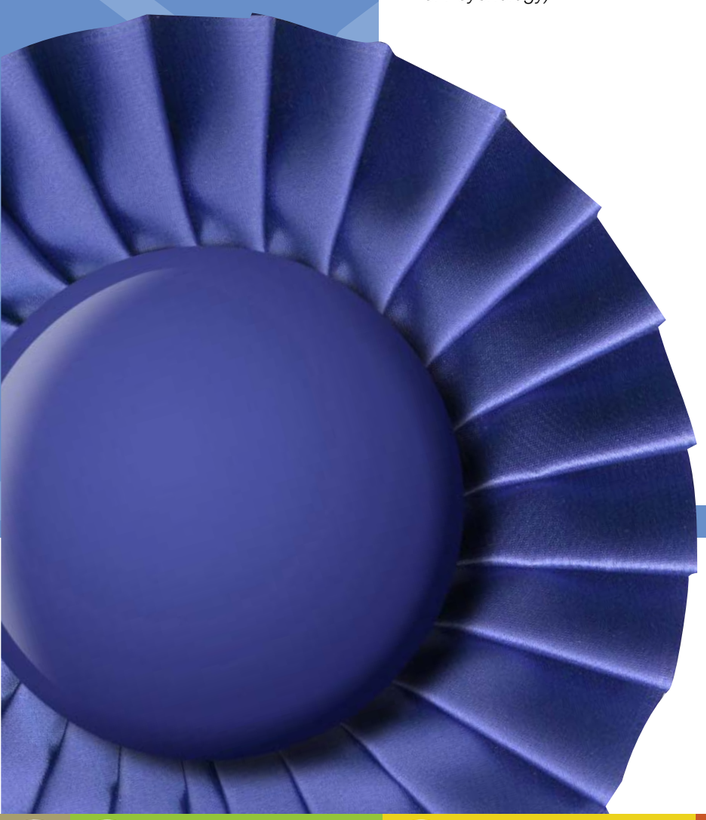
FELLOWSHIPS AND AWARDS

FELLOWSHIPS, AWARDS AND MEMBERSHIPS

2013 UQ FOUNDATION RESEARCH EXCELLENCE AWARDS

UQ AWARDS FOR EXCELLENCE IN RHD SUPERVISION

FELLOWSHIPS, AWARDS AND MEMBERSHIPS



Australian Research Council Australian Laureate Fellows

Professor Bernard Degnan
(School of Biological Sciences)

Professor Alex Haslam
(School of Psychology)

Professor Jenny Martin
(Institute for Molecular Bioscience)

Professor Jason Mattingley
(Queensland Brain Institute/School of Psychology)

Professor Lorraine Mazerolle
(Institute for Social Science Research)

Professor Peter Mumby
(School of Biological Sciences)

Professor John Quiggin
(School of Economics)

Australian Research Council Federation Fellows

Professor Peter Koopman
(Institute for Molecular Bioscience)

Professor Gerard Milburn
(School of Mathematics and Physics)

National Health and Medical Research Council Australia Fellows

Professor Matthew Cooper
(Institute for Molecular Bioscience)

Professor Wayne Hall
(UQ Centre for Clinical Research)

Professor Wendy Hoy
(School of Medicine)

Professor Robert Parton
(Institute for Molecular Bioscience)

Queensland Government Smart Futures/State Premier's Fellows

Professor Matthew Brown
(UQ Diamantina Institute)

Professor Ove Hoegh-Guldberg
(Global Change Institute)

Professor Anton Middelberg
(Australian Institute for Bioengineering and Nanotechnology)

Professor Srini Srinivasan
(Queensland Brain Institute)

Queensland Government Senior Clinical Research Fellows

Professor David Paterson
(UQ Centre for Clinical Research)

Professor Peter Sly
(Queensland Children's Medical Research Institute)

AWARDS AND HONOURS

Tianjin University Honorary Professorship Award
Professor Peter Høj
(President and Vice-Chancellor)

2013 Queensland Greats, Queensland Government
Professor Max Lu
(Deputy Vice-Chancellor (Research)/Australian Institute for Bioengineering and Nanotechnology)

Adjunct Associate Professor Dimity Dornan
(School of Health and Rehabilitation Sciences)

2012 Queensland Greats, Queensland Government
Emeritus Professor Ken Donald, AO
(School of Medicine)

2012 Rolex Laureate – Science and Health, Rolex Awards for Enterprise
Professor Mark Kendall
(Australian Institute for Bioengineering and Nanotechnology)

2012 Australian Museum Eureka Prize
Voiceless Eureka Prize for Scientific Research that Contributes to Animal Protection

Professor Clive Phillips
(School of Veterinary Science)

2012 John Oxley Library Fellowship, State Library of Queensland

Adjunct Professor Don Watson
(School of Architecture)

Fresh Scientist of 2012, Science in Public

Dr Anneline Padayachee
(Queensland Alliance for Agriculture and Food Innovation)

2011 Australia Mining Award, Excellence in Environmental Management

Dr Laurence Rossato
(Sustainable Minerals Institute/ School of Agriculture and Food Science)

2012 Women in Technology Awards

Biotech Research Award

Dr Margaret Mayfield
(School of Biological Sciences)

Infotech Research Award

Associate Professor Shazia Sadiq
(School of Information Technology and Electrical Engineering)

FELLOWSHIPS, AWARDS AND MEMBERSHIPS

WiT Rising Star Award

Dr Eve McDonald-Madden
(School of Biological Sciences)

Scopus Young Researcher of the Year

Dr Genevieve Healy
(School of Population Health)

Australian Sports Medicine Federation Fellows Awards

Asics Medal – Best Paper Overall

Associate Professor Kay Crossley
(School of Health and Rehabilitation Sciences)

Asics Best Paper – Clinical Sports Medicine

Associate Professor Kay Crossley
(School of Health and Rehabilitation Sciences)

John Sutton Award for Best New Investigator – Exercise and Sports Science

Dr Tina Skinner
(School of Human Movement Studies)

2012 Queensland Young Tall Poppy Science Award

Dr Tammy Hoffman
(School of Health and Rehabilitation Sciences)

Dr Morena Mills
(Global Change Institute)

Dr Kristofer Thurecht
(Australian Institute for Bioengineering and Nanotechnology)

Dr Trent Woodruff
(School of Biomedical Sciences

von Karman Award for International Cooperation in Aeronautics

Professor Michael Smart
(School of Mechanical and Mining Engineering)

2012 Emerald/European Foundation for Management Development Outstanding Doctoral Research Award in the field of hospitality management

Dr Jie Wang
(School of Tourism)

2012 Clinical Researcher Award, Queensland Health and Medical Research Awards

Associate Professor Emma Duncan
(UQ Diamantina Institute/School of Medicine)

2012 Farrer Memorial Medal

Professor Graeme Hammer
(Queensland Alliance for Agriculture and Food Innovation)

2012 Peter Goldacre Award, Australian Society of Plant Scientists

Dr Joshua Mylne
(Institute for Molecular Bioscience)

2012 Australian Academy of Technological Sciences and Engineering Clunies Ross Award

Professor Stuart Crozier
(School of Information Technology and Electrical Engineering)

Professor Gideon Chitombo
(Sustainable Minerals Institute)

2012 Life Sciences Queensland Industry Excellence Award

Professor Maree Smith
(School of Pharmacy)

2012 Kaye Ibbertson Award, Australian and New Zealand Bone and Mineral Society

Associate Professor Emma Duncan
(UQ Diamantina Institute/School of Medicine)

2012 Mid-Career Research Award – Endocrine Society of Australia

Associate Professor Emma Duncan
(UQ Diamantina Institute/School of Medicine)

2012 Australian Water Association - Queensland Water Awards

Water Professional of the Year

Professor Jurg Keller *(Advanced Water Management Centre)*

Young Water Professional of the Year

Dr Paul Jensen
(Advanced Water Management Centre)

Research Innovation Award
National Research Centre for Environmental Toxicology

2013 Innovation Awards – Sugar Research and Development Corporation

Research Team Award

'SaveNcane' project team (jointly conducted by UQ and BSES Ltd): Dr Nicole Robinson, Professor Susanne Schmidt, Dr Jessica Vogt, Mr Richard Brackin
(School of Agriculture and Food Sciences)

Young Science and Innovation Award

Mr Richard Brackin *(School of Agriculture and Food Sciences)*

2013 Thayer Lindsley Award, Prospectors and Developers Association of Canada

Adjunct Professor Daniel Wood
(Sustainable Minerals Institute)

2013 Robert M Dreyer Award, Society of Mining, Metallurgy and Exploration

Adjunct Professor Daniel Wood
(Sustainable Minerals Institute)

FELLOWSHIPS, AWARDS AND MEMBERSHIPS

2012 Early Career Award – Australasian Professional Society of Alcohol and Other Drugs

Dr Adrian Carter
(UQ Centre for Clinical Research)

2012 Australasian Marketing Journal Best Reviewer of the Year Award

Associate Professor Jay Weerawardena
(School of Business)

2012 Citation and Innovation Award – Thomson Reuters

Professor Ove Hoegh-Guldberg
(Global Change Institute)

2012 Research Literature Award, Outstanding Contribution to Accounting and Finance – Accounting and Finance Association of Australia and New Zealand

Professor Robert Faff
(School of Business)

Outstanding Journal Article Award for 2011 – European Review of Agricultural Economics

Dr Celine Nauges, Professor Chris O'Donnell, Professor John Quiggin
(School of Economics)

2012 Churchill Fellow, Winston Churchill Memorial Trust

Dr Craig Hardner
(Queensland Alliance for Agriculture and Food Innovation)

2012 Queensland Clinical Researcher of the Year – Australian Society of Medical Research

Associate Professor Emma Duncan
(UQ Diamantina Institute/UQ Centre for Online Health)

2012 Citations for Outstanding Contributions to Student Learning - Australian Awards for University Teaching

Professor Michael Drinkwater
(School of Mathematics and Physics)

Dr Helen Keates
(School of Veterinary Science)

Dr Annetta Tsang
(School of Dentistry)

MEMBERSHIPS (NEW IN 2012/13)

Fellow, Australian Academy of Humanities

Professor Gay Hawkins
(Centre for Critical and Cultural Studies)

Dr Samantha Owens
(School of Music)

Fellows, Academy of the Social Sciences in Australia

Professor Brian Head
(Institute for Social Science Research)

Fellow, Australian Academy of Science

Professor Matthew Brown
(UQ Diamantina Institute)

Professor David Craik
(Institute for Molecular Bioscience)

Professor Max Lu
(Australian Institute for Bioengineering and Nanotechnology)

Professor Ove Hoegh-Guldberg
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Professor Andrew White
(School of Mathematics and Physics)

Members, Australian Research Council College

Professor Jolanda Jetten
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Emeritus Professor Sritawat Kitipornchai
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Professor Andrew Neal
(School of Psychology)

Professor Philip Pollett
(School of Mathematics and Physics)

Professor Andrew Whittaker
(Australian Institute for Bioengineering and Nanotechnology)

Fellow, American Academy of Microbiology

Professor Philip Hugenholtz
(School of Chemistry and Molecular Biosciences)

Fellow, Dietitians Association of Australia

Associate Professor Judy Bauer *(School of Human Movement Studies)*

Fellow (ad hominem), The Royal College of Surgeons of Edinburgh

Associate Professor Mark Smithers
(School of Medicine)

Fellow and Life Membership, Accounting and Finance Association of Australia and New Zealand

Professor Robert Faff
(School of Business)

List current for period 1 June 2012 to 31 May 2013.

DR LACHLAN COIN

INSTITUTE FOR MOLECULAR BIOSCIENCE

$90,000: Identification of structural variation associated with auto-immune disorders

By analysing genomic copy number variations (CNVs), Dr Lachlan Coin from the Institute for Molecular Bioscience wants to better understand the genetic architecture of Systemic Lupus Erythematosus and Ankylosing Spondylitis so that better therapeutics can be developed.

"CNVs, including deletions and duplications, have been found to be an important risk factor for auto-immune disorders," he says, "but only a handful have been strongly linked with disease risk. I hope to develop a computational pipeline for finding disease-associated CNVs."

DR JAN PACKER

FACULTY OF BUSINESS, ECONOMICS AND LAW

$60,000: Taking a break: the restorative benefits of short breaks and vacations

Australians often work long hours and are reluctant to take their leave, resulting in physical and mental fatigue, diminished cognitive and emotional capacity, and high levels of stress.

BEL Faculty's Dr Jan Packer will be investigating the restorative benefits of short breaks and vacations to determine which attributes are most beneficial in enabling people to recover their ability to cope with both work and everyday life.

"Both individuals and the tourism industry will benefit from this research," she says. "It will demonstrate the need for people to take a break, and will suggest strategies that people can use to make sure they get the best possible results when they do."

DR KNOX PEDEN

FACULTY OF ARTS

$11,000: Secularism and philosophy: the challenge of Spinozism

With the resurgence of religious conflict throughout the world, the question of secularism has acquired renewed importance in the academy.

In a multi-year project, Arts researcher Dr Knox Peden will be analysing the pivotal role played by controversial philosopher Benedict de Spinoza (1632-1677) in the history of debates about secularism and the contested nature of religion in its relationship to science and politics.

"Focusing on three distinct episodes of philosophical conflict generated by Spinoza's thought – from the late 18th century to the present – I aim to show that secularism is not simply a social and political phenomenon, but a thus far irresolvable philosophical conundrum," he says.

DR KATE SCHRODER

INSTITUTE FOR MOLECULAR BIOSCIENCE

$80,000: Pinpointing the initiation of immune response

"If we know the pathways that allow our bodies to fight infectious disease, we may be able to develop drugs to boost our natural defences," says the Institute for Molecular Bioscience's Dr Kate Schroder.

She is researching a molecular machine called the "inflammasome" that activates the immune system during infection, and aims to pinpoint its exact location.

"It is currently unclear where this machine resides in the cell, or how it controls cellular processes," she says.

"I hope to find out the answer to this question, and characterise the means by which our bodies sense microbes and launch anti-microbial defence programs."

2013 UQ FOUNDATION RESEARCH EXCELLENCE AWARDS

Now in their 15th year, the UQ Foundation Research Excellence Awards are designed to nurture early career researchers. 2013 saw $571,000 bestowed on eight researchers from a range of faculties, centres, schools and institutes across the University.

DR GENE TYSON

FACULTY OF ENGINEERING, ARCHITECTURE AND INFORMATION TECHNOLOGY

$90,000: A warming world: understanding increased methane emission in thawing permafrost

"We need to understand how earth systems will respond to climate change," says EAIT's Dr Gene Tyson, "and central to this problem is the global carbon cycle, which is mediated by biological processes and is a key driver of climate."

Dr Tyson's project is focusing on the processes that underpin increased methane emission in thawing permafrost. He will be investigating the biological aspects of carbon dioxide and methane cycling in a subarctic wetland system where climate change-induced permafrost melt is transforming methane sinks into sources.

DR CLAUDIA VICKERS

AUSTRALIAN INSTITUTE FOR BIOENGINEERING AND NANOTECHNOLOGY

$80,000: From a petrochemical to a biochemical economy

Modern civilisation relies on petro-chemicals, which provide us with both fuels and myriad industrial products. But petrochemical resources are finite, and they are becoming more expensive. AIBN's Dr Claudia Vickers would like to see our economy convert from petrochemical to biochemical, using synthetic biology to produce sustainable, environmentally friendly fuels and chemicals from engineered microbial cell bio-factories.

"Many petrochemical products can be replaced with products made by living cells," she says, "however, current yields are not large enough to be commercially viable. My project aims to address this problem by engineering yeast cells with improved bio-conversion of sugar into useful products."

Dr Vickers is testing the technology on production of bio-jet fuel.

DR KERRIE WILSON

FACULTY OF SCIENCE

$90,000: Incorporating hydrologic ecosystem services (supply, flows and beneficiaries) into land use planning

"With human development and climate change driving the decline in global biodiversity, as well as degrading the quality of ecosystems that supply our water, we must improve our land-use planning," says Dr Kerrie Wilson from the Faculty of Science.

Her project has two aims: to analyse hydrologic ecosystem services relating to land-use trajectories and climate change, and to integrate ecosystem service flows into spatial land-use plans at multiple scales. With a better understanding of watershed processes, and the supply and flow of freshwater, she hopes to enhance land-use planning for conserving biodiversity and the ecosystem services on which humans depend.

DR JIAN YANG

QUEENSLAND BRAIN INSTITUTE

$70,000: Quantifying the overall contribution of all the DNA variants to motor neuron disease

Understanding the genetic basis of motor neuron disease (MND) is fundamental to better understanding its cause.

Dr Jian Yang from the Queensland Brain Institute will be analysing thousands of DNA samples and other medical data to quantify the overall contribution of all DNA variants to MND, and enable researchers to further identify genes that play a role in the etiology of this disease.

"At the end of this project, the method and software tool I will be using will be made freely available to the research community for any other diseases of interest," he says.

The University of Queensland prides itself on its culture of research excellence developed through the efforts of world-class academics and the provision of first-class facilities.

Approximately 4000 students are currently enrolled in research higher degrees at UQ, and their success is underpinned by advisors guiding them through their candidature. Since 2000, UQ has acknowledged and rewarded outstanding advisors through the Awards for Excellence in RHD Supervision.

PROFESSOR DEE BRADSHAW

SUSTAINABLE MINERALS INSTITUTE

A nurturing leader dedicated to bringing out the best in people, Professor Dee Bradshaw has directly supervised 30 research higher degree (RHD) candidates to completion and mentored many more from around the world. Her students are highly sought after, with many progressing to senior positions within industry and academia.

In addition, Professor Bradshaw has initiated and developed postgraduate courses in Flotation Chemistry, Process Mineralogy and Geometallurgy, and has contributed to a number of professional development courses for industry.

Her exemplary approach to RHD supervision, in conjunction with her professorial responsibilities, demonstrate her commitment to industry engagement, applied research and postgraduate education.

PROFESSOR JEFF COOMBES

SCHOOL OF HUMAN MOVEMENT STUDIES

In his role as Professor in Exercise and Sports Science, Professor Jeff Coombes has seen more than 20 research higher degree (RHD) students to completion.

With a significant research output (150 peer-reviewed articles) and several awards (more than 10 national/ international conference presentation prizes), he leads by example.

Professor Coombes encourages his students to develop their research independence. He provides them with opportunities to exchange ideas and knowledge among their peers, and meets with them weekly, without fail.

His approach is tailored to each student, many of whom attribute their professional and personal goals to his support, leadership and enthusiasm. All describe him as generous, engaging and approachable.

UQ AWARDS FOR EXCELLENCE IN RHD SUPERVISION

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