



DISCOVERY

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CEO'S COLUMN



Professor Peter Høj.
Photograph by Norman Plant.

■ Recently I was fortunate to be a member of a working group reporting to the Prime Minister's Science Innovation and Engineering Council at its 2 June 2006 meeting¹.

The working group was tasked with examining the

emergence of China and India as global economic and technological players and providing advice to the Government on what this means for Australia. Specifically, our brief was to identify: *complementarities* between Australia's research and innovation capability and that of China and India; *threats* that the growth of these two countries may pose; and *opportunities* presented by the new global order to provide significant and sustainable benefits to Australia's own global position. We were also tasked with recommending strategies for capturing those opportunities.

The group was chaired by DuPont (Australia) Limited Managing Director Mr Hutch Ranck and comprised diverse members from the private and public sectors. Among them were Dr Megan Clark, Vice-President Technology, BHP Billiton; Mr Bruce Grey, Managing Director, Bishop Technology Group; Dr James Fox, Managing Director, Vision Systems Limited; Mr Tony Pensabene, Associate Director, Economics and Research, Australian Industry Group; Dr Tony Haymet,

Director, Science and Policy, CSIRO; Professor Peter Sheehan, Director, Centre for Strategic Economic Studies, Victoria University of Technology; and Professor Stephanie Fahey, Deputy Vice-Chancellor (International), Monash University. The task of addressing this issue was large and complex and the group worked on it solidly for about a year.

In essence, the report builds its arguments around a pyramid of *foundation* (base), *linkages* (middle) and *opportunities* (top) in the Australian innovation system. Assuming that the foundations of Australia's education system can be strengthened further, it draws the conclusion that major *opportunities* in the new global economy can be realised through the formation of appropriate *linkage* strategies at the levels of business, science and technology.

The working group made three overarching recommendations:

Recommendation 1

Australia needs to capture the *opportunities* created by the emergence of China and India by encouraging business engagement in our four priority areas, stimulating business investment in R&D, and simplifying private company access to publicly funded intellectual property.

Recommendation 2

Australia needs to enhance the *linkages* with China and India by developing a whole-of-government strategy for engagement and investing in collaborative knowledge infrastructure.

Recommendation 3

Strengthen the *foundations* of Australia's education system by increasing the investment in higher education, attracting higher quality Australian students into science and engineering, strengthening the science and maths teaching and curricula in Australian schools, and attracting higher quality doctoral students from China and India.

The ANAO report concluded that the ARC had a substantial peer-review process in place, with a strong focus on research merit and national benefit enabling the ARC to select and fund excellent research

1 http://www.dest.gov.au/sectors/science_innovation/science_agencies_committees/prime_ministers_science_engineering_innovation_council/meetings/fifteenth_meeting.htm for access to the full report and associated presentation.

The activities that are pursued through the ARC's various schemes are relevant to these recommendations. Through our *Linkage Projects* scheme, we bring about co-investments in R&D between universities and business/other end-users. Through our *Linkage International*, *Centres of Excellence* and *Discovery Projects* schemes, we foster extensive international collaborations. Through all schemes, we contribute to the foundations for a broad research capacity in Australia in the future. All this is at the heart of creating the environments that are necessary for Australian R&D to be on the global radar screens and hence make us attractive collaborators and desirable places for undergraduate, graduate and postdoctoral training. Such activities are necessary for Australia to create, recognise and capture global opportunities. The ARC is looking forward to working with other parts of our innovation system to create all the conditions and attitudes needed to thrive in an environment where the global 'talent war' appears to be ever escalating.

Above, I briefly mentioned some of the ARC's funding schemes. The success of such schemes is critically dependent on the ARC's ability to employ a strong peer review process and, through that, identify and recommend for funding—from more than 5,000 proposals each year—those 20-35 per cent that most effectively will contribute to fulfilling our mission to *Advance Australia's research excellence to be globally competitive and deliver benefits to the community*. This task informs the Australian Government's \$561 million annual investment through the ARC and it is crucial that the administration and integrity of the ARC's procedures are beyond reproach.

One of the means by which the Government is informed about our performance is through audits conducted by the Australian National Audit Office (ANAO). Starting in April 2005 and reporting in May 2006, the ANAO conducted a full

Performance audit of the management of research grants, available at <http://www.anao.gov.au>.

The overall audit conclusion was that the ARC was meeting the requirements of the *Australian Research Council Act 2001* in administering grants for basic and applied research.

It further concluded that the ARC:

- had developed a workable decentralised model with universities for administering grants on ARC's behalf—funding agreements were in place and ARC's monthly payments to universities were accurate and timely.
- had a substantial peer-review process in place, with a strong focus on research merit and national benefit enabling the ARC to select and fund excellent research.

Notwithstanding these positive findings, the ANAO also found areas in which there was scope for improvement, including that the ARC had few systematic processes to monitor progress and final reporting of projects. All up, the ANAO made nine recommendations to which the ARC has agreed and is reacting as fast as possible. At the core of our response will be the continued development of our new research management system, about which more is written elsewhere in this newsletter. We are confident that these steps towards continual improvement will allow all concerned with basic research through the ARC to even more effectively deliver against our mission and associated goals—let us capture the opportunities.

Yours sincerely



Professor Peter Høj

From genes to energy, agriculture and the environment

■ **Western Australia's first ARC Centre of Excellence will focus its research efforts on the genes, proteins and small molecules that define the health, growth and productivity of plants to help increase our knowledge of how plants regulate energy generation in the capture of sunlight to produce food.**

The Australian Government is providing \$12.5 million over five years to the ARC Centre of Excellence in Plant Energy Biology at The University of Western Australia (UWA), opened in April by the Minister for Education, Science and Training, Ms Julie Bishop. An additional \$12.5 million is being provided by UWA, The Australian National University and The University of Sydney.

The Centre will house the laboratories of WA's first Federation Fellow, Professor Steven Smith, the WA Premier's most recent Research Fellow, Professor Ian Small, and the 2005 winner of the Science Minister's Prize for Australian Life Scientist of the Year, Professor Harvey Millar.

"Globally, energy fluxes through plants dwarf even mankind's use of fossil fuels, but much remains to be discovered about how plants control their energy metabolism," acting Centre Director, Professor Jim Whelan, said.

"Using the latest technological advances, scientists at the Centre will develop agricultural and environmental applications for their research."

As well as WA, the Centre has laboratories in Canberra and Sydney.



Ms Bishop and one of the Centre's PhD students, Owen Duncan. Photograph courtesy of the ARC Centre of Excellence in Plant Energy Biology.

The researchers will collaborate with scientists at Zhejiang University in China and at top European plant science centres. In addition, Centre staff will conduct an education program for the WA community to explain the important role played by plant energy biology in increasing the value of Australia's agricultural economy and safeguarding the natural environment.

FEDERATION FELLOWSHIPS

Keeping Australia clever

■ Twenty-five world-class researchers from diverse fields were awarded ARC *Federation Fellowships* in May 2006, bringing the total number of Federation Fellows to more than 100.

The Minister for Education, Science and Training, Ms Julie Bishop, announced \$41.5 million over five years for the new Fellows, 18 of whom are already based in Australia, five expatriate Australians and two foreign nationals.

“The *Federation Fellowships* scheme reflects the Australian Government’s strong commitment to ensuring Australia remains at the forefront of both basic and applied research,” Ms Bishop said.

“The scheme attracts applications of the highest order from around the world. This investment—including \$2 million in start-up funding over two years for six researchers coming from overseas—is enabling Australia to maintain and build its international reputation as a leading research nation.”

This year’s *Federation Fellows* will undertake research in diverse, challenging and thought-provoking fields of endeavour, including biomedical engineering; justice and law enforcement; environmental sciences; architecture; the physical sciences; history; mathematics; biochemistry and cell biology; neurosciences; malaria research; ecology and evolution; electrical and electronic engineering; genetics; and sociology.

Examples of the research projects to be undertaken include:

- developing new drugs to combat mental illnesses
- identifying the reasons for the success or failure of peace building in the Pacific and Asia
- developing a new generation of silicon solar cells that will reduce the costs of generating electricity from sunlight
- improving our understanding of Islam and terrorism in Southeast Asia
- developing new methods of detecting explosives and identifying types of explosives—technology that is relevant to counter-terrorism, medical sciences, forensics, energy generation, monitoring the environment, and quality control in the food industry
- improving our understanding of Australian climate variability and our ability to respond to predicted impacts
- developing polymers (plastic-like materials) that respond to electrical signals which can improve the quality of life for people with heart implants, neuromuscular disorders and spinal cord injuries

Our support for the innovative work of these researchers will help to ensure a brighter future for all Australians



First row l to r: Professor Mark Burry, Professor Guifre Vidal, Professor Andrew White, Minister Julie Bishop, Dr Jamie Rossjohn, Professor Michael Parker. Second row l to r: Professor Graeme Turner, Professor Terry Hughes, Professor Keith Nugent, Professor Hugh Possingham, Professor Timothy Lindsey, Professor Christopher Goodnow, Professor Paul Haddad, Professor Geoffrey McFadden, Professor Gordon Wallace.
Photograph by Norman Plant.

“Our support for the innovative work of these researchers will help to ensure a brighter future for all Australians. *Federation Fellows* are excellent role models for many talented young Australians hoping to have research careers and their work plays a significant role in forming our next generation of high-calibre researchers,” Ms Bishop said.

“In addition, the research will have tangible long-term economic, environmental, social and cultural benefits for all Australians, in particular, and people around the world in general.”

This year, for the first time, researchers who were awarded their *Federation Fellowships* in the 2002 inaugural funding round were eligible to apply for a second Fellowship to continue their groundbreaking work. The Minister awarded a second *Federation Fellowship* to four

outstanding researchers.

The Australian researchers returning to this country have most recently held positions with Harvard University, the University of Minnesota, the University of Oklahoma and Yale University in the USA, and the University of Oxford in the UK. The foreign nationals will come to Australian universities from the National Institute on Drug Abuse and from Brown University in the USA.

For more information, visit www.arc.gov.au.

FEDERATION FELLOWSHIPS

Summary of *Federation Fellowships* announced in May 2006

James Cook University

- Professor Terence Hughes*
Project: *Science for resilience of coral reef systems*

Monash University

- Dr Jamie Rossjohn
Project: *An investigation into infection, immunity and rational drug design*
- Professor Pascal Van Hentenryck
Project: *Adaptive and integrated resource allocation*

RMIT University

- Professor Mark Burry
Project: *Complex architecture and convergent design*

St Vincent's Institute of Medical Research

- Professor Michael Parker
Project: *Structural neurobiology—developing a new capability in Australia to treat mental illness*

The Australian National University

- Professor John Braithwaite*
Project: *Restorative justice and responsive governance: Fresh challenges, new theory, global networks*
- Professor Christopher Goodnow
Project: *Discovering genes and mechanisms regulating immune responses*

The University of Melbourne

- Professor Peter Hall
Project: *Nonparametric statistical methods—new directions, theory and applications*

- Professor David Karoly
Project: *Improving understanding of climate change and its impacts in Australia*
- Professor Timothy Lindsey
Project: *Islam and modernity: Syari'ah, terrorism and governance in South-East Asia*
- Professor Geoffrey McFadden
Project: *Drug targets in malaria parasites*
- Associate Professor Ivan Marusic
Project: *Wall turbulence drag: Physical mechanisms and practicable control strategies*
- Professor Keith Nugent*
Project: *Coherent x-ray science and biophysics*
- Associate Professor David Studdert
Project: *Using law to improve population health and the quality of health care services*

The University of New South Wales

- Professor Martin Green*
Project: *Nanostructured silicon-based tandem solar cells*

The University of Queensland

- Dr Paul Burn
Project: *Dendritic organic semiconductors*
- Professor David Fairlie
Project: *Chemical mimics of bioactive protein surfaces*
- Professor Hugh Possingham
Project: *Theory for global biodiversity conservation*

- Professor Graeme Turner
Project: *Television in the post-broadcast era: The role of old and new media in the formation of national communities*
- Professor Guifre Vidal
Project: *Quantum information and entanglement: A new framework for science and technology with quantum many-body systems*
- Professor Andrew White
Project: *Integrated quantum photonics*

The University of Sydney

- Professor Benedict Kiernan
Project: *Cambodia—place, people and politics: Environmental, economic, cultural, political and regional history since earliest times*
- Dr Toni Shippenberg
Project: *Cellular and neurochemical basis of drug addiction*

University of Tasmania

- Professor Paul Haddad
Project: *Separation science based on nanoparticle-coated monolithic scaffold stationary phases*

University of Wollongong

- Professor Gordon Wallace
Project: *Nanobionics*

* Denotes second Federation Fellowship

For more information, visit
www.arc.gov.au.

FEDERATION FELLOWSHIPS

Federation Fellowships 2006: Overview

Total number of applications

163 (plus one withdrawn)

Australians returning from overseas	35	(21%)
Foreign Nationals	19	(12%)
Resident Australians	109	(67%)

Number of Federation Fellowships awarded

25 (four researchers have been awarded a second Federation Fellowship in 2006)

Australians returning from overseas	5	(20%)
Foreign Nationals	2	(8%)
Resident Australians	18	(72%)

Funding

- Each Federation Fellow will receive an annual salary of \$250,970 (2006 dollars).
- In addition to salary, the ARC will provide 26 per cent in on-costs, bringing annual ARC funding to each Federation Fellow to \$316,222.
- Over the five years, the salary component for the 25 Fellowships will total \$31.4 million.
- Over the five years, the total salary and on-costs funding for the 25 Fellowships will be \$39.5 million.
- In addition, start-up grants have been offered to six researchers, totalling \$2 million over two years.
- Overall, ARC funding to the 25 researchers offered *Federation Fellowships* will be \$41.5 million over five years.

Discipline groupings

Although a number of the Federation Fellows announced in 2006 will conduct research that fits squarely within particular ARC discipline groupings, many will conduct research that overlaps two or three discipline groupings. In broad terms, their research fits into the following groupings:

Biological Sciences and Biotechnology	6	(24%)
Engineering and Environmental Sciences	3	(12%)
Humanities and Creative Arts	4	(16%)
Mathematics, Information and Communication Sciences	4	(16%)
Physics, Chemistry and Geoscience	6	(24%)
Social, Behavioural and Economic Sciences	2	(8%)

Years since award of PhD

The ARC encourages applications from early- to mid-career researchers who could play a leadership role in building Australia's internationally competitive research capacity. The amount of time since each Federation Fellow announced in 2006 completed a PhD is as follows:

0-15 years	7	(28%)
16-20 years	6*	(24%)
21+ years	12	(48%)

* One since award of MA

Age distribution

Of the Federation Fellows announced in 2006, 18 are under 50 years of age. The age distribution range is as follows:

< 40 years	4	(16%)
40-49 years	14	(56%)
50-59 years	7	(28%)
60+ years	0	(0%)

Host organisations

The Federation Fellows announced in 2006 will conduct their research at the following host organisations:

James Cook University	1
Monash University	2
RMIT University	1
St Vincent's Institute of Medical Research	1
The Australian National University	2
The University of Melbourne	7
The University of New South Wales	1
The University of Queensland	6
The University of Sydney	2
University of Tasmania	1
University of Wollongong	1

The 90 *Federation Fellowships* accepted between 2002 and 2005, plus the 25 announced in 2006, are distributed amongst host organisations as follows:

CSIRO – Australia Telescope National Facility	2
CSIRO – Health Sciences and Nutrition	1
CSIRO – Molecular Science	1
CSIRO – Petroleum Resources	1
Deakin University	1
Griffith University	2
James Cook University	2*
La Trobe University	1
Macquarie University	5
Mental Health Research Institute of Victoria	1
Monash University	6
Queensland University of Technology	1
RMIT University	1
St Vincent's Institute of Medical Research	1
The Australian National University	19*
The University of Adelaide	3
The University of Melbourne	16*
The University of New South Wales	9*
The University of Newcastle	2
The University of Queensland	18
The University of Sydney	16
The University of Western Australia	3
University of Tasmania	1
University of Technology, Sydney	1
University of Wollongong	1

* Includes a recipient of two *Federation Fellowships*

Welcome: New MIC and PCG executive directors

■ Professor Jonathan Manton

The ARC's new Executive Director, Mathematics, Information and Communication Sciences, Professor Jonathan Manton, comes to the ARC from the Research School of Information Sciences and Engineering at the Australian National University. A former Queen Elizabeth II Fellow,



Professor Manton is also an honorary Professorial Fellow in the Department of Electrical and Electronic Engineering at the University of Melbourne.

"I'm very excited about the challenges and opportunities offered by my new role at the ARC," Professor Manton says. "I am keen to further contribute to Australia's research efforts in a wide variety of ways, including promoting the importance of research to the community, drawing international attention to research in Australia, contributing to the national research agenda, and playing a part in ensuring Australian researchers are well funded and acknowledged as world class.

"I have a particular interest in encouraging younger people to get involved in mathematics and improving the level of mathematics knowledge that students have when they reach university. I recently became a member of the ACT Secondary School Board Mathematics Panel and hope to be able to extend my efforts to enhance community awareness of the importance of mathematics research through my ARC activities."

Professor Manton's research interests include signal processing, wireless communications, optimisation on manifolds, estimation theory, stochastic filtering theory, and applications of commutative algebra, algebraic geometry and differential geometry.

For example, one of his long-term projects involves the application of differential and algebraic geometries to non-linear signal processing problems. "Traditionally, the signal processing community approached non-linear problems by clever, but ad-hoc, manipulations and approximations, usually with the aim of reducing the problems to linear ones, but this resulted in sub-optimal solutions," he says. "In fact, certain classes of non-linear problems can be solved exactly using differential geometry or algebraic geometry."

Professor Manton has a BSc Mathematics, BE (Hons, Class I) in Electrical and Electronic Engineering and a PhD in Electrical and Electronic Engineering, all from The University of Melbourne. He is a Senior Member of the Institute of Electrical and Electronic Engineers and a Member of the Australian Mathematical Society, the Society for Industrial and Applied Mathematics and the American Mathematical Society.

Photograph by Arthur Mostead.

■ Dr David Falvey

Dr David Falvey will return to Australia from the UK to take up the position of ARC Executive Director, Physics, Chemistry and Geoscience. Since 1998, Dr Falvey has served as Executive Director at the British Geological Survey (BGS), a public sector research agency within the UK's Natural Environment Research Council.



With an annual budget of A\$135 million, half of which is won competitively, BGS is recognised worldwide. It routinely wins international contracts from the World Bank, European Commission and the Department for International Development to provide services and surveys in several developing nations in Africa and Asia, including Afghanistan and Papua New Guinea. It has also won competitive service and survey contracts from national governments in the United Arab Emirates, Saudi Arabia, Cyprus, Canada, Greece, Morocco, Botswana and Ireland.

Under Dr Falvey's stewardship, the BGS has moved from traditional, 2D (map-based) geological survey, into 3D digital modelling, hazard research, groundwater research, soils and contaminated land research, the urban environment, and 'e-science'. A study of the economic benefits of the BGS to the UK community has shown a direct benefit/cost ratio of 10:1.

Dr Falvey has a BSc (Hons, Class 1) from The University of Sydney and a PhD in marine geophysics from The University of New South Wales. He is a Fellow of the Geological Society of London and has received an honorary science doctorate from Nottingham Trent University for his contribution to Earth science.

Dr Falvey is a visiting Professor at the University of Leicester, Member of the European Commission Advisory Council on Zero Carbon Emission Power Plants, Governor of Integrated Ocean Drilling Program Management International and a Companion of the Chartered Management Institute.

In 2001, he was the runner-up in a UK competition, sponsored by British Telecom and Business Sunday, to find the most visionary public or private sector leaders. BGS was recognised as one of Britain's one hundred most visionary organisations.

Other positions Dr Falvey has held include: Director Ocean Drilling Programs, Joint Oceanographic Institutions, Inc. Washington, DC; Associate Director, Australian Geological Survey Organisation; Chief, Division of Marine Geosciences and Petroleum Geology, Australian Bureau of Mineral Resources; Senior Lecturer in Geophysics at The University of Sydney; and Exploration Geophysicist, Shell Development (Australia) Pty Ltd.

Photograph courtesy of Dr David Falvey.

History comes to life through 18th century 'movie' simulation

■ Artist-scenographer Philippe Jacques de Louthembourg pioneered revolutionary developments in the technology and culture of multimedia through 'spectacles'.

His first 'moving picture' show, at a London theatre on 26 February 1781, featured landscape scenes of Greenwich, Gibraltar, Tangier, Naples and other Mediterranean sites in various phases of transition. Using lighting, magic lantern slides, coloured silk filters, clockwork automata, three-dimensional models, painted transparencies and a sound system to create the show, de Louthembourg delighted audiences with this new entertainment.

In December 2005, at The Australian National University in Canberra, ARC Federation Fellow Professor Iain McCalman, with assistance from 30 or more colleagues offering a diverse range of skills and expertise, built a replica 'Eidophusikon' (de Louthembourg's name for his show) and created a small and partial simulation of one of de Louthembourg's spectacles.

Historians generally agree that Britain underwent a series of fundamental social, economic, cultural and political transformations during the late eighteenth century, but the 'spectacle revolution' which occurred at this time has been largely neglected. Professor McCalman's research contends that de Louthembourg's multimedia revolution needs to be understood within the broader cultural transformation in Britain called Romanticism.

"De Louthembourg's multi-sensory displays for entertainment and knowledge foreshadowed modern cinema and multimedia and provide models for new ways of understanding and practising history," Professor McCalman says.

"There's a real value in trying to re-create what eighteenth-century pantomimes and spectacles were like. After all, these were the blockbuster recreations of their day. The germs of modern cinema and virtual reality displays go back at least two centuries.

"Until now we have been unable to capture dynamic visual and theatrical processes of the past as they might have impinged on sensoria centuries ago. We need to visualise these spectacles to understand their impact on audiences and how the need to create illusion influenced the content of performances."

Professor McCalman says that such re-creations can help us to recover lost historical sources and processes, including "aspects of the material world that were expressed through ephemeral visual images".

"I am going to write a conventional academic book, with the idea of extending the audience, but I am also working with a film and media specialist, Kim McKenzie, to turn it into a CD-ROM and a re-enactment on film," he says.

His book will be the first de Louthembourg biography and an exploration of the sources and processes of creativity.

De Louthembourg was trained as an engineer and a protestant

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Professor Iain McCalman with his replica de Louthembourg Eidophusikon. Photograph by Norman Plant.



Front view of Professor McCalman's replica Eidophusikon. The simulation re-created de Louthembourg's eighteenth-century 'moving picture' of the sinking of an East Indies merchant ship called the *Halsewell*. This scene shows the ship, moved by mechanical pulleys from the left of the frame to the right, entering the storm. The sea moves on mechanical rollers, getting gradually rougher as the weather worsens. The background is a painted screen. Lanterns are lit behind the screen to depict darkening clouds. As the viewer watches, a digital recording of thunder clapping mechanically produced by the snapping of copper sheets is played.



This is a 3-D rendition of the same scene from the back of the little wooden theatre. It shows, using twenty-first century digital technology, what one would imagine to have been at the rear of de Louthembourg's mechanical theatre. Experienced with 3-D glasses, earphones and digital recordings of storms, the simulation pretends to depict the eighteenth-century equipment used by de Louthembourg. The purple silkscreens create atmospheric colour change. The storm recording is created from snapping copper sheets, a huge tambourine with mechanical hitting lever and tinkling balls running down the wooden rain 'machine'.

Images courtesy of ANU Visualization Laboratory.

I love a sunburnt country...



■ Dorothea Mackellar's *My Country* describes Australia's harsh environmental extremes—including droughts, flooding rains and fire. Unfortunately, many scientists expect that, in the context of climate change, environmental disasters will become more frequent, more extreme and affect more people—not just in Australia, but around the world.

Monash University Professor and Federation Fellow Amanda Lynch is researching and developing an approach to characterising environmental extremes and adapting to them. She is looking at coastal flooding and fire, events not usually predicted by climate models and difficult to study because they are rare.

“In Australia, as in other countries, our vulnerability to extreme events depends only in part on the uncertain projections of increasing frequency and intensity of climate extremes in the future,” Professor Lynch says. “Our increasing population and investment in infrastructure also contribute to our vulnerability. “The combined effects of more extreme events and more people and things we value being at risk represents a complex and potentially dangerous challenge to Australian society. However, this challenge also represents an opportunity for development and transformation.”

Professor Lynch asserts that societies have faced both gradual and abrupt weather and climate changes for millennia and, in many cases, adapted successfully and efficiently to these changes.

She argues that with forethought and improved strategies, Australia could become more prepared to deal with changes in climate.

Professor Lynch is studying the complex interactions within and between the atmosphere, ocean, land and social systems. The development of practical applications must take a context-sensitive approach and include input from affected communities, she says.

For example, she is collaborating with the Alpine Shire community in rural Victoria, to assess its capacity to adapt its agriculture-based economy to climate change and extreme weather patterns. The Alpine Shire has experienced some extreme events during the past few years, including fire, flood, drought, reduced snow pack and severe frosts.

Professor Lynch's research involves examining the community's need to change and adapt its agricultural practices to survive. And it will provide invaluable information to individuals and groups managing the impact of weather and climate variability on their communities.

More information:

Professor Amanda Lynch
 Monash University
 Tel: 03 9905 8291
 Email: amanda.lynch@arts.monash.edu.au
 Web: www.arts.monash.edu.au/ges/who/lynch.html

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History comes to life through 18th century 'movie' simulation

pastor who undertook a lengthy apprenticeship as a landscape artist. He was also an alchemist who believed in the elixir of eternal youth, a scholar of Hebrew and the Bible, an optical physics theorist and practitioner, an expert engraver, an occultist and a self-trained mystical and medical healer.

“Innovation comes often from strange and unpredictable directions, and cannot be instigated by isolating technical and scientific worlds from cultural, artistic and social ones,” Professor McCalman says. “Indeed, de Louthembourg would not have thought to separate science and magic.”

Professor McCalman is a strong advocate of inter-disciplinary research. A diverse team of people who had to improvise a myriad of bygone skills contributed to his vision and achievement of a simulated de Louthembourg production.

“I don't think research can be done in isolated pockets any more. The twentieth century was about the specialisation and desiccation of research, with projects having a smaller and smaller focus. The twenty-first century is about how to put this research all together to benefit society.

“Historians have been slow to explore or use the potential of technological advances within electronic and digital media. Yet these technologies, sensitively applied, offer new ways of

Indeed, de Louthembourg would not have thought to separate science and magic

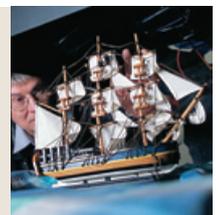
interrogating and assembling data, not least by integrating visual, cartographic and textual materials in holistic combinations.

“Perhaps one of the most important outcomes of my research will be the part it plays in inspiring other humanists to interrogate their sources in new ways and present or publish their research in forms congenial to younger audiences whose intellects have been moulded by visual cultures and technologies,” he says.

Professor McCalman and his team are negotiating with institutions around the world to scale up the de Louthembourg simulation and make it a permanent working exhibition.

More information:

Humanities Research Centre
 The Australian National University
 Tel: 02 6125 2700
 Email: administration.hrc@anu.edu.au
 Web: www.anu.edu.au/hrc



Delusional beliefs help make sense of an insensible world



Models used for illustration purposes only.

■ **Imagine looking into a mirror and seeing the reflection of a stranger staring back at you or feeling so detached from your life partner that you actually believe he or she has been replaced by an impostor.**

Sound unlikely? Not so. Such delusions are well documented as ‘realities’ for people suffering from a broad range of psychiatric illnesses and associated medical conditions, such as schizophrenia, dementia, temporal lobe epilepsy, Huntington’s disease, Parkinson’s disease, multiple sclerosis and traumatic brain injury.

People who have delusions cannot be dissuaded from often bizarre beliefs, even when presented by family members, friends or clinicians with facts that prove the beliefs untrue. Some individuals have a large collection of delusional beliefs that form a complex belief system, while others have a monothematic delusion. That is, they hold one delusional belief about a single fact.

Federation Fellow and Director of the ARC-funded Macquarie Centre for Cognitive Science Professor Max Coltheart is conducting *The Belief Formation Program*, which comprises several independent studies into the cognitive and psychological processes that generate, evaluate, and then accept or reject beliefs.

According to Professor Coltheart, some monothematic delusions are reported more often than others. One of the most frequently reported is Capgras delusion, the belief that someone emotionally close to the sufferer—often a spouse—has been replaced by an identical-looking impostor.

“Strange as this condition seems, there are hundreds of papers in the scientific literature reporting cases of Capgras delusion,” he says.

“Other monothematic delusions include Fregoli delusion—the belief that people you know are constantly following you but cannot be recognised by you because they are in disguise; Cotard delusion—the belief that you are dead; and mirrored-self misidentification—the belief that the person you see when you look in the mirror is not you, but some stranger who looks like you.”

In the past, some scientists claimed that the occurrence of delusions would never be understood. Others offered psychiatric explanations. However, Professor Coltheart believes a two-factor neuropsychological theory of delusional belief offers the most plausible explanation for the occurrence of monothematic delusions.

In Capgras delusion, the first factor—the formation of the delusional belief—is supported by crucial evidence obtained from experiments that measured the physiological emotional responses of individuals shown familiar and unfamiliar faces. The experiments found that the response generated in a non-delusional person is much stronger when looking at a familiar face than an unfamiliar face. But in a person suffering from Capgras delusion, there is little physiological emotional response to either familiar or unfamiliar faces.

“Think about how a person must feel when he or she does not respond to the face of the person to whom others say he or she is married,” Professor Coltheart says. “People with Capgras delusion make sense of their world by taking on the belief that their spouse is not their spouse.

“While this may seem odd, it is important to understand that none of the mental processes that lead to the formation and subsequent adoption of a belief need be conscious. In fact, most of our mental life is not accessible to consciousness.”

The theory’s second factor involves a person’s ability to evaluate beliefs, which depends on regions in the right hemisphere of the brain.



None of the mental processes that lead to the formation and subsequent adoption of a belief need be conscious...most of our mental life is not accessible to consciousness

Professor Max Coltheart.
Photograph courtesy of the Macquarie Centre for Cognitive Science.

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Delusional beliefs help make sense of an insensible world

“We know there are people with damage to certain regions of the frontal lobes of the brain who lack emotional responsiveness to faces but who are not delusional about their spouses. So there must be an additional factor involved in Capgras delusion—that is, an impaired ability to evaluate beliefs.

“The lack of an emotional response to faces that should evoke such a response *prompts the belief* that ‘this person is not my spouse’. As evidence to the contrary is presented, the belief should be rejected by a person whose brain follows the normal mechanisms of evaluation and rejection. But in a person with Capgras delusion, the facts *don’t lead to rejection of the belief* because of an abnormality in these mechanisms.”

Professor Coltheart says this two-factor theory also explains mirrored-self misidentification and may help us to understand and treat other monothematic delusions.

“Beliefs, once formed, can be modified,” Professor Coltheart says.

“We therefore consider that our theory of delusional belief has therapeutic implications. It provides a theoretical basis for the use of cognitive behavioural therapy, a psychological therapy based on belief modification, as a treatment for people with delusions.”

More information:

Professor Max Coltheart
Macquarie Centre for Cognitive Science
Tel: 02 9850 8086
Email: max@maccs.mq.edu.au

Supporting early-career researchers

■ Each year, the ARC is pleased to sponsor several outstanding early-career researchers to attend science and humanities networking and professional development events in Canberra.

Expanding Horizons, hosted in late March by the Council for the Humanities, Arts & Social Sciences (CHASS), provided an opportunity for participants to talk to parliamentarians and other people of influence about new industries or problem areas that would benefit from a cross-disciplinary approach—including at a breakfast at the National Library of Australia hosted by the Minister for Education, Science and Training, Ms Julie Bishop; workshop collaborative ideas with colleagues and leading researchers; and attend a National Press Club luncheon.

In late May, ARC-funded early-career researchers attended the Australian Academy of Science’s annual *Science at the Shine Dome*. The event attracts renowned scientists, providing early-career researchers with an excellent opportunity to meet leaders in their fields and learn about the latest research across a range of science disciplines, and attend an annual symposium.

This year’s participants attended career development seminars on two themes: Media and communications skills; and Presenting and interpreting data in publications. The symposium topic was *Science on the way to the hydrogen economy*.



Australian actress Sigrid Thornton proved a popular guest speaker at the *Expanding Horizons* National Press Club luncheon.



Minister Bishop with some of the *Expanding Horizons* delegates at the National Library of Australia.

Photographs courtesy of CHASS.

Boger fluids captivate commercialisation conference

■ **Delegates at Knowledge Commercialisation Australia's "Commercialisation Expo 2006—Today's knowledge is tomorrow's innovation" held in Melbourne in June were captivated by a demonstration of Boger fluids by researchers from the ARC Special Research Centre for Particulate Fluids Processing at The University of Melbourne.**

The normally consistent and reliable flow of a fluid alters when its properties are changed. For example, as particles are added to water—a Newtonian fluid—it turns into a non-Newtonian fluid and its flow becomes difficult to predict. By inventing a way of predicting how fluids behave in different circumstances, 2005 winner of the Prime Minister's Prize for Science and long-term recipient of

ARC funding Professor David Boger has achieved environmental benefits and saved the mining, food, agriculture and micro-technology industries tens of millions of dollars.

For example, in collaboration with Alcoa Australia, Professor Boger developed a revolutionary, effective and environmentally friendly waste disposal system for the toxic 'red mud' residues produced during the processing of alumina. After identifying key properties of the red mud, he made the sticky residue into a fluid that was pumped down a pipe to a disposal area, where it dried and solidified. Much of the caustic waste was recovered, the dry solid stacked until it formed a stable surface and overlaid with soil and planted with grass and trees. With the help of one of Professor Boger's

students, Alcoa has taken the further step of pumping waste carbon dioxide through the caustic mud, sequestering the carbon and producing a less caustic waste that could potentially be re-used.

The benefits of Professor Boger's research in the aluminium industry are anticipated to continue for the next century, given current resources. His research has also been adopted in the nickel and gold sectors and used in the design of inks, paints, toothpaste, tomato sauce, ointments, insecticides, and new drug delivery systems.



Photograph by David Hine.

New application and grants management system

■ **The ARC is getting ready to make redundant its long-serving, innovative-in-its-day Grant Application and Management System (GAMS), along with several other systems, to make way for a new, improved and multifunctional Research Management System (RMS).**

Anticipated to take three years in total, RMS has been under development for the past 18 months. It will replace several systems with a single system that will deal with the full range of internal and external ARC business activities.

"The new system will increase the efficiency and accuracy of operations and ensure the ARC is able to effectively support and manage all aspects of its investment in research by enabling the full electronic submission, processing and reporting of funding," ARC Chief Operating Officer Len Marsden says.

"When the web interface is released with the final rollout phase in 2007, RMS will provide significant performance enhancements over existing systems and enable many more users to concurrently interact with the system, ensuring that frustrating delays are minimised during peak periods of demand.

"In addition, RMS will be flexible, designed to enable all ARC schemes to fit into a broad, standardised structure. For ARC assessors, research office staff and applicants, the system will be simple and easy to use and provide a greater ability to track the progress of requests."

The introduction of RMS is occurring in phases. The first trial of Phase 1 involved using the new system in parallel with existing systems for the May 2006 *Linkage International* selection meeting. This will be followed by the replacement of all internal ARC systems in a gradual, staged rollout, allowing for refinements to be made along the way. The final phase, which will totally replace GAMS with the more robust RMS system, is scheduled to take place in late 2007.

"As RMS is rolled out, internal and external users will be offered the opportunity to provide feedback on the system's operation, functionality and performance," Mr Marsden says.

"External stakeholder feedback and suggestions has been, and will continue to be, invaluable to the ARC in developing the RMS. The focus in the immediate future will be on how the ARC can best implement full electronic processing to support post-award reporting and variations to funding."

The ARC is taking a flexible and innovative approach to systems development, enabling intellectual property to be consolidated from various sources into one repository from which the system will be generated. The front end of RMS will be entirely web-based, ensuring that users will be able to access it from most locations in the world.

"RMS is a significant investment for the ARC. The RMS project team is of the highest quality and, through its development of the new system, has helped to form new ideas on best possible business practice and better understand the ARC's existing business.

"With further input from the research community, I am confident that RMS will provide an exciting, efficient and practical system that is easily supported and may be further enhanced as time goes on.

"Most importantly, RMS will fulfil the needs of all ARC stakeholders," Mr Marsden says.

More information:

Mr Ian Laslett
Acting Assistant Project Manager
Tel: 02 6287 6635
Email: rms@arc.gov.au



RESEARCH in the national interest - enabling the future

NEWS IN BRIEF

- The ARC has achieved a Green Building Council of Australia (GBCA) Four Star rating for the environmentally friendly fitout at its new Brindabella Business Park offices. The rating system evaluates energy and water efficiency, indoor environment quality and resource conservation. The four star rating recognises 'best practice'.

The ARC achieved the rating through the use of paints and carpets that are all low VOC (volatile organic compounds), and composite wood products—like the timber used in joinery and workstations—certified to be low formaldehyde. The timber products used to make the furniture were sourced from renewable sources, with preference given to products with a high recycled content.

The ARC's office is located in Australia's first Five Star Green Star Certified building.



- This year, more than 140 people representing 57 organisations—universities, medical research institutes, hospitals, museums and NGOs—attended the Research Administrators' Seminar hosted by the ARC and the NHMRC in association with the Australasian Research Management Society (ARMS).

Topics covered during the two-day seminar included research scheme overviews, administrative processes for applying for grants, assessment and approval processes, ethics, communication, and research evaluation.

The ARC and NHMRC thank ARMS for hosting a cocktail party to allow participants to network with colleagues from other research organisations, the ARC and NHMRC.

Feedback on the seminar was very positive. It is envisaged that the event will be held again next year.



ANU Research Office Director Dr Ian McMahon and Director of The University of Sydney's Research Office, Mr Warwick Dawson, at the Research Administrators' Seminar. Photography courtesy of the National Museum of Australia.

- The ARC is calling for nominations in several discipline areas for positions on the College of Experts in 2007. Applications close at 5.00pm AEST on Friday, 11 August 2006. For more information, visit www.arc.gov.au.

SUBMITTING ARTICLES

The ARC welcomes suggestions and articles for *Discovery*. Articles may be edited for style and/or length. Edited articles are referred to authors before publication for correction and feedback. There is no guarantee that all submitted articles will be published. Submissions should be sent to fiona.skivington@arc.gov.au.

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CONTACT INFORMATION

AUSTRALIAN RESEARCH COUNCIL
 1st Floor, 8 Brindabella Circuit
 Brindabella Business Park
 Canberra Airport ACT 2609
 GPO Box 2702, Canberra ACT 2601
www.arc.gov.au

GENERAL INQUIRIES
 Tel: +61 2 6287 6600 | Fax: +61 2 6287 6601
info@arc.gov.au

NATIONAL COMPETITIVE GRANTS PROGRAM
ncgp@arc.gov.au

www.arc.gov.au