THE UNIVERSITY of ADELAIDE

The University of Adelaide

Research Impact

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Contents

Vision

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Outstanding research universities share some common characteristics. They are responsive to emerging global and national research priorities, they have access to high quality research facilities and they are surrounded by highly talented researchers and higher degree students. Upon joining the University of Adelaide in July 2012, I was pleased to discover that the University not only possesses these traits, but is committed to innovation and continuing the pursuit of research excellence. This is important because it provides a very strong foundation for realising our new Strategic Plan 2012-2023, Beacon of Enlightenment and also reinforces our increasing research success, evident in our ability to attract key funding grants.

Over the period 2007-2011 the University’s research income has increased from $115.7million to $170.1 million, at an average rate of 12% per annum. This is the highest growth rate over the period in the Group of Eight universities. In recent years, the University has also been Australia’s top performer, on a per capita basis, in attracting national competitive grants. One example of our success includes a record $44.8 million in National Health and Medical Research Council (NHMRC) funding for health and medical research. This represents the most funding awarded to an Australian research organisation relative to size. We also achieved a $4.3 million boost in Australian Research Council (ARC) Linkage Project funding for 11 new projects.

Responding to the needs of the community also requires commercial application of research. The University of Adelaide has demonstrated its ability to listen and problem solve with revenue from commercial agreements up more than 10% to over $39 million. This income is generated from research agreements with the private and public sector, driven by Adelaide Research and Innovation (ARI).

This success reaffirms our position among the nation’s leading research universities and provides a solid base for us to build upon. This Research Report provides an overview of just some of our recent achievements and the people who made them possible.

Professor Warren Bebbington
Vice-Chancellor and President

One of the most important aspects of a university is the way in which it can provide society with the fruits of its endeavours, both tangible and intangible, and bring about an improvement in people’s lives. This may be in the form of a new medical procedure to alleviate chronic pain, a new device to provide more efficient power generation, or a greater understanding of the thoughts and influences which drive group behaviour.

To do this successfully, we work individually and collectively to ensure that our research is of high quality—something which is measured in numerous ways. Pleasingly, the Federal Government’s 2012 Excellence in Research for Australia assessment process helped to confirm the University’s reputation for world-class research in many different areas. Furthermore, at another level there are a myriad of examples where a specific research project is delivering a more immediate impact based on proven validity. This quality stretches from fundamental basic research which may be investigating the nature of dark matter that appears to make up much of the Universe, to more applied applications such as a new gel to stem bleeding and heal wounds more quickly.

Bringing together the support for research quality with the achievement of research outcomes in areas of societal and technological need is fundamental to our mission. Much of the research conducted at the University of Adelaide today is focussed on addressing ‘grand challenges’, whether it be the challenge of feeding our world into the future, sustaining our environment, achieving a healthier population or creating sustainable energy sources. As examples, our researchers are experimenting with solar and geothermal energy; devising treatments to alleviate diabetes; improving the iron content of rice; and developing tools to allocate water to catchments to optimise environmental, ecological and social outcomes.

> “Much of the research conducted at the University of Adelaide today is focussed on addressing ‘grand challenges’.”

Looking through the individual stories contained in this report, and reflecting on the breadth and depth of the talent and expertise which abounds at the University, I can only admire greatly our talented researchers and feel deeply privileged to work in such an environment.

Professor Mike Brooks
Deputy Vice-Chancellor and Vice-President Research

Research at a Glance

Consistently ranked in the top **1%** of the world's universities

19 out of 22 of our research areas rated at or above world class

150 new University Research Scholarships in 2012

Awarded **3** of the 26 new ARC Discovery Outstanding Researchers Awards in 2012

Over **$39m** in revenue across more than 500 commercial agreements

59 Research Centres

12 Research Tuesday events sharing research with the community in 2012

302 postgraduate research qualifications in 2012

Awarded ~ **81%** of total Australian Research Council (ARC) Discovery project grant funding in South Australia in 2012

9 ARC Future Fellowships in 2012

5 world-class Research Institutes

156 new Australian Postgraduate Awards

1,811 Research staff

Awarded ~ **67%** of total National Health & Medical Research Council (NHMRC) funding in South Australia in 2012

#1 university in South Australia for research collaboration with industry

2,418 Research students

568 new postgraduate research students in 2012

Over **$170m** total research income in 2011

106 Rhodes Scholars

Research Excellence

ERA

Excellence in Research for Australia (ERA) is an initiative of the Federal Government, which aims to assess research quality, using a combination of metrics focused on researchers, research outputs, research income, esteem and applied measures.

Following a strong performance in the 2010 ERA process, the University of Adelaide was rated even higher for the quality of its research in the latest results, released December 2012. The outcome confirms many of the University's fundamental research strengths in areas including geology, evolutionary biology, cardiology, oncology, nursing, nutrition, physics, chemistry, horticulture, and artificial intelligence.

The University of Adelaide found itself in an elite group of institutions unsurpassed in three major disciplinary (or 2-digit field of research code) areas, all rated at 'well above world class': Physical Sciences, Medical and Health Sciences, and Studies in Creative Arts and Writing.

At the sub-disciplinary (or 4-digit field of research code) level, the University was unsurpassed in 27 areas. In comparison to the ERA 2010 results, it increased its proportion of sub-disciplines assessed at 'above or well above world class' from 44% to 58%, and at 'world class or above' from 80% to 90%.

The University's investment in Research Institutes continues to align well with ERA high performers, with each of the Institutes achieving a rating of 5 (the equivalent of an academic "gold medal") in at least one area:

- **Institute for Photonics and Advanced Sensing**
  (Scored 5 in Optical Physics)
- **Waite Research Institute**
  (Scored 5 in Horticultural Production)
- **Institute for Mineral and Energy Resources**
  (Scored 5 in Geology)
- **Robinson Institute**
  (Scored 5 in Paediatrics and Reproductive Medicine,)
- **Environment Institute**
  (Scored 5 in Evolutionary Biology)

Funding Success

- Awarded ~ 67% of total National Health and Medical Research Council (NHMRC) funding in South Australia in 2012
- Awarded ~ 81% Australian Research Council (ARC) Discovery project grant funding in South Australia in 2012

Australian Research Council (ARC)

In 2011, the University of Adelaide was awarded $12.4 million in ARC Discovery Project Funding and $650,000 under the Linkage Infrastructure, Equipment and Facilities Program.

In 2012, $12.4 million and $3.8 million respectively was awarded to the University for the two programs.

In the Discovery Early Career Researcher Awards Program, the University attracted 12 new fellows commencing in 2012 and 9 new fellows commencing in 2013.

In the new prestigious Discovery Outstanding Researchers Awards the University was awarded three fellowships commencing in 2012: Professor Gus Nathan, Dr Adrienne Paton and Associate Professor Samer Akkach. In 2013 the University was awarded a further three fellowships: Professor Mathai Varghese, Professor Garrett Cullity and Dr Tom Wigley.

In October 2012, the University was awarded a record $6.8 million to fund 9 new Future Fellows. This represents 65% of the total funding awarded to South Australia in the ARC Future Fellowships Scheme. The University also received funding totalling $3.6 million for 11 new research projects in the ARC's Linkage Projects Scheme, a collaborative scheme with industry.

National Health and Medical Research Council (NHMRC)

In 2011, the University and its affiliate organisations, SA Pathology, the Royal Adelaide Hospital, Queen Elizabeth Hospital, the Women's and Children's Hospital, the Women's and Children's Health Research Institute and the Lyell McEwin Hospital, were awarded a record total of $44.8 million by the NHMRC. Highlights include:

- The University achieved the best funding in Australia relative to size, and was the sixth most successful in absolute terms.
- Project grants increased from $22.8 million in 2010 to $33.5 million in 2011, across 45 projects.
- Twelve University of Adelaide researchers and affiliates received $6.3 million in total for Early Career and Research Fellowships; and
- In 2011, the University was awarded two new Centres of Research Excellence:
  - 'Food for future Australians', Human Nutrition Professor Maria Makrides, and
  - 'Dental health services research for improved oral health', dental health services Associate Professor David Brennan.

These centres were awarded $2.5 million and $2.4 million respectively.

In October 2012, the University of Adelaide was awarded a further $31.1 million by the NHMRC to enable 50 new health and medical projects. This represents 67% of all NHMRC funding awarded in the state. In addition, the University has also been awarded $2.5 million for one new Centre of Research Excellence:

- 'Translating Nutritional Science to Good Health', Medicine & Head Endocrine Unit Professor Michael Horowitz.

Other Research Funding

The Grains Research Development Corporation provided over $14 million for new projects in 2011-12. This includes funding for projects aimed at increasing malt extract and the export competitiveness of Australian barley (led by Dr Jason Eglinton); and for the Pulse Breeding Australia Germplasm Enhancement Program (led by Dr Jeff Paull).

Dr Lisa Moran, from the University's Robinson Institute and School of Paediatrics and Reproductive Health, was awarded $450,000 by the National Heart Foundation and SA Health, to look at the most effective ways of reducing heart disease in women and children.

Funding was received from the South Australian Premier's Science and Research Fund to boost a number of the University's research capabilities in key areas. This included funding to:

- The Institute for Photonics and Advanced Sensing for optical fibre research equipment
- The Adelaide Proteomics Centre to support research into the fight against diseases such as cancer and the development of therapeutics to treat the disease
- The Australian Wine Research Institute, (part of the Wine Innovation Cluster at the Waite Campus) to enhance research services to support bioscience research across a range of fields, including enabling wine producers to have greater control over wine quality and characteristics.

In February 2012, the University of Adelaide's School of Economics was awarded $1 million to lead new global projects on food security. This includes funding from the Australian Centre for International Agricultural Research (ACIAR), AusAid and the Rural Industries Research and Development Corporation (RIRDC).

Five University of Adelaide researchers were awarded more than $362,000 at the 2012 Diabetes Australia Research Trust (DART) awards in March 2012. The aim is to help make a difference in the fight against one of Australia's biggest health problems – diabetes.

Professor Andre Luiten was awarded a $1 million fellowship from the State Government to take up the Chair of Experimental Physics in February 2013. Professor Luiten will strengthen Adelaide's reputation as a world leader in optics and photonics research.

The State Government signed an agreement with the University's Centre for Automotive Safety Research (CASR) in May 2012 to extend funding for its world renowned road safety. The agreement provides more than $1 million each year until 2017.

In 2011, the Premier announced that the South Australian Government would be providing a further $2 million to the SA Centre for Geothermal Energy Research, which is a resounding endorsement of the importance of developing novel solutions to challenges of sustainable energy delivery. This follows the initial $1.6 million awarded by the state government in 2009 to establish the Centre.

In September 2012, the Australian Renewable Energy's Agency (ARENA) awarded the University $1.25 million to lead research into the geothermal challenges through its Emerging Renewables Program. The project will be led by the South Australian Centre for Geothermal Energy Research, which is part of the University's Institute for Mineral and Energy Resources, in collaboration with CSIRO and partnered by South Australia's Department for Manufacturing, Innovation, Trade and Energy Resources and geothermal companies Panax Geothermal Limited and Geodynamics Ltd.

The University of Adelaide will receive $4.6M in funding over the next 8 years from the Australian Solar Institute and the Australian Renewable Energy Agency to participate in the Australian Solar Thermal Research Initiative (ASTRI).

Professor Gus Nathan, Director of the Centre for Energy Technology, will lead one of four nodes in the consortium which involves staff and students from the University's Schools of Mechanical Engineering and Chemistry & Physics. ASTRI will be led by CSIRO, and includes all the South Australian universities, the Australian National University, University of Queensland, the Queensland University of Technology, research collaborators in the USA, and leading international and Australian solar companies.

ASTRI's objectives are to transform Australia into a global leader in concentrated solar power (CSP) technologies through a series of highly targeted research programs. ASTRI will have national economic benefit by reducing solar electricity generation costs.

World Rankings

- On a global scale, the University of Adelaide is consistently ranked in the top 1% of universities in the world.
- The University of Adelaide was ranked 176 in The Times Higher Education World University Rankings 2012-13. The University of Adelaide is also ranked exceptionally highly across a range of specific subject areas.
- In 2012 the University of Adelaide was ranked within the Top 201 - 300 universities in the world by the Shanghai Jiao Tong Academic Ranking of World Universities.
- The University was also ranked 102 in the 2012-13 QS World University Rankings.

Research Strengths

- Engineering and Environmental Sciences
- Social and Behavioural Sciences
- Biological and Agriculture Sciences
- Humanities, Law and Creative Arts
- Physical, Chemical and Earth Sciences
- Mathematical, Information and Computing Sciences
- Medical and Health Sciences

For more detailed information on our strengths in specialised areas, please visit **www.adelaide.edu.au/research**

Global Challenges

The University of Adelaide is committed to expanding its research outputs. Our five institutes and 59 centres are set-up to ensure we are attending to national, state and global priorities, focussing on the key challenges of critical value to society. Australia's National Research Priorities are: to create an environmentally sustainable Australia, to promote and maintain good health, to develop frontier technologies for building and transforming industries; and safeguarding Australia.

In line with these priorities, some of the challenges that we are addressing include:

> food security,

> the management of natural resources,

> the development of sustainable energy sources,

> advancements in health and medical genetics research, and

> adapting to and mitigating climate change.

Institutes and Centres

The University has established a number of world-class research institutes in partnership with government and industry.

Institutes

The institutes, comprising a research community of approximately 1200 staff and students, bring together world-leading researchers, supported by modern infrastructure and an innovative culture, to tackle state, national and global research priorities.

The multi-disciplinary focus of our institutes and centres provides a collaborative platform for research partnerships across the University and with other research organisations.

The University is also an active participant in Commonwealth-funded research centres – being the site of three national research centres and a participant in a significant number of Cooperative Research Centres. It is also home base for many specialist research centres in a wide range of disciplines.

Environment Institute

Focus: Management of natural resources under changing climate and economic conditions.

The Environment Institute creates and leads large-scale research initiatives which aim to deliver globally competitive solutions to environmental problems. The Institute brings together leading research groups in the fields of science, engineering and economics relating to the management and use of natural resources and infrastructure.

Research undertaken within the Institute delivers know-how and understanding that will underpin improvements in the management of natural resources such as water, soil, land and native flora and fauna, particularly under changing climate and economic conditions.

Robinson Institute

Focus: Reproductive health, stem cell research and health across generations

The Robinson Institute comprises a unique group of more than 350 researchers and clinicians, focusing on creating life and sustaining health. A number of the Institute's researchers have been named among the nation's best, with their international discoveries achieving major advances in IVF and fertility.

By focusing on the earliest stages of life, the Robinson Institute is looking at preventing disease and promoting health in children and adults across generations.

The Institute bridges the gap between research discoveries and medical practice with many of the Institute's senior researchers also being leading clinicians in their fields.

Institute for Mineral and Energy Resources

Focus: Petroleum engineering, mining engineering, petroleum and minerals, geoscience and geothermal energy.

IMER is designed to address one of the biggest challenges facing Australia: to continue to grow the economically critical mineral and energy resources industries in a technically, economically, socially and environmentally sustainable manner.

IMER's research priorities are linked to key global trends and the Institute is fast becoming a leading research and educational facility for the mining and energy sectors in the Asia Pacific region. The Institute provides integrated research, education, professional development and consulting services across all aspects of mineral and energy resources – from exploration through processing to international trade.

Institute for Photonics & Advanced Sensing

Focus: optical fibres, lasers, luminescence, surface chemistry, proteomics and virology.

IPAS brings together physicists, chemists and biologists to pursue a new trans-disciplinary approach to science. The institute is developing novel photonic, sensing and measurement technologies that will change the way science is applied within traditional discipline areas – stimulating the creation of new industries, and inspiring a new generation of scientists to be engaged in solving real-world problems.

IPAS research targets application in four key market areas: defence and national security, environmental monitoring, preventative health, and food and wine.

Waite Research Institute

Focus: Plant and crop sciences, soil science, viticulture and oenology, food and nutrition and food chain economies.

The Waite Research Institute brings together researchers from a range of disciplines including plant biology, genetics, soil sciences, agronomy and agricultural economics. Research undertaken with the Institute aims to find solutions to global problems including the challenge of ensuring global food security, and ensuring Australia's agricultural wine and food industries remain competitive by providing innovative research-led developments.

Centres of Excellence

Australian Research Council (ARC)

Australian Centre for Plant Functional Genomics (Lead)

The Australian Centre for Plant Functional Genomics (ACPFG) focuses on improving the tolerance of wheat and barley to environmental stresses such as drought and salinity; and researching ways to make plants use nutrients more efficiently.

The University of Adelaide is the major shareholder and host of the headquarters.

The Centre is developing the technologies and resources needed to produce new cereal varieties that allow sustainable farming to generate economic, social and environmental benefits to Australia. ACPFG research is helping to ensure Australia maintains its competitive position in cereal production.

ARC Centre of Excellence in Plant Cell Wall Biology (Lead)

The ARC Centre of Excellence in Plant Cell Wall Biology's mission is to advance fundamental scientific understanding of plant cell wall biology to enable sustainable biomass production for food security, human health, and energy biomass conversion.

Led by the University of Adelaide, the Centre is a $32 million collaboration with the Universities of Melbourne and Queensland in partnership with SA State Government and seven international institutions.

ARC Centre of Excellence in Plant Energy Biology (Partner)

The Australian Research Council Centre of Excellence in Plant Energy Biology (PEB) is focused on better understanding the way in which plants produce and use their energy systems in response to environmental change.

The Centre focuses on unlocking the secrets of plant energy metabolism. By unlocking these fundamental processes it is able to better understand plant biomass productivity, fruit and grain yield, plant nutrient composition, and adaptation to abiotic and biotic stresses.

This information is provided to plant breeders and geneticists to get the best out of plants.

ARC Centre of Excellence for the History of Emotions (Partner)

The ARC Centre of Excellence for the History of Emotions uses historical knowledge from Europe, 1100 - 1800, to understand the long history of emotional behaviours.

Emotions shape individual, community and national identities and the Centre applies this knowledge to improve the social, cultural and emotional welfare of modern Australians.

ARC Centre of Excellence for Particle Physics at the Tera-Scale (Partner)

The ARC Centre of Excellence for Particle Physics at the Terascale (CoEPP) coordinates , terascale, high-energy and particle physics research. Bringing together theoretical and experimental physicists CoEPP's research includes the prospect of understanding the origin of mass, discovering new physical laws, and producing and studying dark matter in the laboratory.

CoEPP is a collaborative research venture between the University of Adelaide, University of Melbourne, the University of Sydney and Monash University.

National Health and Medical Research Council (NHMRC) Centres of Research Excellence

Centre of Research Excellence Food for Future Australians (Lead)

The Centre of Research Excellence in Foods for Future Australians brings together researchers, clinicians and allied health professionals with an interest in nutrition during pregnancy and infancy. Its team of investigators includes basic scientists, dieticians, immunologists, and research clinicians who work together to undertake world-class research in this area.

The vision of the Centre is to undertake high quality basic, clinical and translational research to determine the best nutritional advice for the health and future of young families.

Centre of Research Excellence in Translating Nutritional Science to Good Health (Lead)

The Centre of Research Excellence in Translating Nutritional Science to Good Health focuses on four primary areas of research: diabetes, obesity, nutrition in the elderly and those with critical illness.

The Centre brings together a range of researchers, including clinical investigators, basic scientists, nutritionists, leaders in primary health care, nurses, and health psychologists; with the aim of preventing diseases by improving people's nutrition.

The Centre's research findings will be applied into the community, helping to make a substantial impact on people's health.

Centre of Research Excellence for Electromagnetic Bioeffects Research (Partner)

Centre for Research Excellence for Electromagnetic Bioeffects Research is focusing on the possible health impacts of mobile phones.

The electromagnetic energy (EME) that powers mobile phones is everywhere, but little is known of associated health effects. The Centre will promote Australia's EME health both in the immediate future, and through the development of human research capacity in this field, into the future.

The University of Adelaide is a partner, with head office based at the University of Wollongong.

Centre of Research Excellence in Post-Market Surveillance of Medicines and Medical Devices (Partner)

The Centre of Research Excellence in Post-Market Surveillance of Medicines and Medical Devices is focused on improving patient safety and identifying adverse events from medicines and medical devices in healthcare.

The centre aims to tackle the costly problems of adverse events of medicines and failures, ensuring both medicines and medical implants are used more safely in the Australian community.

Centre of Research Excellence in Primary Oral Health Care (Partner)

The Centre of Research Excellence in Primary Oral Health Care conducts research to improve primary oral health care for disadvantaged Australians, comprising four major themes:

- Successful ageing and oral health
- Rural oral health
- Indigenous oral health
- The oral health of people with physical and intellectual disabilities.

Centres

	ENGINEERING & ENVIRONMENTAL SCIENCES	BIOLOGICAL & AGRICULTURAL SCIENCES	HUMANITIES, LAW & CREATIVE ARTS	MATHEMATICAL, INFORMATION AND COMPUTING SCIENCES	PHYSICAL, CHEMICAL & EARTH SCIENCES	SOCIAL & BEHAVIOURAL SCIENCES	MEDICAL & HEALTH SCIENCES
Environment Institute							
Australian Centre for Ancient DNA (ACAD)	■						
Australian Centre for Evolutionary Biology and Biodiversity (ACEBB)	■						
Sprigg Geobiology Centre (SGC)					■		
Water Research Centre	■						
Robinson Institute							
Research Centre for Reproductive Health (RCPH)							■
Research Centre for Early Origins of Health and Disease (EOHaD)							■
Centre for Stem Cell Research (CSCR)							■
Australian Research Centre for Health of Women & Babies							■
Children's Research Centre							■
Institute For Mineral And Energy Resources							
Centre for Energy Technology	■						
Centre for Tectonics Resource and Exploration (TRaX)	■				■		
South Australian Centre for Geothermal Energy Research	■				■		
Institute For Photonics & Advanced Sensing							
Waite Research Institute							
FoodPlus Research Centre (joint venture with WCHRI)		■					■
Australian Research Council (ARC)							
Australian Centre for Plant Functional Genomics (Lead)		■					
ARC Centre of Excellence in Plant Cell Wall Biology (Lead)		■					
ARC Centre of Excellence in Plant Energy Biology (Partner)		■					
ARC Centre of Excellence for the History of Emotions (Partner)			■				
ARC Centre of Excellence for Particle Physics at the Tera-Scale (Partner)					■		
NHMRC							
Centre for Research Excellence Food for Future Australians (Lead)		■					■
Centre of Research Excellence in Translating Nutritional Science to Good Health (Lead)							■
Centre for Research Excellence for Electromagnetic Bioeffects Research (Partner)							■
Centre of Research Excellence in Post-Market Surveillance of Medicines and Medical Devices (Partner)							■
Centre for Research Excellence in Primary Oral Health Care (Partner)							■

	ENGINEERING & ENVIRONMENTAL SCIENCES	BIOLOGICAL & AGRICULTURAL SCIENCES	HUMANITIES, LAW & CREATIVE ARTS	MATHEMATICAL, INFORMATION AND COMPUTING SCIENCES	PHYSICAL, CHEMICAL & EARTH SCIENCES	SOCIAL & BEHAVIOURAL SCIENCES	MEDICAL & HEALTH SCIENCES
Other Centres							
Adelaide Centre for Economics (ACE)						■	
Adelaide Centre for Neuroscience Research							■
The Adelaide Proteomics Centre		■					■
Adelaide Radar Research Centre				■			
Australian Centre for Visual Technologies (ACVT)	■			■			
Australian Population & Migration Research Centre						■	
Australian Research Centre for Population & Oral Health (ARCPOH)							■
Australian Workplace Innovation and Social Research Centre (WISeR)						■	
Centre for Advanced Nanomaterials	■				■		
Centre for Biomedical Engineering (CBME)	■						
Centre for Coastal Research	■	■				■	
Centre for Defence Communications and Information Networking (CDCIN)	■			■			
Centre for Heart Rhythm Disorders							■
Centre for High Performance Integrated Technologies & Systems (CHIPTec)				■			
Centre for Housing, Urban and Regional Planning (CHURP)						■	
Centre for Infectious Diseases							■
Centre for International Economics Studies						■	
Centre for Molecular Pathology		■					
Centre for Orofacial Research & Learning (CORAL)							■
Centre for Personalised Cancer Medicine							■
Centre for Quantification & Management of Risk				■			
Centre for Subatomic Structure of Matter					■		
Centre for Traumatic Stress Studies							■
Data Management & Analysis Centre (DMAC)				■			■
Defence Systems Innovation Centre (DSIC)				■			
Fay Gale Centre for Research on Gender						■	
Freemason's Foundation Centre for Men's Health							■
Indo-Pacific Governance Research Centre (IPGRC)						■	
Institute for Geometry and its Applications (IGA)				■			
International Centre for Financial Studies (ICFS)						■	
JM Coetzee Centre for Creative Practice			■				
Mosaic Fertilizer Technology Research Centre	■						
Orthopaedic and Trauma Research Centre							■
South Australian Centre for Economic Studies (SACES)						■	
Teletraffic Research Centre				■			
Wine Economics Research Centre		■				■	

Research Impact

The University of Adelaide aims to advance new knowledge across a range of areas to make a positive impact locally and globally.

The next section details just some of the projects and researchers that have achieved recent success across the following areas:

- Environment
- Food security
- Climate change and clean energy
- Engineering
- Health
- Arts

Endangered species: how do we choose which to save?

The loss of a species is unarguably a tragedy.

Beyond the individual suffering involved, the delicate balance of entire ecosystems can be seriously jeopardised, leaving other lifeforms open to new and dangerous threats.

Not surprisingly, it's a challenge many highly capable people across the globe have devoted themselves to meeting. But a major difficulty faced has been identifying which endangered species are in most urgent need of intervention and have the best chance of recovery. However, thanks to recent research involving the University of Adelaide, this challenge has been addressed.

Two Adelaide researchers, Professor Corey Bradshaw and Professor Barry Brook, have collaborated with peers from James Cook University to create a new index to accurately indicate how close species are to extinction, and therefore their likelihood of positively responding to conservation efforts.

Called "SAFE" (Species Ability to Forestall Extinction), the index builds on previous studies into minimum wild population sizes needed by species to survive, by factoring in key variables to measure how close a species really is to its minimum viable population.

According to Professor Bradshaw, Director of Ecological Modelling at the University's Environment Institute, the research, originally published in the journal *Frontiers in Ecology and Environment*, is a significant leap forward.

"While the idea itself is fairly simple, we've created more than just a formula," he said. "Our studies have shown that SAFE is the best predictor yet of the vulnerability of mammal species to extinction."

Professor Bradshaw said SAFE would complement the widely referenced International Union for Conservation of Nature (IUCN) Red List of Threatened Species, and that using the two together would provide conservationists with the most accurate gauge possible of where to focus their resources.

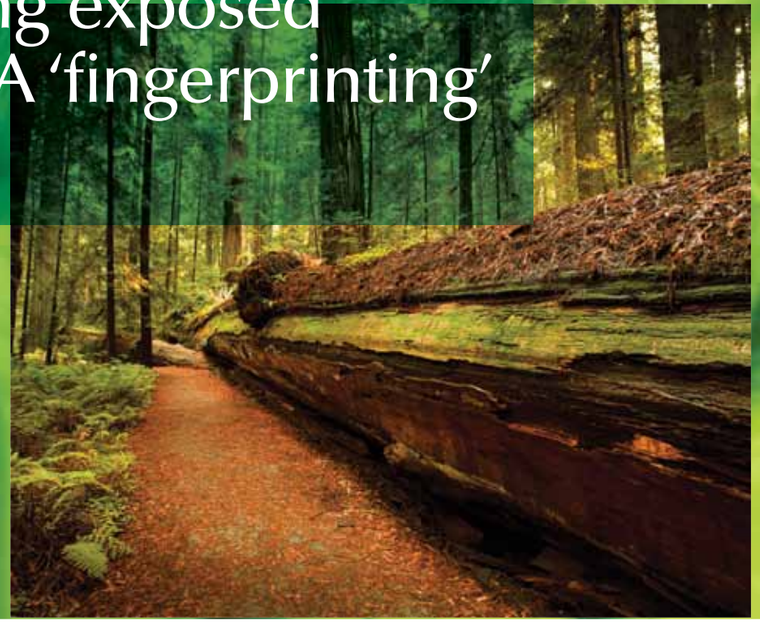
"For example, our studies show that practitioners of conservation triage may want to prioritise resources on the Sumatran rhinoceros instead of the Javan rhinoceros," he said.

"Both species are critically endangered, but the Sumatran rhino is more likely to be brought back from the brink of extinction based on its SAFE index."

Underlining the importance of SAFE's development, of 95 mammal species considered during the team's research, more than one in five were found to be close to extinction, and over half were at "tipping points" that could take their populations to the point of no return.

> "Our studies have shown that SAFE is the best predictor yet of the vulnerability of mammal species to extinction."

Illegal logging exposed by mass DNA 'fingerprinting'



When it comes to timber purchases, the vast majority of us want to do the right thing by our environment.

Given a choice between a product made from sustainably sourced wood and one that uses illegally logged timber from a protected forest or bushland, we'd take the former without hesitation. Unfortunately, however, at the point of sale that choice is rarely clear, and virtually impossible to verify. So the need for watertight industry controls, particularly at the customs level, is paramount. Recent research led by the University of Adelaide has enabled us to confidently identify the source of the timber.

Led by Professor Andrew Lowe, Director of the University's Australian Centre for Evolutionary Biology and Biodiversity, and Dr Hugh Cross, Molecular Biologist at the State Herbarium of South Australia, the research team has for the first time enabled logs and wood products to be traced en masse to their forests of origin through DNA "fingerprinting".

According to Professor Lowe, the technique is not only accurate, but quick and cost-effective - all crucial steps in the policing of illegally traded timber, which still accounts for an estimated 10% of wood imported into Australia.

"We've been able to apply molecular marker methods to freshly cut wood for a number of years," said Professor Lowe.

"But this is the first time we've been able to advance DNA fingerprinting to the point that large-scale screening of wood material can be done cheaply, quickly and with a statistical certainty that can be used in a court of law."

Importantly, he added, the methods are suitable for application at customs entry points and, unlike certification documents, could not be falsified.

Professor Lowe and Dr Cross worked in collaboration with Singapore company Double Helix Tracking Technologies (DoubleHelix), a leader in applied genetics for forest trade and conservation, which now intended to drive the technology's global uptake.

"We're looking at a large-scale application in the Congo Basin, as well as working with governments in Europe and America to tighten the grip on the illegal timber trade," said DoubleHelix Director Jonathan Geach.

Published in 2011 in the journal of the *International Association of Wood Anatomists*, the research is closely aligned with another major University project Professor Lowe is involved with: the development of a DNA "barcode" for every tree and grass species on earth.

"The 'Barcode of Life' project will take five years to complete," said Professor Lowe, "but the information will lead to a step-change in the way we can manage our species and ecosystems right across the globe."

> "We're looking at a large-scale application in the Congo Basin, as well as working with governments in Europe and America to tighten the grip on the illegal timber trade."

How will we feed our exploding population?

A perfect storm is gathering in the area of global food security. Our population, and therefore our demand for food, is soaring.

Finite supplies of arable land are dwindling, with climate change threatening to make what we do have less productive. Global markets are dangerously vulnerable to financial crises and potential energy supply problems. As a leader in the Asia-Pacific region, Australia has an important role to play in developing sound economic policy. The University of Adelaide's Faculty of Professions is tackling this head on.

In 2011 the University was awarded the lead role in three federally funded research projects, which together will increase understanding of global food security issues and help to frame responses to them.

The first, entitled "Assessing farmer responses to climate change in Vietnam and China", is a 12-month project led by economist and Executive Dean of the University's Faculty of the Professions Professor Christopher Findlay.

Professor Findlay said he and his team, including collaborating scientists from China and Vietnam, were seeking to establish not just how farmers in those countries were responding to climate change, but the ways in which market fluctuations were influencing those responses.

"We want to explore the extent to which farmers' adaptations are exaggerated by market failures," he said. "That's going to give us a better understanding of how farmers might respond to future adjustment opportunities, such as presented by technology. It will also help us identify farmers most at risk and design responses for them."

A second 12-month project, "Meeting food security goals with good policy", is also being led by Professor Findlay, this time involving collaborators from China, Vietnam, Indonesia, the Philippines and Thailand. Professor Findlay said the study sought to arm APEC-region policy makers with sound evidence and analysis.

"We're aiming to give them the information they need to promote the adoption of food security policies consistent with international market conditions, and to implement them at minimum cost."

The third project, "Climate change, trade policies and food security: implications for Australia", is being led by Professor Kym Anderson of the University's School of Economics.

According to Professor Anderson, the three-year project, also involving Dr Don Gunasekera of CSIRO Complex Systems Science, and Dr Anna Strutt of Waikato Management School, New Zealand, will help to ease concerns in the Australian community about our growing dependence on imported foods.

"We're aiming to develop a clearer understanding of the drivers of the global food market over the next 20-40 years, the uncertainties associated with them, and their local affect.

"That will also assist in prioritising efforts to influence policies in areas such as climate change, research and development, production and trade in products containing genetic modifications, foreign direct investment in global agriculture, and commercial diplomacy."

> "We want to explore the extent to which farmers' adaptations are exaggerated by market failures."

Barley ‘sugar’: better breeds promise farmers better returns

Barley is big business. With an annual farm-gate value of around $1.5B, it’s Australia’s second largest field crop.

Maintaining that output, however, let alone increasing it, is no simple matter. In harsh climatic conditions and an extremely competitive global market, a huge investment is required. Integral to this effort is the breeding of improved varieties, a field in which the University of Adelaide has played a leading role for over half a century. With two more exciting commercial releases of barley varieties in 2012, the University is continuing to break valuable new ground.

The University of Adelaide Barley Program has had a very busy year. Located within the School of Agriculture, Food and Wine, and with funding contributed by global agri-business Viterra Ltd and the federal government’s Grains Research and Development Corporation, the team has had both a new malting and feed variety barley accredited for commercial release.

According to Program Leader Dr Jason Eglington, the new malting variety, called “Navigator”, promises to benefit Australia’s $30B brewing industry.

“Navigator has a lot going for it,” said Dr Eglington. “It’s shown very good resistance to scald, net-type net blotch and powdery mildew. Physical grain quality and yield potential are also significantly improved.”

The outlook was similarly rosy for feed variety “Fathom”, he said.

“With Fathom we incorporated a novel gene from wild barley that allows it to produce improved grain yield, and quality, under the stress of drought.

“It also delivers a high yield under favourable conditions and has a strong disease-resistance profile, so we’re confident it will become a major part of the farming system.”

Developed using a range of biotechnologies and advanced plant science techniques, including DNA-based selection for specific genes, Dr Eglington said the new breeds added to a “long line of successes” for the University.

Barley breeding commenced at the University of Adelaide in 1956 and its first commercial variety, “Clipper”, was released in 1968. Clipper was the dominant Australian barley crop throughout the 1970s, and since then subsequent varieties developed at the Waite Campus have accounted for over 50% of national production.

“Over the last five years alone, barley produced using University of Adelaide varieties has had a farm-gate value of around $4B,” said Dr Eglington.

> “With Fathom we incorporated a novel gene from wild barley that allows it to produce improved grain yield, and quality, under the stress of drought.”

Technology grows food security as climate change looms

If you thought farming cereal crops was already a challenging task, take a moment to consider the mid-range forecast - increased incidence of drought, rising salinity and a growing population.

Maintaining our supply of food is almost certain to become one of the global issues facing society in the coming, climate-change-affected decades. The University of Adelaide is committed to finding long-term solutions for food security, and one of the areas making exciting progress is the Computer Science team.

Led by Professor Anton van den Hengel, Director of the University’s Australian Centre for Visual Technologies, the team is developing image-analysis technology that will enable cereal breeders to accurately assess a new variety’s yield potential - under many different growing conditions - far more rapidly than previously possible.

The development of varieties that promise increased yields in harsh conditions can then be prioritised and expedited, ensuring efforts are directed where they’ll have the greatest chance of success.

“This project will not only help Australian agriculture prepare for the impact of climate change and a growing population,” said Professor van den Hengel, “but it will also help improve the industry’s efficiency and international competitiveness.”

The technology, being developed in collaboration with plant physiologists and industry partner LemnaTec, will use multiple images of plants at all stages of growth to construct computerised 3-D models that match the plants’ changing “shape” with corresponding biological properties and, ultimately, yields.

“This will allow us to predict yield based on measurable attributes quite early in the plant’s lifespan, rather than having to wait for it to fully mature,” said Professor van den Hengel. “It promises to transform crop breeding.”

The image-based analysis will be incorporated into the Plant Accelerator at the University’s Waite Campus. Opened in 2010, the Accelerator houses more than 1km of conveyor systems that deliver plants automatically to imaging and other stations.

Industry partner LemnaTec, which provided some of the equipment used in the Plant Accelerator, will help commercialise the technology.

> “[The technology] promises to transform crop breeding.”

Building a cleaner, greener future with nano 'lego'

It's recognised no *one step* can realistically be expected to adequately mitigate the potential effects of global warming over coming decades.

Action must be taken on a number of fronts, including, many believe, the capture of CO_2 from the emissions of coal-fired power stations. To-date, this particular goal has proven impossible to achieve in an economically viable way, or without consuming a massive percentage of the plants' power output. But ironically, ongoing research led by the University of Adelaide promises to solve this enormous challenge by tackling it at the smallest of levels - using nanotechnology.

Dr Christian Doonan and Dr Christopher Sumby, Director and Deputy Director respectively of the University's Centre for Advanced Nanomaterials, are leading the development of a class of materials that could potentially make the capture of CO_2 from large, single-point emissions sources economically and energetically viable.

Known as metal-organic frameworks (MOFs), the advanced nanomaterials possess a unique combination of qualities that make them ideally suited to the adsorption (collection in a condensed surface layer) of gas molecules.

According to Dr Sumby, MOFs are synthesised in a building-block style akin to "molecular lego". "They're composed of a series of metal or metal-oxide 'nodes' linked by organic molecules," he said. "They're robust, with high thermal and chemical stability, very low density and unprecedented internal surface areas - up to 5,000 m^2 per gram, in some cases. That's the equivalent of a football field in one teaspoon of material, and it's all available for the adsorption of gas molecules."

The large-scale collaborative project, the first of its type in Australia, is also investigating exciting possibilities raised by another MOF quality - the ability to "tune" their properties by altering their chemistry.

Large modifications can be achieved by using different types of metal ions or organic molecules, and subtle changes by adapting the length of 'links' or the nature of internal surfaces.

"We're looking at ways to enhance MOFs' affinity with CO_2 and improve its separation from flue emissions," said Dr Sumby. "Once we've done our work on the chemistry, other collaborators on the project will investigate how to scale up the results and apply it to industry – such as the removal of carbon dioxide from the flues of power plants, or in other industries."

In addition, the project is pursuing modifications that could allow the nanomaterials to 'breathe' – to uptake then expel gases, as well as converting captured CO_2 into something more useful and less damaging to the environment.

"There have been some very exciting developments in nanomaterials in recent years that may enable us to utilise these materials in ways not realised before," said Dr Sumby.

"In collaboration with colleagues at other institutions, we're trying to synthesise porous MOFs lined with catalysts to actually convert captured CO_2 into useful commodity products, such as feedstocks for agriculture, hydrocarbon fuels, or materials that could be helpful in making solar cells.

It is therefore hoped that in the future, carbon capture and storage might well become carbon capture and recycling.

"It's an exciting area of research, and one that we hope will make a significant and lasting impact on the greenhouse gas situation our world is currently facing," said Dr Sumby.

> "We're looking at ways to enhance MOFs' affinity with CO2 and improve its separation from flue emissions."

The CO_2 'sledgehammer': can we avoid extinction?

Many of us are concerned about the threat of global warming and the harmful effects it may have on future generations.

But what many of us don't know is that there is an associated risk of something very permanent – extinction. University of Adelaide research recently uncovered clear geological evidence of prehistoric mass extinctions triggered by only a slight increase in atmospheric CO_2. However, the study also revealed how nature previously solved the problem, and that could lead the way to a powerful new human response.

Adelaide's Professor Martin Kennedy, working collaboratively with Professor Thomas Wagner of Newcastle University, analysed core samples drilled from the sea bed off the west coast of Africa in a "greenhouse ocean" area - exhibiting depleted oxygen levels and increased temperature and CO_2.

The pair found evidence of an abrupt mass extinction of marine life in the Late Cretaceous Period, 85 million years ago. Ominously, it was triggered by only slight increases in atmospheric temperature and CO_2, which occurred at just a fraction of the rate predicted for coming decades.

"In comparison, if atmospheric CO_2 levels double over the next 50 years as forecast, it will be like hitting our ecosystem with a sledgehammer," said Professor Kennedy. "It could have a rapid, catastrophic impact on life in our oceans, and in turn on many land-based species, including us."

However, the research, published in the *Proceedings of the National Academy of Sciences of the United States of America* (PNAS), also provided some cause for optimism. Further analysis of the core samples indicated that natural carbon-burial processes had activated in response to the Late Cretaceous greenhouse phase, which ultimately restored oxygen concentrations, cooled the planet and allowed marine life to return.

Importantly, said Professor Kennedy, this "natural solution" appeared to be land-based, with soil-formed minerals acting to collect and bury the excess organic matter dissolved in seawater, effectively trapping its carbon.

"So if we can learn more about this process we may actually be able to harness it and reduce the present rate of warming."

> "... if atmospheric CO2 levels double over the next 50 years as forecast, it will be like hitting our ecosystem with a sledgehammer."

New app allows eco worriers to assist science's eco warriors

The dire predictions regarding the global impacts of climate change are troubling for all.

For particularly concerned citizens, however, that inner tension can be exacerbated by a lack of clear choices when it comes to doing something meaningful - beyond reducing their own carbon footprint - in response. Clearly, science must lead the way. But how can the concerned layperson contribute to scientific work? In 2012, researchers at the University of Adelaide not only developed an innovative local answer, but created new technology to share the benefits of it with scientists all over Australia.

The University's Transects for Environmental Monitoring and Decision Making (TREND) research group has developed a remarkable smartphone app that allows members of the public to contribute to the collection of South Australian environmental data critical to local climate change research.

Called "Citizen Science", the downloadable app lets users take photos of the landscape at various set locations throughout the state, then directly upload them into a University landscape monitoring program. Over time the changes observable in the images, which are automatically stamped with date and location, will inform and improve the management of the state's environment.

"With the information provided through Citizen Science, we'll be able to see how native species are adapting to environmental changes like climate change, human pressures and land use change," said TREND team member and Ecologist Stefan Caddy-Retalic.

"We can also monitor how the landscape's changing in terms of carbon cycling (how much carbon is moving between the soils, vegetation and atmosphere), weed invasions and flowering times."

At each photo point, "Citizen Scientists" will be asked to take a shot from two slightly different angles a metre apart. Researchers will then use the resultant stereo image to create an information-rich 3D model of the landscape.

According to TREND lead researcher and Director of the Australian Centre for Evolutionary Biology and Biodiversity Professor Andrew Lowe, the valuable data collected will be stored and made accessible to environmental scientists all over the country via another groundbreaking University of Adelaide innovation - the Australian Ecological Knowledge and Observation System (AEKOS).

"AEKOS is getting attention all over the world," said Professor Lowe. "It's a unique online e-research application that will allow vastly easier reuse of stored ecological data.

"Up until now, differences in collection information and format have made it extremely time consuming to access and reuse peers' data. Researchers can be forced to spend up to 70% of their available time on data preparation alone.

"AEKOS, and its associated search, discovery and extraction tools, is going to turn that around."

A full production version of AEKOS is expected to be launched in mid-2013.

> "...we'll be able to see how native species are adapting to environmental changes like climate change, human pressures and land use change."

Arabana action: adapting Indigenous life to climate change

There's no shortage of scientific information available on the potential environmental impacts of climate change - globally, nationally and even regionally.

A great deal of research, some of it documented within this report, is also being conducted on ways to prevent or reduce the impacts. But with no guarantees regarding if or when these measures will be viable or effective, it is prudent to consider how communities could best adapt should their local living conditions change. In collaboration with the Arabana people in the State's central north, that's what the University of Adelaide has been exploring through the *Arabunna Country Community-based Adaptation to Climate Change* project.

According to project leader and Senior Lecturer in Geography, Environment and Population Dr Melissa Nursey-Bray, the 2011-launched project represents a "vital next step".

"A lot of research has focused on documenting the problems climate change could create in particular areas," said Dr Nursey-Bray. "We want to build on that by helping people develop an adaptation plan to keep their communities alive - in this case South Australia's Arabana Indigenous community."

Dr Nursey-Bray said Arabana country had been chosen because of its large population, wide range of predicted climatic impacts and significant size. It covers an almost 70,000 km^2 area, including Lake Eyre and the Wabma Kadarbu Mound Springs Conservation Park.

While the interdisciplinary project will involve the input of many scientific experts, equally important will be the integration of this with local Arabana knowledge - something that attracted the involvement of Deakin University Chair Indigenous Knowledge Systems, and Arabana woman, Dr Veronica Arbon.

"I'm interested in how we can use research as a tool to help us, as a people, maintain our wellbeing and strength in the face of climate change" said Dr Arbon.

"If we can combine the science and Aboriginal knowledge to pre-empt some of the changes, we might be able to create a framework to manage it better."

> "I'm interested in how we can use research as a tool to help us, as a people, maintain our wellbeing and strength in the face of climate change."

Protecting life and heritage from quake devastation

They're among the most terrifying demonstrations of nature's power we're ever likely to see.

Large earthquakes can wreak death and destruction on a staggering scale, leaving physical, psychological and financial scars that can take years, if not decades to heal. Sometimes communities never recover. Naturally, it's a danger we'd all like to feel safe from. The University of Adelaide is leading an international project to find how we can best give that peace of mind to some of those most at risk.

Led by Chief Investigator Professor Mike Griffith of the University's School of Civil, Environmental and Mining Engineering, the collaborative research team is developing a model to identify those unreinforced masonry buildings most vulnerable to earthquake damage, and the most effective ways of strengthening them.

According to Professor Griffith, he and his co-researchers from New Zealand's University of Auckland and Italy's University of Pavia, are analysing data on building damage collected in Christchurch following the earthquakes in February 2011 and September 2010, which they originally gathered as part of their work for the Canterbury Earthquakes Royal Commission.

"We're taking what we observed and learned from Christchurch to assess the level of risk posed by earthquakes to masonry buildings generally, including here in Adelaide," he said.

While New Zealand stopped constructing masonry buildings after the major 1931 Hawke's Bay earthquake, the style continued in Australia for some time, with many people still renovating and living in masonry buildings today, some heritage-listed.

"We're also looking closely at the unreinforced masonry buildings in Christchurch that had some seismic strengthening, in order to identify which retrofitting schemes were more effective than others.

"Our work to-date has shown that masonry buildings strengthened to about one-third of modern building standards offered no significant protection, whereas those strengthened to two-thirds of current requirements showed significantly less damage."

Professor Griffith noted that higher-level strengthening schemes were more invasive and came at much higher cost.

"So we're trying to establish an accurate cost-benefit ratio that will ultimately be applicable for multiple construction styles all around the world."

> "We're taking what we observed and learned from Christchurch to assess the level of risk posed by earthquakes to masonry buildings generally..."

Reducing on-road threats for vulnerable pedestrians

It's no secret our roads can be a dangerous place. What's not widely known is that many of those who suffer serious injury or fatalities aren't in vehicles at the time.

Pedestrians account for a significant proportion of all Australian road casualties. To help lessen the toll, in 2011 the University of Adelaide launched a cutting-edge vehicle safety testing facility specialising in pedestrian crash impacts.

The Vehicle Safety Laboratory, purpose-built by the University's Centre for Automotive Safety Research (CASR), is the only facility of its kind in Australia and one of the most advanced in the world.

Located in Kent Town (Adelaide) and meeting the most rigorous international regulations, directives and protocols, the Laboratory has been appointed as the official testing facility for the pedestrian component of the Australasian New Car Assessment Program (ANCAP).

According to CASR Director Professor Mary Lydon, it promises to provide valuable assistance in the design and development of more pedestrian-friendly vehicles.

"The Laboratory puts the spotlight on protection offered to pedestrians by different vehicle structures and means we can measure improvements and differences in safety," she said. "With pedestrians accounting for 16.5% of all road fatalities within Australia, and 8.5% of all serious injuries, it's an important step forward."

The new facility has allowed the already world-renowned CASR to expand its range of testing in such areas as the impact performance of bull bars, various energy absorbing materials and vehicle interiors, crash reconstruction, high-speed film capture and high-resolution data acquisition.

ANCAP Chair Lauchlan McIntosh also believes it has improved his organisation's internationally recognised crash-testing regime, benefiting all Australian road users.

"The Vehicle Safety Laboratory definitely provides a better amenity for our pedestrian tests, which form a major part of any vehicle's overall ANCAP safety rating," said Mr McIntosh. "It only strengthens our relationship with CASR."

> "The Laboratory puts the spotlight on protection offered to pedestrians by different vehicle structures and means we can measure improvements and differences in safety."

Innovative Centre puts SA in national arts spotlight

Have you ever marveled at the ability of a musical or ballet to reduce audiences to tears?

Are you fascinated by the spine-tingling impact of a stirring operatic aria? If so, you'll understand the uniquely compelling focus of the J.M. Coetzee Centre for Creative Practice. Launched by the University of Adelaide in March 2012, the Centre is exploring uncharted cultural territory: the remarkable and inspiring relationship between the creative and performing arts.

Great writing, music, dance, theatre and film moves us in ways little else can. Indeed, our emotional response to it is an intrinsic aspect of what it means to be human. And when these artforms collaborate, the result can be work of incredible beauty and power, far greater than the sum of its parts. The J.M. Coetzee Centre for Creative Practice seeks to help us understand the dynamics of this captivating interplay, and ultimately enhance our appreciation of its creations.

The Centre draws from the University of Adelaide disciplines of Creative Writing and Music, both rating highest in the country in the Federal Government's official research measure Excellence in Research for Australia. Outputs will not only include the traditional articles and books, but also multidisciplinary works of art - something we have never seen before in Australia.

"We'll be producing some really innovative research and creative works," said Centre Co-Director and Elder Conservatorium lecturer Professor Mark Carroll. "It will be a place where curiosity, inspiration, and innovation come together."

According to Professor Carroll, the Centre's official launch event provided a perfect example of this - the world premiere of Professor Graeme Koehne and Professor Peter Goldsworthy's complete Ring Tone Cycle, a mini-operetta that tells the story of a love affair in a text-message age.

"It exemplified what can happen when consummate artists from different disciplines pool their talents," said Professor Carroll. "Graeme Koehne is one of Australia's leading composers and Peter Goldsworthy an award-winning author.

"Together they created an amazing operetta, which then reached even greater heights thanks to the input of performers such as the Seraphim Trio and soprano Lisa Harper-Brown."

The Centre is named after Adelaide's Nobel laureate Professor of Literature J.M. Coetzee, himself a member of the centre, and co-directed by Professor Brian Castro, a past winner of many state and national literature prizes, including The Australian/Vogel literary award, The Age Fiction Prize and the National Book Council Prize for Fiction.

Situated on the cultural precinct of North Terrace, it will also showcase the strengths of the Elder Conservatorium, the oldest music institution in Australia and home to many musicians and researchers of international repute.

"It's going to have a tremendous impact on South Australia's cultural scene," said Professor Carroll. "And the world will be watching."

> "It will be a place where curiosity, inspiration, and innovation come together."

New hope is ‘launched’ in ongoing cancer battle

Few medical conditions evoke such fear and dread as cancer.

Its many forms continue to account for a frightening number of deaths around the world, and treatment typically remains an arduous test for sufferers and their families. We are constantly seeking new hope in the battle against this fierce disease, and in 2011, the University of Adelaide provided such hope with the launch of two new world-standard specialist research facilities.

The Dean Bowman Brain Tumour Laboratory (DBBTL) was opened in May 2011, and the Centre for Personalised Cancer Medicine (CPCM) seven months later in December. Both facilities are equipped with the most advanced technology available and will pursue cutting-edge treatment and prevention approaches, reinforcing the University’s 5-star world rating in clinical health research.

Funded by generous donations from Santos and South Australia Police, the DBBTL will be used by the University’s NeuroSurgical Research Foundation to primarily investigate the causes of brain tumours, an extremely aggressive form of cancer responsible for the death of one Australian every six hours.

According to Foundation Chair and Head of the University’s School of Medical Sciences Professor Bob Vink, it’s a vital step forward. “Brain cancer is the leading cause of cancer death in people aged under 40,” he said. “Survival rates haven’t improved in two decades, but this research laboratory will allow us to really focus on how brain tumours gain a foothold. By preventing cancer cells from other parts of the body entering the brain, we hope to reduce the impact of brain cancer and save lives in the process.”

With a slightly broader mandate, the CPCM aims to improve outcomes for cancer patients at all levels - prevention, treatment, rehabilitation and palliative care - by exploring innovative approaches tailored to the individual, taking into account their unique DNA, genetic variations and personal reaction to specific drugs.

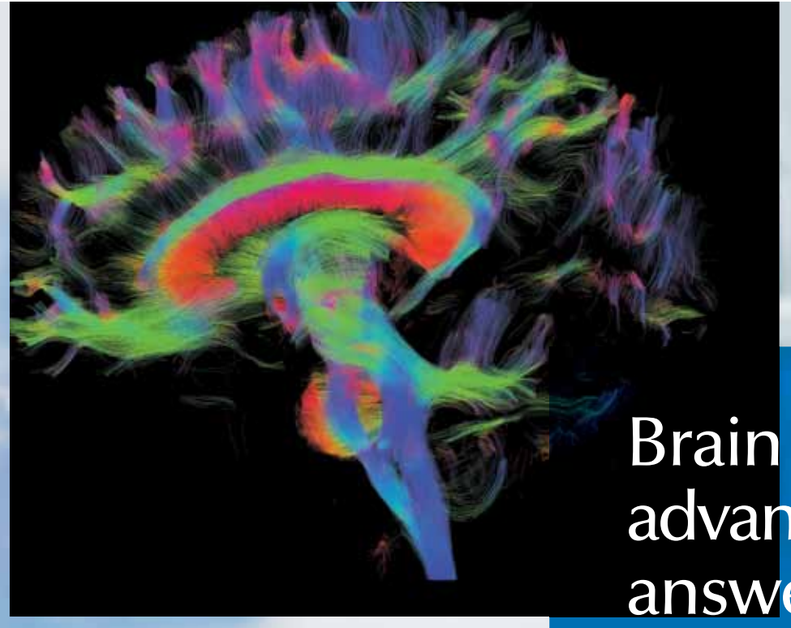
“The big thrust at the moment is DNA sequencing,” said Professor David Callen, who heads the Centre’s world-leading research team. “But we’re also using tumour profiling and animal and cellular models to develop new drugs that target particular molecular changes in individual cancer patients.”

Professor Callen said the Centre was already making headway in some areas, most notably in the treatment of sarcomas, rare malignant tumours that disproportionately affect young people and have a high mortality rate.

“Dr Paul Neilsen, who oversees our Sarcoma Research Group, is collaborating with Royal Adelaide Hospital surgeon Associate Professor Susan Neuhaus to trial new drugs on individual patient’s tumours in a laboratory setting.

“They’ve identified weak points in the tumours and are targeting them with new agents. The next step is to support pre-clinical trials in Australia.”

> “By preventing cancer cells from other parts of the body entering the brain, we hope to reduce the impact of brain cancer and save lives in the process.”



Brain imaging advance; promising answers for mild injury sufferers

Traumatic brain injuries (TBIs) affect tens of thousands of Australians, mostly young males, every year.

Tragically, a number of these will result in death or permanent disability. But for most, the injury is considered mild. Within this “mild” group however, a small number continue to suffer debilitating effects for many years, long after others in similar circumstances have recovered. Reasons for this have been a mystery for quite some time. Are existing brain injury assessment techniques failing to identify hidden damage? An exciting new imaging technique being researched at the University of Adelaide is helping to reveal the answer.

Called “Diffusion Tensor Imaging” (DTI), the unique non-invasive technique is a variation of existing Magnetic Resonance Imaging (MRI) technology and has been utilised by the University’s Adelaide Centre for Neuroscience Research.

According to project leader Professor Jane Mathias of the School of Psychology, it allows a clearer picture to be gained of the microstructure of the brain’s white matter.

“We can now more accurately and reliably delineate neural pathways in healthy white matter, and in turn use this technology to identify subtle disruptions to those pathways as a result of mild TBIs,” she said.

This important advance promises to help explain why people with outwardly similar mild TBIs - whether sustained through a motor vehicle accident, sporting injury, assault, or workplace or accidental injury - can experience different cognitive, psychological and physical effects, to varying degrees and over different timeframes.

“We’re investigating this, along with the influence of several other possible contributing factors that may either increase the impact of an injury or help to protect a person against its effects,” said Professor Mathias. “These include the severity and cause of an injury, the site and side of impact, the influence of alcohol, genetic differences that may affect the physiological effects of an injury and pre-injury levels of functionality.”

The team is comparing five test groups. Three have had a TBI - one “mild”, another “moderate” and the third “severe”. A fourth group is composed of people who’ve had another type of injury not involving the head, such as a broken leg, and the final group is injury-free.

“Each person completed a series of cognitive tasks and questionnaires, had a DTI brain scan, and provided a sample of saliva for genetic testing,” said Professor Mathias.

“A subset also underwent the same procedures a year later so we could see what, if any, changes had occurred. The results are now in and we’re assessing the extent to which each of these factors, including any subtle differences in neural pathways revealed by DTI, can explain the varying functional deficits experienced by mild-TBI patients.”

The next step is to identify some of the factors that increase the risk of a person having a poor outcome, and to use this information to improve the treatment, rehabilitation and quality of life of these people.

> “We can now accurately and reliably delineate neural pathways in healthy white matter, and in turn identify subtle disruptions to those pathways as a result of mild TBIs.”

Answering dental SOS for children and Indigenous Australians

Poor diets, bottled water, low fluoride toothpastes and lack of education – these are just some of the reasons behind the deterioration of oral health in children and Indigenous Australians.

To help tackle this major health problem, the University of Adelaide has launched two research initiatives.

In 2011, the School of Dentistry's Australian Research Centre for Population Oral Health made two very important announcements.

In May it was awarded the lead role in a federally funded study of the status and causes of Australian children's deteriorating dental health, and this was followed in December with the launch of a dedicated Indigenous Oral Health Unit (IOHU).

Professor John Spencer was appointed to lead the study team, which also includes all eight State and Territory public dental authorities, in the search to establish why the dental system is failing our five-to-14 year olds.

"Despite approximately $1 billion dollars annually being directed to children's dental services in Australia in the last decade, their oral health has actually worsened," said Professor Spencer.

"The latest statistics show dental restorations and extractions are the most common reason for hospital admissions among Australian children under 14 years of age. In 2006 nearly 27,000 children - 8,114 of them pre-schoolers - were admitted to hospital for dental work."

The four-year study will look at the organisation and delivery of school and private dental services, and document their results across the child population.

"The challenge is to identify barriers to our children's dental health so that we can eliminate them, improving service delivery, reducing risks and promoting healthy diets."

Similarly, the IOHU will be focusing resources on the investigation of causes and prevention, rather than physical treatments.

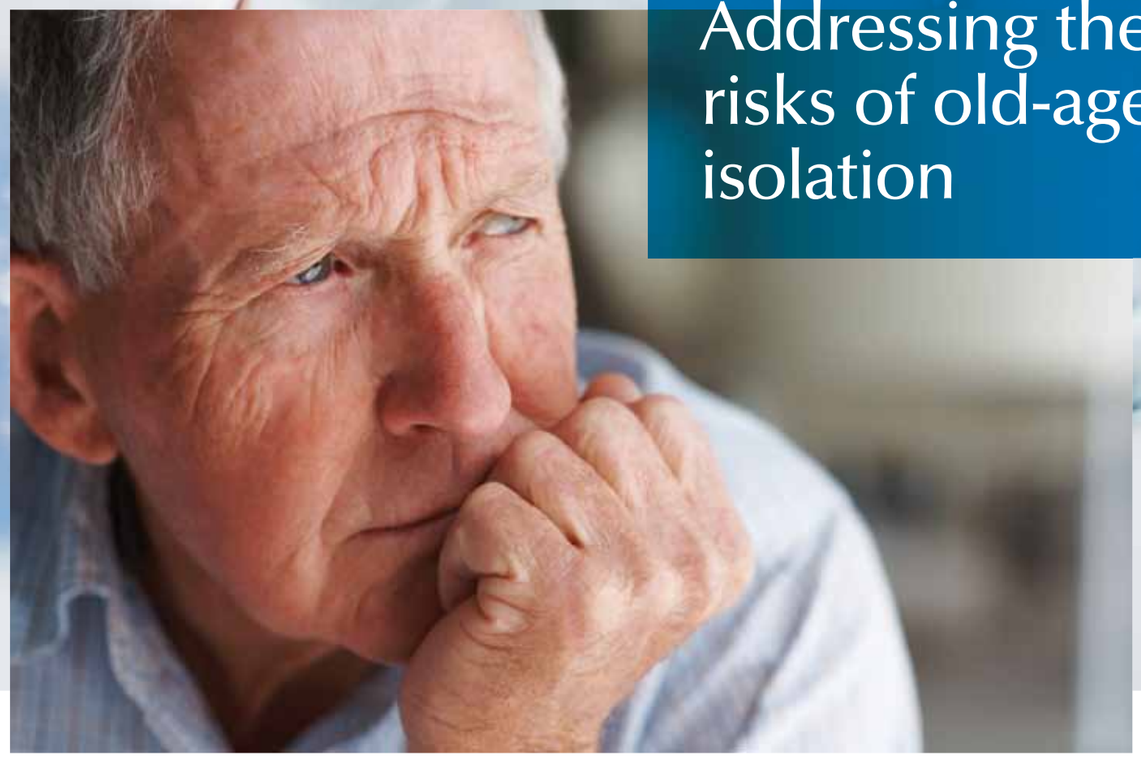
"We're particularly interested in the social determinants of Indigenous oral health," said IOHU Director and Associate Professor Lisa Jamieson.

"That includes education, behavioural change, advocacy and culturally appropriate service provision. We also want to encourage more Indigenous students to become involved in oral health courses, to help make progress more sustainable."

Associate Professor Jamieson said it had been known since the 1980s that Indigenous people were significantly more likely to suffer from dental cavities, periodontal disease and tooth loss than other Australians.

"So another of our immediate goals is to bring urgent attention to that and facilitate access to relevant information for all who need it."

> "The challenge is to identify barriers to our children's dental health so that we can eliminate them, improving service delivery, reducing risks and promoting healthy diets."



Addressing the risks of old-age isolation

Our twilight years are supposed to be golden. We look forward to having time at our disposal, the ability to pursue new interests, and having the health to support these activities.

But for increasing numbers of older Australians, life isn't turning out that way. The reality is one of crushing social isolation and, physical and mental suffering. With a rapidly ageing society, action desperately needs to be taken. Fortunately, a nationwide study led by the University of Adelaide aims to address the risks and improve quality of life.

Launched in 2011, the Australian-first project will seek to identify the most effective approaches to reducing social isolation among older people, by analysing the structures, methods and outcomes of all successful programs currently in operation.

Chief Investigator and Director of the University's Centre for Housing, Urban and Regional Planning Professor Andrew Beer said the knowledge gained would be of critical importance, with social isolation recognised as one of the most serious health risks facing the nation.

"It can do the equivalent damage of smoking 15 cigarettes a day," he said. "It's more harmful than not exercising and twice as harmful as obesity."

According to Professor Beer, social isolation, which is estimated to affect 20% of older Australians, could lead to insomnia, depression and elevated blood pressure, as well as increasing the likelihood of developing dementia.

"That in turn places extra strain on carers and health services, reduces our sense of community and increases the need for acute interventions by local governments, housing providers and other welfare services."

Professor Beer's team included Adelaide colleague Dr Debbie Faulkner, researchers from the Queensland University of Technology, University of Melbourne, Curtin University, King's College London, and representatives from aged care and charitable organisations.

Although reluctant to jump to conclusions, Professor Beer said early evidence gathered by the group appeared to suggest the most effective programs were those that targeted specific population groups, included an educational component and recruited people from the same neighbourhood.

"We need to look at this in a lot more depth though, and examine the differences between gender, location, housing options, age, the presence of a disability and socio-economic status."

Around 900 older Australians will be surveyed as part of the three-year study, along with focus groups, service providers and relevant policy makers.

> "[Social isolation] can do the equivalent damage of smoking 15 cigarettes a day. It's more harmful than not exercising and twice as harmful as obesity."

New gel to benefit millions of sinus sufferers worldwide

If you've never experienced the discomfort of chronic sinusitis, chances are you know someone who has.

Affecting around 18% of Australians, its associated facial pain and pressure brings misery to millions. For many, surgery to enlarge the nasal passages leading to the sinus cavities is the only hope of relief. But even this fails in around a third of cases, with scar tissue forming and re-blocking passages. Naturally, it's a problem medical researchers have been keen to solve. And in 2011, an international team led by the University of Adelaide finally did so.

Led by Adelaide's Professor PJ Wormald, a world-renowned ENT (ear, nose and throat) surgeon, and including University of Otago Emeritus Professor Brian Robinson and his son, ENT surgeon Mr Simon Robinson of Robinson Squidgel Ltd, the collaborators developed a new gel that controls bleeding, improves healing and prevents scarring following sinus surgery.

According to Professor Wormald, the dressing put an end to the previous post-surgery practice of packing the nose with ribbon gauze to stop bleeding and prevent adhesions, which patients typically found extremely uncomfortable.

"The new gel's placed into the sinuses immediately after surgery and is very effective in controlling bleeding," said Professor Wormald. "It forms a coating over the wound that slowly dissolves over two weeks, allowing the sinuses to heal properly without the formation of scar tissue."

Derived from chitosan, a polymer extracted from crab shell and squid, the gel has important blood clotting abilities and has been successfully trialled in sheep and humans.

Professor Wormald said the new product - the patent for which has been purchased by Medtronic, the world's largest medical technology company - represented a significant advance for ENT surgeons and their patients everywhere.

"It will improve a huge number of surgical outcomes in the years ahead," he said. "Millions of people will benefit."

> "The new gel is placed into the sinuses immediately after surgery and is very effective in controlling bleeding."

Collaboration

Businesses are increasingly looking outside their organisations to find solutions to technical problems and social issues.

The University of Adelaide has a long and proud history of collaborating with industry, government, other research institutions and the community to co-create and share ideas and best practice.

“Universities are a source of highly educated people and a major source of new ideas. Along with their teaching and research activities, they attract knowledge and resources from external sources and adapt existing knowledge to local conditions” – Professor Goran Roos

Adelaide Research & Innovation (ARI) is South Australia’s premier commercial research hub, facilitating access to the research and expertise of the University of Adelaide. It offers resources, support and funding to researchers, and provides a point of access for government and business to engage with academics on research, development and innovation. The ARI team have a wide base of skills and experience across a variety of research, commercial and public activities. So we are well equipped to bridge the different cultures that can sometimes frustrate interactions.

ARI is currently managing over 600 agreements between the University of Adelaide and private and public sector, amounting to over $40 million in revenue – all of which flows back to the University and its researchers. These engagements offer significant scope for the development of new knowledge and practices, products, services and improved policy—translating into a sharper competitive edge and broader community benefit.

Following are some examples of recent collaborations and the tangible outcomes that have resulted. These are only a few of hundreds of other- largely unsung - success stories of engagement between the University and its partners.

Rob Chalmers

Managing Director
Adelaide Research & Innovation Pty Ltd

Flying high: partnership making Adelaide Airport nation’s greenest

Major airports are vast physical structures, with numerous operational systems to be powered, large air fleets to be maintained and thousands of people to be catered for on a daily basis.

Not surprisingly, their energy consumption is enormous, leaving a massive carbon footprint. Adelaide Airport Limited (AAL), however, is determined to see this change for the better. It has partnered with the University of Adelaide’s Centre for Energy Technology (CET) to deliver clean energy solutions and, in the process, become Australia’s most ecologically sustainable airport.

The partnership between AAL and CET, which sits within the University’s research-focused Institute for Mineral and Energy Resources, swung into action in early 2011 on three key fronts.

Most notable among these, according to CET Director Professor Gus Nathan, is the development of a transient, thermodynamic model of the airport’s entire Terminal 1 (T1) building.

“Once validated it will be the first such model in Australia to be successfully used on such a large, complex building,” said Professor Nathan.

The model will take into account T1’s geometry, location, local weather, occupancy, lighting systems, heating, ventilation and air-conditioning systems to accurately assess the overall cost-benefit impact of introducing energy-efficiency technologies or practices at any point.

“It will also integrate the outcomes of the two other key projects we’re undertaking with AAL,” he said.

“The first is focusing on the potential benefits for the airport of indirect evaporative cooling (IEC) technology as a pre-cooling system. Our calculations so far have indicated IEC could reduce heating, ventilation and air-conditioning power consumption by as much as 20%.

“And the second is the development of a smart mechanical plant control system, utilising advanced feedback or feed-forward methods to optimise system performance and create more consistent conditions within the building.”

Professor Nathan said the AAL partnership directly supported several other CET projects investigating a range of clean energy tech-nologies to the broader benefit of society.

“We’re looking at turbine wake generation and propagation in collaboration with Korean Maritime University, as a means of improving wind energy utilisation.

“We’re exploring the use of catalytic technologies to generate hydrogen from solar energy as a clean fuel source. A unique laser diagnostic experimental facility is being developed to research more efficient and clean burning flames and solar energy-flame hybrid concepts. And we’re continuing our world-leading research into the optimisation of fuel combustion systems.”

A prominent example of the real-world application of the Centre’s fuel combustion research, the Gyrotherm low NOx burner, which was developed in partnership with FCT-Combustion, reached a significant milestone in 2011.

The 34 Gyrotherm burners installed around the world since its commercial release were last year estimated to have reduced global greenhouse gas emissions by the equivalent total of 29.6M tonnes of CO_2.

“That’s around the annual CO_2 emissions of the whole of South Australia,” said Professor Nathan.

> “We’re exploring the use of catalytic technologies to generate hydrogen from solar energy as a clean fuel source.”

Unlocking the gift of sustainability in plant life

The importance of plants to human civilisation cannot be underestimated.

As a source of food, fuel and raw materials for industry, they're as precious as the air we breathe. As with any resource, however, the degree to which we can utilise and benefit from plants' considerable gifts is enormously dependent on how efficiently, effectively and sustainably we can access and manipulate their contents. That means advancing our scientific understanding of plant cell wall biology. A collaborative research centre hosted by the University of Adelaide is leading the search.

The Australian Research Council (ARC) Centre of Excellence in Plant Cell Walls is a collaboration between the Universities of Adelaide, Melbourne and Queensland, in partnership with the South Australian Government and seven international institutions.

Established in 2011 with $20.5 million funding from the Australian Research Council and $11.5 million from the partner institutions, the Centre's headquarters are at the University of Adelaide's Waite Campus, with nodes at Melbourne and Queensland Universities.

According to Centre Director Professor Geoff Fincher, his team aims to advance understanding of plant cell wall biology to support three key pursuits.

"We're working towards results that will inform the development of sustainable and efficient fuels, superior raw materials for application in industry, and more secure production of healthy food," he said.

Professor Fincher, the 2011 Bio Innovation SA Industry Leader of the Year, added that the Centre had already achieved significant success, with the development of a new barley grain that could drastically reduce the amount of water required to brew beer.

"Usually when malting barley it has to be immersed in water for up to 24 hours, because its cell walls are so thick and difficult for the water to penetrate.

"But by identifying the genes that make up those cell walls, we've been able to reduce the amount of cell wall components and make it much thinner. Use of our new barley grain could accelerate the malting process by up to eight hours and reduce the amount of water needed by up to 40 per cent.

"Based on current production levels in Australia, that could save enough water to satisfy the needs of 30,000 people annually."

> "Use of our new barley grain could accelerate the malting process by up to eight hours and reduce the amount of water needed by up to 40 per cent."

This little algae went to market: new biofuel venture leads world

Imagine finding a clean, viable, mass-production source of biofuel that didn't also steal precious arable land and freshwater from vital food crops.

In collaboration with another Australian university, we found one: Algae-derived oil. Now, with the added support of a commercial partner, we've formed a company to take it to market. And it's a world-first.

Announced in early 2011, Muradel Pty Ltd is a joint venture between the University's commercial development company Adelaide Research & Innovation Pty Ltd, Perth's Murdoch University and Adelaide-based commercial partner SQC Pty Ltd.

The new company aims to be the world's first to produce algae for renewable fuel in a large-scale commercial business by leveraging the natural advantages of the environment at Karratha, in the north-west of West Australia.

According to Murdoch University Professor Michael Borowitzka, who heads the company's research and development team, it has the potential to lead the global biofuels industry.

"Our team's early research proved it's possible to grow large quantities of algae in open saline ponds, without contamination, for commercial biofuel," said Professor Borowitzka.

"Between 2008 and 2011 we consistently achieved a world's-best production rate of over 50 tonnes per hectare, per year, with over half that converted to oil. That gave us the confidence to establish a large-scale plant at Karratha in 2011, where there's a natural abundance of sunlight and a climate conducive to algal growth year-round. Our production rates are now on track to reach up to 50 tonnes per hectare, per year."

Working alongside Professor Borowitzka is Adelaide School of Chemical Engineering Researcher, Dr David Lewis. Internationally recognised for their work in this emerging field, the pair contribute highly complementary skills and knowledge to the project - commercial production of algae and algal products, and the engineering aspects of algal processing respectively.

Dr Lewis said a particularly exciting appeal of algae-derived biofuel was its sustainability, as it didn't compete for natural resources with food crops.

"The algae grows on non-arable - even arid - land without any need for freshwater in cultivation," he said. "By contrast, biofuel crop canola requires a lot of freshwater and good-quality farm land."

> "Between 2008 and 2011 we consistently achieved a world's-best production rate of over 50 tonnes per hectare, per year, with over half that converted to oil."

Healing time: integrating Western and Traditional Chinese Medicine

Modern medicine is on a relentless march, constantly advancing in all disciplines towards more effective remedies for what ails us.

But not all progress comes from looking forward. Traditional Chinese Medicine, backed by vast amounts of qualitative evidence, can be traced back more than 2,000 years. Yet its effect on our bodies at the molecular level has remained unknown. Could these long-hidden secrets play a part in enhancing the Western medicine of tomorrow? A collaborative research centre launched by the University of Adelaide and two Chinese partners aims to find out.

The Zhendong Australia China Centre for Molecular Traditional Chinese Medicine was established in May 2012, in a joint venture between the University of Adelaide, the Shanxi College of Traditional Chinese Medicine and the Zhendong Pharmaceutical Company.

The Centre is investigating the mode of action of Traditional Chinese Medicine at the molecular level, with the ultimate aim of facilitating its evidence-based integration into Western medicine.

According to Centre Director and Head of the University's School of Molecular and Biomedical Science Professor David Adelson, the research team will be employing the rapidly growing field of Systems Biology, which looks at the regulation of complex biological systems in the body.

"The application of systems biology to Traditional Chinese Medicine is particularly exciting," said Professor Adelson.

"It explores what effects there may be on entire molecular and genetic networks that are altered in sickness. This will not only provide us with an understanding of how Traditional Chinese Medicine acts, but will also increase our understanding of the fundamental molecular mechanisms underlying disease."

On the Centre's launch, former University Vice-Chancellor and President Professor James McWha said the significant partnership had the potential to produce health benefits worldwide.

"By working together this way, bringing exponents of traditional Chinese medicine together with molecular science, we're opening the way for new funding, the expansion of interest in traditional Chinese medicine and its potential use in global healthcare," he said.

"It's an exciting venture that can only strengthen ties between our countries."

> "The application of systems biology to Traditional Chinese Medicine is particularly exciting."

Snap Technologies

In recent years we have witnessed increased security in many public places - particularly within high traffic areas such as airports, sporting venues and shopping centres.

This has led to growth in the digital video surveillance industry - estimated at $3.6 billion in 2011 and expected to rise to $10.6 billion by 2016. At the University of Adelaide, researchers in the Australian Centre for Visual Technologies (ACVT) identified this opportunity back in 2006, and have since commercialised new technology in large-scale video surveillance.

Between 2006 and 2009 ACVT, in a project led by Dr Henry Detmold, undertook research into large-scale video surveillance. Based on computer vision research, the ACTV delivered a uniquely scalable approach to estimation of the overlap between fields of view of large numbers of surveillance cameras. This resulted in the development of software that learns which surveillance cameras view overlapping areas and which view areas nearby to each other. Using this technology video surveillance operators are empowered to take control of large-scale networks.

With the technology delivering a five-fold improvement in operator speed, effectiveness and efficiency, the team realised they had developed a product that offered unique and advanced benefits. Inspired by the challenge of commercialisation, Dr Detmold along with Professor Anton van den Hengel, then founded Snap Network Surveillance Pty Ltd - a spinout company part owned by the University. Together they raised over $2.2m in equity funding to support the venture, and now the ACVT research technology has been transferred into Snap Network Surveillance Pty Ltd.

Snap's software has since been trialed at a major international airport (demonstrating a multi-million dollar benefit to the airport) and the team is now gearing up to sell potential life-saving video surveillance software products globally under the Argus brand name.

Excitingly, in August 2012 Snap signed a distribution agreement with Pacific Communications (a division of the iconic South Australian company, Hills Holdings), the market leader in integrated IP systems for the Australian and New Zealand security surveillance market. The backing of Pacific Communications means Snap's breakthrough technology is now ready for market and is destined for use at shopping centres, sporting venues, airports and city centres across Australia and New Zealand.

Snap's Argus product was also exhibited at the recent Security 2012 trade show, and was named by Security Electronics and Networks as Best Product at Security 2012.

Now employing seven full-time staff in Adelaide, Snap is a prominent Australian example of early commercialisation and technology transfer success.

Our Researchers

Dr Stephen David Gregory Ecology / Environmental Science

Ecology could be described as the science of statistics to understand patterns in nature, their processes and their interactions. As such, it was the only option for self-described nature-loving statistician, Stephen Gregory.

Research

Dr Stephen Gregory joined the University of Adelaide as a Postdoctoral Fellow after completing a PhD at the Ecologie, Systématique et Evolution lab at the Université Paris Sud XI. Stephen's research in the field of Ecology aims to improve understanding of species' distributions and abundance and the processes that drive them. He also examines how future changes in these processes will impact their long-term persistence.

As part of this research, Stephen develops statistical tools to understand the importance of particular drivers – in isolation and in synergy – under current and future environmental conditions.

One group of species to come under investigation in Stephen's research is Australia's large kangaroos (family Macropodidae). Stephen has built distribution models that are critical for kangaroo management, and has demonstrated the importance of using non-climate information to advise current and future conservation.

Another of his projects involving kangaroos examines the 'edge of range' theories, introduced 25 years ago by prominent Australian ecologist Graeme Caughley.

Other key projects examine the extinction rate of Australian and global fauna, and the conservation of orangutans.

Stephen's orangutan research in North Borneo brings together forest management and climate science to understand how payments for ecosystem services schemes can help mitigate their risk of extinction, and whether habitat corridors will be effective under changing environmental conditions.

To ensure his research makes a difference, Stephen collaborates widely with governments, academic institutions around the globe and wildlife managers. This ensures that the tools that he develops - and their results - are relevant and applied.

Dr Emma Baker Housing and Health

Historically, owning a home has been the great Australian dream - and for many of us it's our largest ongoing expenditure, the main inheritance we pass down to our kids, and the place where we spend most of our lives. But how does access to, and characteristics of, our housing impact on our lives and our health?

Research

Dr Emma Baker's research focuses on building evidence around the ways in which housing influences health in Australia. There is little evidence in Australia of the relationship between housing and health. This is surprising because these are two of the largest areas of government expenditure.

In places such as the UK or New Zealand, cold damp houses are an obvious cause of health problems. However, in Australia, where we have a mild climate and good quality housing, there is less evidence of the connection. Whilst it may be more subtle here in Australia, issues such as affordability and security of tenure do influence health.

The ultimate aim of Emma's research is to provide hard evidence, which is both accessible and useful to decision makers and governments, so that better policies and interventions can be developed.

Emma's work, as part of the Centre for Housing, Urban and Regional Planning, involves multi-disciplinary collaboration – working with epidemiologists, housing researchers, labour economists, policy makers and others to unpack the relationship between housing and health. Together they use large datasets that allow them to monitor changes to their housing and corresponding health throughout their lives.

Emma is working on a number of projects, including: the way employment and housing work together to influence health, the impact of poor quality housing, and how housing (among other social-economic disadvantages) impacts the mental health of people with disabilities.

Research Impact

Recently, Emma completed a project commissioned by VicHealth that found compelling evidence that not only does poor housing lead to poor health, but poor health also leads to poor housing. While these findings seem straight-forward, they have rarely been system-atically tested and shown in Australia.

The work was well received across the policy community, and nominated for a 2011 VicHealth award for outstanding achievement in health promotion. Perhaps the most pleasing impact of this research was the way it appears to have made major organisations like VicHealth and some non government organisations interested in the issues around housing and health.

Professor Stephen Nicholls Cardiology

The South Australian Health and Medical Research Institute (SAHMRI) and the Heart Foundation are planning the way forward, working with the research community to prevent and improve the quality of life for those suffering from heart disease.

Research

In May 2012, SAHMRI formalised a collaborative partnership with the Heart Foundation to launch the key Heart Disease Research Theme. Professor Stephen Nicholls is the inaugural theme leader, as well as a Professor of Cardiology at the University of Adelaide.

Stephen is a University of Adelaide graduate (Bachelor of Medicine/Surgery 1995 and PhD (Medical Biochemistry) 2004), who continued his professional education in the USA and Europe. His most recent positions include Assistant Professor in Molecular Medicine and Cardiovascular Director at the Cleveland Clinic. After a prestigious eight-year career overseas, he has returned to take up these positions.

Stephen's research covers basic bioscience, clinical research, and large-scale trials involving multiple sites world-wide, with interests ranging from new developments in imaging for cardiology to developing new drugs to prevent heart disease.

Stephen and his research team are involved in basic research, working with patients, looking at the broader population level, involved in big clinical trials, and determine how learnings from a clinical setting can be applied. All of them have an important role to play in identifying, treating and preventing heart disease, which is the single biggest cause of death in Australia.

Dr Luke Harrald Music / Performing Arts

The computer becomes like a virtual musician. It pushes past being the tool we might typically expect, to become an active participant in the performance, on equal footing with the live performer.

Research

Dr Luke Harrald is a composer, performer and new-media artist. With a PhD in composition from the Elder Conservatorium of Music, he is also widely known for his groundbreaking work with improvisation and interactive computer music.

Drawing on methods from mathematics and computer science (including Game Theory and Artificial Life), Luke writes music that incorporates interactive computer music systems. These systems are able to generate music and interact with performers during live performances, becoming 'virtual musicians' that act in tandem with the live performer.

Luke's work is inspired by the dynamic nature of technology, and explores ways that we interact with it. He's interested in the way in which computer models can reveal aspects of human behaviour that aren't readily apparent by other means. He also explores self-organising systems in both computers and nature.

By exploring the social relationships and behaviours involved with improvised music, it is hoped that the insights discovered will be relevant not only to creativity and music, but potentially revolutionary in the study of other social situations. New forms of interacting with information technology will also ultimately be developed.

In tandem with this research, Luke is currently applying ideas from his work to create interactive public art. These installations engage with both heritage and our experience of place to reinvigorate forgotten or neglected sites in the community.

One example of this was Luke's involvement in building a tourist attraction for the South Australian Tourism Commission in the Northern Flinders Ranges. Aspects of his work were adapted to create a unique underground experience in an abandoned mine. The work has been highly successful, attracting a large audience and employing people in the local community since it's opening in mid-2010.

Through his research at the University of Adelaide, Luke has been able to present on his work around Australia, and internationally in London, Paris and Montreal. He was one of only nine participants worldwide to be selected to attend the electronic music summer intensive at the Centre Iannis Xenakis (CIX) in Paris.

Luke is currently the head of studies for the Popular Music and Creative Technologies program, and lectures in Sonic Arts. He is also an associate artist with the Australian Music Centre.

Professor Shizhang Qiao

Chemical Engineering - Nanomaterials

Professor Shizhang Qiao joined the University of Adelaide in 2012 as the inaugural Chair of Nanotechnology.

Research

Professor Shizhang Qiao has established an international reputation in the field of the design and synthesis of novel nano-particles and nanoporous materials for applications in emerging areas, such as sustainable energy, environmentally friendly chemical technology and drug delivery.

Shizhang's ultimate goal is to achieve cheaper and more durable clean energy technology, and effective drug/Si-RNA delivery technology for cancer therapy. His research program develops tailor-designed new porous and nanocomposite materials with prescribed surface, structural and morphological properties for emerging applications and improving current technology.

The University of Adelaide has provided large start-up funding to help Shizhang advance new energy technologies (fuel cells, lithium ion battery, and solar cells), bioseparation and drug/gene/RNA delivery.

Research Impact

Shizhang has co-authored more than 135 papers in refereed journals, including *Nature, Angew Chem Int Ed, J. Am. Chem. Soc, Advanced Materials*. He has attracted more than $3.5 million in research grants from industrial partners, the ARC, National Natural Science Foundation of China, and The University of Queensland.

He has filed three patents on novel nanomaterials. His patented technology was applied to establish a startup company (Lightanate Pty Ltd, with joint investment by UniQuest and Cleantech Ventures Pty Ltd) to develop solar cell and photocatalysis techniques.

Dr Lisa Butler Prostate Cancer

Prostate cancer is a major public health issue in Australia and a leading cause of morbidity and mortality in men.

Research

Fascinated by cancer research since her undergraduate days, Dr Lisa Butler has spent the last 10 years focussing her research on prostate cancer. She directs a major research program that aims to identify better approaches to block prostate cancer growth, using multiple combinations of existing agents and new emerging agents.

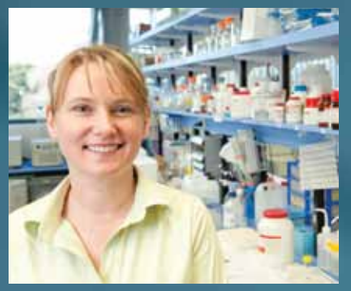
Lisa and her team have demonstrated strong synergy between agents that target androgen (hormone) signalling pathways, at much lower doses than are used currently. This raises the possibility that these combinations may be effective treatments of cancer, with much less toxicity for patients.

A major new research direction for Lisa over the past five years has been the development of better pre-clinical models of prostate cancer. These overcome the well-accepted limitations of cell and animal models and also allow us to fast-track drug discovery by yielding results that are likely to represent, more closely, the individual responses in men with prostate cancer. The model, involving culture of human prostate tissues, relies on fresh specimens and has been made possible by a multidisciplinary collaboration, which Lisa developed between urology surgeons, pathologists, research nurses and researchers.

This human explant model is expected to transform the way we do basic research, test potential therapeutic agents and potentially monitor drug responses in the future. This model has just been published in *Clinical Cancer Research* and is to be featured in the *Research Highlights of Nature Reviews Urology* due to the international interest the research has generated.

Research Impact

Lisa had an early career highlight during her postdoctoral fellowship studies when she performed the key experimental studies that led to a new class of drugs being trialled in patients. It is rare for most basic scientists to see their work translated into clinical practice, particularly in such a short time frame, and was a very exciting (and nerve-wracking) time for Lisa and her team in the laboratory. This experience played a pivotal role for Lisa and has driven her ever since.



Lisa now works with the Adelaide Prostate Cancer Research Centre and the Centre for Personalised Cancer Medicine. She also holds a Senior Research Fellowship with the Cancer Council of SA.

Her ultimate goal is to achieve better treatment responses in patients, using a new drug or therapeutic strategy, while maintaining the best possible quality of life. But her greatest motivator is the evolution of her research program to one which operates closer to the patient's bedside. Lisa also aims to impart her enthusiasm onto her students and research fellows. In the future, it is they who will be responsible for new discoveries that will transform medical care and reduce the future burden of cancer.

Professor Andre Luiten

Physics (Precision Measurement; Frequency Standards; Spectroscopy; Clocks)

"As a child I was always interested in trying to understand things that were beyond direct human experience. It has always been my, perhaps arrogant, belief that these things are ultimately understandable as long as one has a sufficiently good measurement." **Professor Andre Luiten**

Research

Currently an Australian Research Council (ARC) Future Fellow, Professor Andre Luiten's work has two main goals. First, he aims to develop new instruments that have a measurement precision beyond that of any previous device – that is, to measure properties of objects that lie far beyond the ability of the human senses, either because these objects are too small, too fleeting or too weak to be directly experienced. His second goal is to develop robust versions of high-performance measurement devices that can be used outside the laboratory. He is working to simplify and shrink devices so that the precision measurement technology can be taken into the field.

Measurement instruments are critical to scientific discovery across a wide range of fields and Andre's ultimate goal is to produce devices that can enhance human understanding of the universe, or that generate an economic or other benefit for society. He is particularly excited by the possibility of applying these instruments to solve problems for industry or medicine. Some of the possible impacts include: using instruments to search for trace contaminants in natural gas streams that could avoid blockages that are otherwise a large cost and danger to industry; or using similar technology to look for chemicals in the breath that can be pointers to disease.

Previously, Andre has been both an ARC ARF Fellow and an ARC APD Fellow. He won the Bragg Medal for his PhD thesis, and in Western Australia where he previously lived, Andre won the Inaugural Premier's Prize for Early Career Achievement in Science.

Future Research

In February 2013, Andre will take up the Chair of Experimental Physics, with support from a $1 million South Australian Research

Fellowship. He will bring with him a high-calibre team of researchers to establish a suite of world-leading facilities for precision measurement. Based in the University's School of Chemistry & Physics, Professor Andre Luiten will conduct research within the Institute for Photonics & Advanced Sensing (IPAS). He will help to support IPAS's vision to create sensing technologies that will transform our capacity to answer pressing problems both in research and industry,

Andre's new role at the University will also involve teaching and his passion and excitement for physics research will inspire and motivate our next generation of undergraduate scientists.

Dr Kerry Wilkinson Oenology (Wine Sciences)

Imagine if your favourite wine suddenly smelled and tasted like smoked bacon, cold campfires and bandaids. That's exactly what happened to some Australian winemakers when smoke drifted into their vineyards during the Black Saturday bushfires that burned across Victoria in 2009.

Research Impact

Dr Kerry Wilkinson is committed to grape and wine related chemistry initiatives that bring long-term benefits to the Australian wine industry. The Australian wine industry is worth $5 billion annually and wine is our third largest export, after meat and wheat; but when bushfire smoke taints grapes and wine, it can affect the financial viability of grape-growers and winemakers.

Kerry and her team's research interests concern the chemical and sensory analysis of grapes and wine. Over the past 5 years, she has led a research program investigating the impact of vineyard exposure to bushfire smoke, which aims to help the Australian wine industry overcome the issue of smoke taint.

This research, funded through an Australian Research Council (ARC) Linkage Project grant and by the Grape and Wine Research and Development Corporation, identified some of the compounds responsible for smoke taint. It also uncovered methods for removing them from grapes and wine, and developed new analytical techniques for assessing the extent of smoke taint. Now, when a vineyard is exposed to smoke, grape-growers and winemakers can make more informed decisions about whether or not to harvest the fruit, and/or how to process the fruit to minimise the intensity of smoke-related sensory attributes in the final wine.

Other current research projects include:

the use of vineyard management practices to manipulate the 'green' (i.e. herbaceous and vegetal) characters of Cabernet Sauvignon and Merlot wines; and the contribution of oak derived aroma and flavour to wine, resulting from barrel maturation.

Kerry is also currently involved in a Wine2030 funded project involving the development of an iPad application, which will educate users in the sensory evaluation of wine; specifically, in describing wine appearance, aroma, taste and mouth-feel. The application aims to enhance wine enthusiasts' enjoyment of wine by improving their understanding of wine and winemaking.

Dr Matthew Gilliham

Plant Nutrition and Plant Abiotic Stress Tolerance

"How plants grow and how they tolerate what the environment throws at them has always fascinated me. Unlike animals, plants can't run and hide so they have developed a whole host of mechanisms to cope with environmental adversity."
Dr Matthew Gilliham

Research

Dr Matthew Gilliham's research on Plant Nutrition and Plant Abiotic Stress tolerance spans across areas of Agriculture, Viticulture, Plant Science, Plant Nutrition and Plant Salinity stress tolerance. The long-term goal is to improve the stress tolerance of plants to improve their yield in sub-optimal conditions, and improve their nutritive value or quality for the benefit of human and animal diet.

Matt's research is of particular importance in Australia, as he aims to support productivity in two of our major export industries: wheat and wine.

One of Matt's areas of research is on soil salinity, and how wheat and grapevines might better tolerate this. In Australia, soil salinity affects approximately 30% of all agricultural soils and 69% of the wheat belt, reducing the yield and quality of our crops. Globally, 800 million hectares of agricultural soil is classified as saline and this figure is predicted to rise with climate change – so it is truly a global problem. Improving the salinity tolerance of agricultural crops will support efforts to improve global food security, and in particular will provide a boost to the rural communities of Australia that face an uncertain future in regard to water supply.

Currently, more than one in seven humans (or 900 million people) is undernourished. By 2050, the global population will increase to 9 billion people and to meet the demand, food production will have to increase by up to an estimated 78% over current rates. This drives Matt's research forward, and demonstrates what he sees as the number one global challenge – ahead of climate change.

In collaboration with researchers at the Australian Centre for Plant Functional Genomics and CSIRO, Matt has been developing more salt-tolerant crop species using both genetically modified (GM) and non-GM plants to achieve his aims.

Research Impact

The global area of agricultural land is in decline due to climate change, soil degradation, and urbanisation. Furthermore, mineral nutrient deficiency is widespread throughout the developed

and developing world. Therefore, key challenges facing agricultural scientists and food producers are improving both the quantity and quality of primary crops.

An example of how Matt's research can make a difference is the demonstration that wheat yield can be improved on salty soils by 25%, using non-GM breeding techniques, through the introduction of genetic diversity only currently present in a distantly related ancestral cousin of wheat.

This work, which was performed in collaboration with CSIRO, has been regarded as a landmark study as it's the first time a single gene not associated with disease, pest or herbicide resistance has been shown to have a profound effect on yield in the field. As such, it has attracted considerable scientific and media interest from around the world. This research is currently being expanded into other crops and further gains are expected.

Next Generation Researchers

Stephen Warren Smith Physics, Optical Fibre Sensing

"My biggest encouragement and inspiration to study fibre optics came from my Honour's supervisor, Professor Tanya Monro. Her enthusiasm and excitement, coupled with the opportunity to be part of a new research group are the main reasons I chose a career in optics." **Stephen Warren Smith**

Research

While completing his Bachelor of Science (Honours) at the University of Adelaide, Stephen Warren Smith was supervised by one of Australia's leading physicists, Professor Tanya Monro. Inspired by her enthusiasm and success, Stephen decided to choose a career in fibre optics.

Stephen is currently working as an ARC Super Science Fellow, on a three year fellowship. His project is to develop new sensors for diagnosing women's fertility. The sensors use a special type of optical fibre, which consists of tiny holes that run along the fibre's length. The holes serve as a mechanism for transporting light and biological sample collectors. By chemically treating these internal holes the fibre can become sensitive to a variety of biomarkers, such as those indicative of uterine receptivity.

The ultimate goal is to develop a minimally invasive probe that can measure an array of biomarkers and thus determine when a woman's uterus is receptive to implantation and, if it is not, what the problem is. The sensor can then be used as a tool to either time In Vitro Fertilisation implantation or diagnose infertility resulting from uterine dysfunction.

Research Impact

During his PhD, also at the University of Adelaide, Stephen researched optical fibre sensing for a rather different application of corrosion sensing. This was an applied project, but it also led to important fundamental discoveries on both the theoretical operation and fabrication of optical fibre sensors – and these were published in leading scientific journals. These discoveries may help turn Stephen's current research into a commercial application, and it is also hoped that his published work will help other scientists to understand and take advantage of optical fibre sensors.

Mable Yuen-Yan Fong Nanoscience

Early detection, accurate diagnosis, and personalised treatment are the keys to combating cancer. One material that is proving useful for diagnosis and even treatment is gold. Yes, precious, shiny gold.

Research

Normal bulk gold is well known for its use in jewellery, coinage, and art. Much less familiar are the useful and interesting properties that gold has when it exists, not as discernible chunks of metal, but as tiny particles less than a hundred times smaller than a human cell. Mable Fong was captivated by Nanoscience when studying her Bachelor of Science; and is now undertaking a PhD in this area.

Gold nanoparticles, so named because they are nanometres or billionths of a metre in size, are small enough to be absorbed by the human body and into cells. As gold is a very stable and un-reactive metal, these nanoparticles have no toxic effects, which is a useful feature for a medical agent.

Gold nanoparticles can act as sensors to detect cancer cells in the body, enhancing the diagnosis process enormously and improving the chances of early detection. They have not only been used to develop quick and accurate diagnosis techniques, but also in drug delivery and cancer therapy.

Research Impact

The ultimate goal of Mable's research is to develop anti-cancer agents that can be efficiently, specifically, and reliably delivered to a tumour without damaging healthy cells or being degraded beforehand.

Gold nanoparticle-based anticancer treatments are not yet a clinical reality, but cutting-edge research, like Mable is conducting, should soon see these tiny bits of precious metal joining the fight against this disease.

Clare Parker History

In the late 1960s and early 1970s South Australia was the first state to legalise abortion and male homosexuality. As part of her PhD, Clare Parker took a look at the radical social policies of Don Dunstan's government and SA's pioneering laws.

Research

Clare Parker's research project is titled 'Abortion, Homosexuality and the Slippery Slope: Legislating 'Moral' Behaviour in South Australia'. It examines the views of politicians, churches, the medical profession, activist organisations, the media and the general public at the time when laws around abortion and homosexuality were passed.

It also examines the worldwide move towards liberal social reform that occurred at the time; and factors unique to the history of South Australia that contributed to the state's leadership on 'moral' law reform.

Clare's research on abortion was published in the international journal '*Social History of Medicine*', and she has also contributed a book chapter on homosexual law reform.

Research Impact

Clare hopes that her research is interesting and accessible for younger South Australians, so that they can learn how law and morality has changed in recent times. "Abortion and homosexual law reform only happened because people spoke out for what they believed in, and it's important that younger generations understand the power of activism and how to bring about social change – no matter which side of the issues they believe in".

Undertaking a PhD has given Clare the skills to research and analyse the history of a wide variety of important issues in Australian society, and has also provided her with the confidence to pursue her dream of writing a book.

"It's a privilege to be given the opportunity to share my findings about local history with local people, so we can use lessons from our past to make a positive impact on shaping the social policies of our future".

Awards

In addition to an Australian Postgraduate Award to support her PhD research, Clare was the inaugural recipient of both the Ian Wilson Liberal Research Scholarship (2011) and the South Australian Parliament Research Library Supplementary Scholarship (2012).

Jared Peacock Geophysics

"The shift from fossil fuels to clean renewable energy is the biggest challenge that economies will face in the near future. Research and development needs to be done before investor confidence stimulates growth of geothermal as a competitor to fossil fuels." **Jared Peacock**

Research

With a Master of Science (Geophysics) from the Colorado School of Mines, Jared Peacock is a now PhD student in geology and geophysics at the School of Earth and Environmental Sciences. His research focus is on geothermal energy. A relatively new idea, geothermal has the potential to ease the transition from fossil fuels to clean renewable energy.

Jared is currently conducting research to test the viability of using electromagnetic methods to monitor a hydraulic stimulation for the development of an enhanced geothermal system. He is using the Earth's natural time-varying magnetic field as a source and measuring the Earth's response to that field. This gives us an estimation of geologic structure from depth of 10's of metres to 100's of kilometres.

This project is supported by the Department for Manufacturing, Innovation, Trade, Resources and Energy, and in kind by Petratherm and South Australian Centre for Geothermal Energy Research.

The goal of Jared's research is to develop a simple, cheap, yet elegant method that can monitor volumetric fluid injections at depth from the surface using electromagnetic geophysical methods. The experiment focuses on development of an enhanced geothermal system but can be expanded to CO_2 sequestration or fluid injections for coal seam gas.

Research Impact

Results from Jared's research are the first of their kind, and open the door for new applications to an existing geophysical method, while progressing enhanced geothermal research and development. Jared has had an article published in *The Advertiser* and has attended conferences around the world, including Egypt, China, USA, and New Zealand.

Rebecca Sarah West Reintroduction Biology

Rebecca West's PhD is studying the recovery and reintroduction of black-footed rock-wallabies (known to traditional owners as 'warru') on the Anangu Pitjantjatjara Yankunytjatjara (APY) lands of South Australia.

Research

Rebecca learnt of the warru recovery effort during a visit to Australia in 2009. This project aims to conserve the species and also to create positive social outcomes for Anangu through training, employment and the development of new tjukurpa (dreaming) for warru. The opportunity to be involved in the research aspects of this project and make positive contributions to the community whilst completing her PhD inspired Rebecca to move to Australia and join the team.

The goal of Rebecca's PhD project is to answer key knowledge gaps outlined in the Warru Recovery Plan to inform future adaptive management. Contributing to this knowledge will assist in implementing the plan which ultimately aims to downgrade the conservation status of warru from endangered to vulnerable in South Australia, whilst also having lasting positive environmental and social impacts on the APY Lands.

Rebecca is using GPS collars, remote surveillance cameras and genetic analyses to monitor the movement patterns of wild and reintroduced warru to assess how they use the habitat and how they interact with one another. She is also using the data to examine how warru use patch burns, to see if fire management can be used to improve the habitat structure and food availability for rock-wallabies.

Rebecca has secured multiple grants totalling $50,000 to support her research costs.

Research Impact

Rebecca's research offers the privilege to work with traditional owners, scientists, land managers and the communities of APY to fulfil the visions of the Warru

Recovery Team. These experiences will mean that Rebecca finishes her PhD at the University of Adelaide with a portfolio of skills in the area of reintroduction biology, which she hopes to be able to use to contribute towards positive outcomes for other species and communities.

Each field trip reinforces the positive impact that the project is having on the communities. Sharing the milestones of the project (such as the first release of warru to the lands) and the excitement of the results (finding pouch young in the reintroduced individuals) have been personal highlights of Rebecca's PhD so far.

Nadira Ruzehaji

Tissue Repair and Regeneration

Every 30 seconds there is a lower limb amputation in Australia caused by diabetes-related wounds. Nadira Ruzehaji decided she wanted to make a difference. Now she and a group of researchers and clinicians are working to save the limbs and lives of countless Australians.

Research

Nadira Ruzehaji's research relates to skin disorder, whether it results from burn injury (common in children), an inherited skin disorder or chronic wounds related to diabetes - something becoming more common and often resulting in amputation. Nadira focuses on the development of new treatments that allow the body to restore damaged skin more efficiently.

The biology of wound healing is complex, requiring interaction of skin and immune cells, which remove bacteria and make molecules called proteins. Nadira's research group identified the protein called Flightless, and over the past eight years, have been probing the mysteries of specific functions of this protein. They were the first group in the world to recognise the importance of this protein in the wound healing process.

Nadira and her team use mice that are programmed to produce different levels of the protein throughout their bodies. They have innovated a way to mimic human wounds in mice and Nadira's experiments have shown that mice lacking this protein heal faster than mice with high levels of the protein. These results suggest that the special protein has a capacity to inhibit healing. This was of great scientific and clinical interest, because we now know that too much of this protein in the wound is bad for healing.

Research Impact

Nadira and her team have developed a product based on their research around this protein. The product is a cream that contains antibodies, which neutralize the harmful activity of this protein, thereby making wounds heal quicker. They're now testing this new treatment in a human clinical trial. Depending on the results, it may take another five years before the treatment finds its way from the lab bench to the patient bedside. However the hope is that one day it will be used in the clinic to enable people to lead longer, more comfortable lives - with all four limbs still in place.

Nadira has had her research featured in press, interviews and radio. She has presented her work at international conferences in France and Italy and spent two months doing research at a University in Canada.

Awards

- Winner of the SA Young Investigator Award 2011
- Winner of the University of Adelaide AUGU/ RC Heddle Award and Australian Federation of University Women Brenda Nettle Award,
- Winner of the Freemasons Foundation Trevor Prescott Memorial Award,
- Winner of the 'Best PhD Oral Presentation' the conjoint 3rd Conference of Australasian Wound and Tissue Repair Society and 9th Australasian Society for Dermatology Research, Sydney, NSW, Australia
- Winner of the 'Best Oral Presentation' Australian Society for Medical Research SA Scientific meeting, Adelaide, June 2012.

David Wilke

Mathematical Sciences Physiological Fluid Dynamics

Many problems within medical and biological contexts require sophisticated mathematical techniques. The field of physiological fluid dynamics is an area of research at the intersection between such mathematics, engineering and medical worlds.

Research

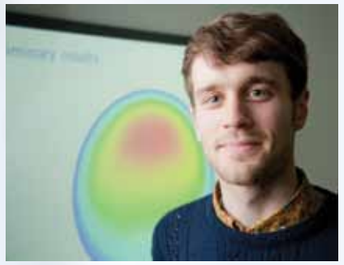
The umbilical cord has a complex three-dimensional structure that is known to influence blood flow between the placenta and developing fetus. This blood flow is responsible for oxygen and nutrient delivery as well as the return of waste products to the mother. Because of this, the structure of the umbilical cord bears a significant influence upon the outcome of the pregnancy.

David Wilke's research project involves the computational modelling of arterial blood flow within the umbilical cord, with the goal being to understand the influential geometric factors that lead to pathological outcomes within the umbilical cord. This research will hopefully lead to improved diagnostic methods for umbilical pathologies as well as an improved understanding of fluid flow within highly curved pipes.

By examining the blood flow using mathematical methods, the system can be analysed using high performance computing. Modelling in this way helps to non-invasively investigate the effects of the geometry and other important features on the characteristics of the blood flow and hence to determine the critical factors which lead to pathological outcomes.

Research Impact

"My research at the University of Adelaide has helped me to become more



independent and improved my problem solving abilities. It has also allowed me to utilise tools acquired throughout my undergraduate studies in order to approach issues within a practical context.

Meeting with medical professionals has enhanced my understanding of the field and attending conferences and workshops within Australia and overseas has shed light on the broader research community and has also provided a great travel experience."

Bert Harris

Conservation Biology

Currently, 13% of the world's bird species are considered to be threatened with extinction, but the effects of climate change will likely revise this estimate to 35% of the global avifauna.

Research

Bert Harris is studying towards a PhD in the field of Conservation Biology, with an EIPR scholarship. For his PhD Bert is measuring and predicting the effects of

climate change on Southeast Asian and Australian birds, with the ultimate goal being to conserve species diversity in the face of mounting pressure from the two most important anthropogenic extinction drivers - habitat loss and climate change.

Most bird species are found in the tropics, but most ecologists and conservation biologists work in the temperate zone. Bert seeks to uncover information on poorly known tropical ecosystems and combine this information with models to characterise extinction risk.

His research involves fieldwork comparing past and current bird distribution and abundance to detect the effects of climate change. He also quantifies bird abundance along elevational gradients to predict possible impacts of climate-change-induced range shifts up mountains. Bert also builds models that combine demographic information (survival and fecundity) with dynamic habitat maps to make predictions of climate change impacts more realistic.

Bert's work in Southeast Asia is funded by the Loke Wan Tho Memorial Foundation and National Geographic. His Australian work is funded by the South Australian Department of Environment and Natural Resources.

Research Impact

While at the University of Adelaide, Bert made a considerable contribution to conservation, publishing 12 peer-reviewed papers and presenting at three international conferences. He received significant media coverage for his project on the United States' Endangered Species Act's poor coverage of species considered by the IUCN to be threatened (articles in *Scientific American* and *The Conversation*).

He will soon be starting a postdoctoral fellowship that was made possible by the above outcomes.

Markus Wagner Computer Science

Bio-inspired algorithms mimic the kind of problem solving that we see in nature – such as the efficient foraging of ants, or the passing on of parents' useful traits to their children.

In his research, Markus Wagner is looking at how these algorithms can be applied to solve complex problems, such as stock-market prediction or the optimal layout of wind farms.

Research

Since the 1960s, bio-inspired algorithms have successfully been applied to numerous domains, leading to strongly practical-oriented interests. The theory of those algorithms, however, is far behind the knowledge gained from experiments and this discrepancy motivated Markus to undertake theoretical investigation.

Markus' research has two main goals. The first goal is to contribute to the theoretical understanding on the inner workings of the bio-inspired optimisation techniques. The second is to actively push these optimisation techniques out of the academic environment into actual industry applications.

Markus has already made significant progress in regards to the second goal, having worked on several applied projects with industry. He worked with the Australian Institute of Sports to help reduce the race time of their cycling teams in team track pursuit; and he has also developed approaches to optimise the layout of wind farms in order to increase the farm's energy outputs.

Research Impact

During his studies at the University of Adelaide, Markus did more than just deepen his Computer Science knowledge. "I have

also broadened my cultural horizon and become a passionate problem-solver".

Markus has initiated several research co-operations that have resulted in scientific publications at internationally renowned conferences. Having attended these conferences and made many valuable contacts, Markus now relies on social networking sites to extend and maintain his networks to keep abreast of worldwide trends.

Tiffany Lynch Nursing

As part of her PhD, Tiffany Lynch is exploring the experience of migrant nurses attempting to meet English language requirements for registration in Australia.

Research

Tiffany's aim is to investigate the experiences of migrating nurses and determine whether the academic nature of the prescribed tests, International English Language Testing System (IELTS) and Occupational English Test (OET) is a barrier to registration for these nurses in Australia.

There is research to suggest a potential mismatch between linguistic criteria assessed by language professionals and clinical communication deemed relevant by health professionals. The aim of this project is to understand the scope and scale of problems facing migrant nurses in meeting the English standards for registration in Australia.

Findings may be used to improve the registration process of migrant nurses in directed methods of English language testing and education. This will contribute to an improvement in the experience of gaining registration for Non-English-Speaking-Background (NESB) nurses as well as being more effectively language-ready upon gaining employment post-registration and the reduction of the economic, social and personal difficulties faced by NESB nurses.

The findings could also inform other health professions encountering similar issues with their English testing processes for migrants.

There have been several qualitative studies conducted outlining areas of concern however Tiffany's study investigates whether these claims are backed up quantitatively with facts and figures related to how many times on average a nurse sits the tests; which test is more indicative of successful registration; and whether there are many examples of test scores fluctuating between sittings.

She has also sought the opinion of registered nurses who have successfully gained registration in Australia as to how

relevant the English language assessed in these tests is to actual effective workplace communication in their experience.

Research Impact

One of Tiffany's goals was to bring this topic to the attention of more stakeholders. She has achieved this, with an article published in the *Nursing Review* in December 2011, followed by another in May 2012. She also presented at the International Journal of Arts and Sciences conference at Harvard.

Lisa Moon Seismic performance of masonry, earthquake engineering, civil engineering

"My interest in earthquake engineering stems from a childhood visit to the New Zealand (NZ) city of Napier, which was devastated by the 1931 Hawke's Bay earthquake. Although most of the city was destroyed I remember learning of one building that survived, and that got me thinking about why this was." **Lisa Moon**

Research

Lisa Moon's PhD research is in Project Masonry – collecting perishable data on the performance of masonry buildings in the Christchurch, NZ, earthquakes of 2010/2011. She spent much of 2011 in Christchurch documenting earthquake damage to unreinforced masonry buildings, including how well any seismic strengthening techniques that had been applied worked.

Part of this work has been included in reports for the NZ Royal Commission into the failure of buildings after the February 2011 earthquake.

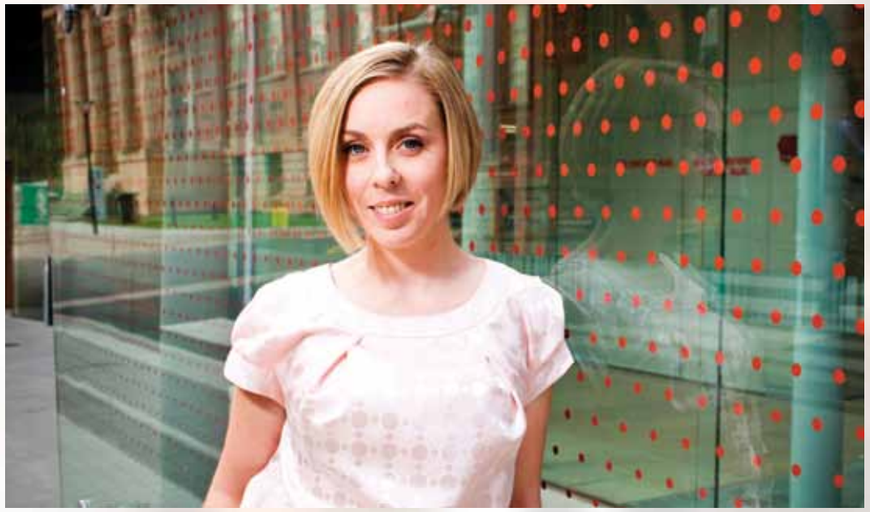
Lisa's research is of great interest to the international structural engineering community, particularly in the US, Australia and New Zealand where there are many seismically vulnerable buildings similar to those which existed in Christchurch.

Research Impact

Information on the performance of existing seismic improvement techniques is rarely available on a scale such as that in Christchurch, and provides the opportunity to compare how these techniques have worked in the field compared to their performance in lab tests.

The goal of the research therefore, is to ensure that as much as possible is learnt from the Christchurch earthquakes, and lessons learnt are shared with the international community. This will ensure that appropriate seismic protection measures can be implemented in buildings across the world, preventing the scale of loss of historic structures seen in Christchurch. This is particularly relevant for Adelaide, as Adelaide has a similar building stock to Christchurch and also has the risk of earthquakes.

Kylie Dunning Reproductive / Ovarian Biology



After mortality, the second greatest concern for cancer patients is their fertility. For patients who become infertile prematurely, research provides hope in restoring their fertility and having a family.

Research

Working in the School of Paediatrics and Reproductive Health and the Robinson Institute, Kylie Dunning's research seeks to restore fertility in women who have become infertile prematurely. Kylie's research seeks to understand how eggs develop in the ovary – specifically, how this environment is critical for the ability of the egg to be fertilised by sperm following ovulation and its development into a healthy embryo. With this understanding, Kylie is mimicking the process in the laboratory.

One of the research projects Kylie and her team are undertaking utilises new methods for growing ovarian tissue within 3-dimensional gels outside of the body in the laboratory. Using this technology, the team aims to determine the key nutritional and 3-dimensional structural requirements for healthy egg development. They hope that this research will yield new knowledge of how nutritional supply and the composition of the surrounding 3-dimensional gel influence the generation of healthy eggs in the laboratory.

Kylie has already discovered that increasing how much fat the eggs and their support cells burn during their growth and development in the laboratory, dramatically increases the number of healthy eggs capable of forming an embryo.

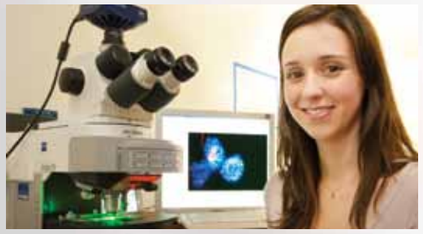
This research, which is funded by the Robinson Institute and ARC early career grants, as well as the Women's & Children's foundation and Channel 7's Children's Foundation, is of particular importance for cancer patients. Cancer treatments like chemo and radiation therapy can reach the ovary and lead to the death of eggs resulting in early menopause and infertility, even in young women and girls. With this research, these patients can maintain hope of having a family.

Research Impact

Scientific discoveries in Kylie's field have a strong history in being translated into medical practice. This means that the benefits of the discoveries made today will provide immeasurable benefits for future generations. In addition, the ability to grow healthy eggs outside of the body also has implications for preserving the fertility of species under threat. Thus overall, this research will significantly benefit the health of women and the biodiversity in Australia. The discoveries made in this area have also resulted in invitations for Kylie to speak at international and national conferences.

Megan Wright Epigenetics

The field of Epigenetics is quite new, and while we are still trying to deduce all the connections with diseases, certain Epigenetic changes in a cell are now understood to be characteristic of cancer.



Research

Megan Wright's research career began with bachelor degrees in Science and Media. It was during these undergraduate years that she developed a curiosity for genetics and decided to pursue Honours in this field. Megan was provided the opportunity to undertake Honours in a laboratory specialising in Epigenetics and her research interests grew from there.

While Epigenetics is a fairly new field, more is known about the processes than how these processes evolved. This is where Megan's interest lies. For her PhD, she is investigating the evolution of processes such as DNA replication timing (the time it takes for a cell to make a new copy of DNA), gene expression, and long-range DNA interactions (how pieces of DNA come together and interact to perform a function).

Throughout her PhD research, she has made some interesting discoveries in terms of how epigenetic mechanisms have evolved, which is something she considers a personal highlight.

Research Impact

The ultimate goal of Megan's research is to provide insight into how Epigenetic processes can be used in terms of therapeutics. With more research, Megan believes we can learn how to use Epigenetic changes as markers for certain diseases.

Throughout Megan's research at the University of Adelaide she has had the opportunity to travel, speak at international conferences and meet highly regarded scientists in her field. "This has had a positive impact on my research career, and my position as a PhD researcher has really opened up other career avenues".

George Tan Geography

Migration is a dynamic and complex process that requires ongoing investigation. The ultimate goal of George Tan's research is to contribute towards the understanding and knowledge of migration, and to allow policy makers to effectively design sound immigration policies.

Research

As a former international student, George Tan has a personal interest in understanding the migration of people around the world. This led to the completion of his Honours and PhD, which investigated the mobility of international students in Australia. George's undergraduate studies armed him with an understanding and appreciation of the value of research in policy making. He is now working actively in this field, and current projects include:

- Working with policy officers from the Office of the Ageing at SA Health to understand key characteristics of South Australia's older population.
- Two ageing projects funded by nationally competitive grants - 'Linking Rural Older People to Community through Technology' funded by the Australian Department of Health and Ageing, and 'Patterns of Intergenerational Transfers of Time and Money in Australia' funded by National Seniors Australia- Productive Ageing Centre.
- Developing research links with Oxford University and with the Australian and New Zealand Association (ANZA) in Singapore. These projects involve understanding the migration of the Australian Diaspora, their transnational linkages with Australia.

Research Impact

In January 2012, George was appointed as a Post Doctoral Fellow at the Australian Population and Migration Research Centre.

In May 2012, he was awarded the Royal Geographical Society of South Australia John Lewis Silver Medal for making a significant theoretical or empirical contribution to Geography.

2011/12
Fellowships and Awards

NHMRC Fellowships

Early Career Fellowships commencing in 2012:

Dr Tod Fullston
Dr Daniel Thomas
Dr Aaron Sverdlov
Dr Han Lim

Career Development Fellowships commencing in 2012:

Dr Tanya Little
Dr Alice Rumbold
Dr Loc Do

Practitioner Fellowships commencing in 2012:

Professor Paul Reynolds

Senior Research Fellowships commencing in 2012:

Professor Claire Roberts
Professor Hamish Scott
Dr Robert Gilchrist
A/Professor Gregory Goodall

ARC Fellowships

Future Fellowships commencing in 2012:

Professor Derek Abbott
A/Professor Alan Collins
A/Professor Leonie Heilbronn
Dr Ivan Nagelkerken
Dr John Paterson
Dr Michael Samuel
Dr Chunhua Shen
Dr Cheryl Shoubridge
Dr Ross Young

Discovery Early Career Researcher Awards Commencing in 2012:

Dr Kylie Dunning
Dr Pedram Hekmati
A/Professor Natalie D Keirstead
Dr Caroline Laurence
Dr Tanya Little
Dr Paul Medwell
Dr Amy Perfors
Dr Gretel Png
Dr Nina Schwensow
Dr Qinfeng Shi
Dr Robert Yuncken

APDI (Australian Post Doctoral Fellow-Industry) Fellowship commencing 2012

Dr Michael Rix

DORA (Discovery Outstanding Research Award) recipients for Discovery Projects 2012:

A/Professor Samer Akkach
Professor Graham 'Gus' Nathan
Dr Adrienne Paton

Other Fellowships

South Australian Cancer Research Collaborative (now named Beat Cancer Project) Fellowships, commencing in 2012:

Professor Gordon Howarth
Dr Loretta Dorstyn
Dr Carmela Ricciardelli

Garnett Passe and Rodney Williams Foundation Training Fellowship commencing 2012:

Dr Claudia Trapetti

National Heart Foundation Career Development Fellowship commencing 2012:

Dr Natasha Harvey

South Australian Cardiovascular Research Development Program Fellowship commencing 2012:

Dr Lisa Moran

RAH Research Committee Mary Overton Early Career Fellowship commencing 2012:

Dr Robert Steinert

The Hospital Research Foundation Early Career Fellowship commencing 2012:

Dr Cassandra McIver
Dr Eleanor Need

Australian Solar Institute Post Doctoral Research Fellowship commencing 2012:

Dr Philip van Eyk

European Union Marie Curie Fellowships commencing in 2012:

Dr Peter Hoch
Dr Pedro Bover

Zhendong Chair of Molecular Traditional Chinese Medicine:

Professor David Adelson

Premier's Science and Research Council – SA Research Fellowship commencing in 2012:

Professor Andre Luiten

Go8 Australia-China Young Researchers Exchange Program

Dr Matthew Gilliham

Awards

2011 SA Science Excellence Awards:

SA Scientist of the Year: Professor Peter Langridge

PhD Excellence – Health & Medical Sciences: Dr Natasha Rogers

PhD Excellence – Physical Science/Mathematics/ Engineering: Dr Stephen Warren Smith

2012 SA Science Excellence Awards:

Early Career STEM Educator – Tertiary Teaching: Dr Femke Buisman-Pijlman

2011 Tall Poppy Award:

Five researchers and one affiliate are among eight South Australian winners:

Dr Stuart Brierley (Neuroscience and Gastroenterology) from the School of Medicine

Dr Claire Jessop (Diabetes and Transplantation) from the School of Medicine

Dr Laura Brooks (Acoustics) from the School of Mechanical Engineering

Dr Mark Tingay (Geoscience and Petroleum Engineering) from the Australian School of Petroleum Science

Dr Tara Pukala (Biological Chemistry) from the School of Chemistry and Physics

Dr Phillip Gregory (Breast Cancer) from SA Pathology is also an affiliate with the School of Medicine at the University of Adelaide

2012 Tall Poppy Award:

Three researchers are among eight South Australian winners:

Dr Matthew Gilliham, plant science/ food security – salinity tolerance and increased productivity

Professor Dmitri Kavetski, modelling of water catchments for planning and the environment

Dr Kerry Wilkinson, analytical chemistry and wine science

Scholars

2011 Fulbright Scholars:

Dr Clare Sullivan, Research Fellow in the Adelaide Law School

2012 Fulbright Scholars:

Adam Webster, PhD student in the Adelaide Law School

Dr Stephanie Reuter Lange, Sciences

Dr Richard Collins, Environmental Sciences

2011 Rhodes Scholars:

Rebecca Richards, Anthropology
Christopher Wong, Medicine

2012 Rhodes Scholars:

Mark Hassall, Medicine
Alyssa Fitzpatrick, Medicine

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