

INSTITUTES IN ACTION



Research Institutes
A Global Research Powerhouse



Research Institutes

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Cover depicts a robot staring out to
the heavens, symbolic of all that is
possible in the future.

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www.ni.unimelb.edu.au
www.bio21.unimelb.edu.au
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Foreword

Welcome to the second edition of *Institutes in Action*.

It is the *raison d'être* of the University of Melbourne's Research Institutes to promote a greater degree of interaction and collaboration across the campus and to harness our disciplinary strengths to work on problems of substantive societal impact.

The recent launch of the University's strategy *Research at Melbourne: Ensuring Excellence and Impact to 2025* signals an even more significant role for our Institutes. Responding to the challenges of the future, the strategy sets out the University's vision for research to 2025.

Complementing our outstanding discipline-focused investigator-driven research, the University will pursue three intertwined Grand Challenges: understanding our place and purpose; fostering health and wellbeing; and supporting sustainability and resilience.

The University has extensive research capabilities in each of these areas and seeks to build this capacity further through the allocation of appropriate resources. Institutional attention on the Grand Challenges will enable the University to better articulate and share the breadth of its capabilities with its partners and peers.

As part of the University's investment in collaboration-enabling activities, in 2009 the development of a portfolio of University-level interdisciplinary Melbourne Research Institutes was initiated. There are currently six such Institutes: Melbourne Energy Institute; Melbourne Materials Institute; Melbourne Neuroscience Institute; Melbourne Sustainable

Society Institute; Institute for a Broadband-Enabled Society; and the newly established Melbourne Social Equity Institute.

The Institutes enhance the research profile of the University, seek significant new partnerships and increase the University's responsiveness to external priorities.

This edition of *Institutes in Action* celebrates key achievements of the Melbourne Research Institutes as well as the Melbourne Institute of Applied Economic and Social Research, the Bio21 Institute, the Nossal Institute for Global Health, and the new Peter Doherty Institute.

The Melbourne Institute of Applied Economic and Social Research, established in 1962, enhances the wellbeing of all Australians through its sustained contribution to economic and social policy development.

The Bio21 Institute, established in 2005, is a multidisciplinary research centre specialising in medical, agricultural and environmental biotechnology.

The Nossal Institute for Global Health, established in 2006 and named in honour of Professor Emeritus Sir Gustav Nossal, works with partners locally and internationally to generate

knowledge and translate it into policies for the improvement of health in areas of greatest need.

The Peter Doherty Institute, with purpose-built premises ready for occupation in early 2014, will combine research into infectious disease and immunity with teaching excellence, reference laboratory diagnostic services, epidemiology studies and clinical services. The \$210 million world-class Institute will support around 700 expert scientists, researchers, clinicians, academics, staff and students to share resources, equipment and knowledge.

In the pages ahead I invite you to observe how we at the University of Melbourne, through our Institutes, continue to engage with and seek to understand some of the major challenges facing the world today.

Professor Liz Sonenberg
Pro Vice-Chancellor
(Research Collaboration)



From left to right: Professor Steven Prawer, Melbourne Materials Institute Director; Professor Trevor Kilpatrick, Melbourne Neuroscience Institute Director; Professor Liz Sonenberg, Pro Vice-Chancellor (Research Collaboration); Professor Mike Sandiford, Melbourne Energy Institute Director; Professor Julie McLeod, Melbourne Social Equity Institute Interim Director; Laureate Professor Rod Tucker, Institute for a Broadband-Enabled Society Director; Professor Craig Pearson, Melbourne Sustainable Society Institute Director.

Social equity

“There is a policy void at both national and state levels when it comes to supporting survivors’ efforts to move beyond the devastating, long-term economic and health impacts of family violence.”



The real cost of family violence

Family violence-related homicides occur at the rate of approximately one per week in Australia, and nearly one in six women have experienced violence by a current or previous partner in their lifetime.

Intimate partner violence is a major health, social, justice and economic issue with long-term implications not only for individuals but also for families, communities and society as a whole. The cost to Australia's economy was estimated at \$13.6 billion in 2008–09.

In 2011, Professor Cathy Humphreys and Dr Lucy Healey from the School of Social Work conducted a pilot study into the impact of intimate partner violence on women's health and wellbeing over the life course, exploring cumulative economic and health impacts rather than focusing on experiences at a specific time. The Interdisciplinary Seed Grant provided by the Melbourne Social Equity Institute provided the basis for an original study of the relations between gender, violence and economic security across the life course, generating insights into potential policy and law reform areas that will be invaluable in shaping the development of a longer-term, interdisciplinary study.

There was previously only limited research that integrated the long-term wellbeing and the economic security impacts of intimate partner violence. This pilot study also explored the impact of structural gender inequities, such as those relating to income support, child support, tax and superannuation, on women's financial and economic security.

Seventeen women were interviewed. They were aged between 36 and 68 years, and each had experienced domestic and family violence from a partner at some stage of their adult life. Most were born in Australia (none identified as Aboriginal or Torres Strait Islander), with four migrating from English-speaking countries and another from a South Asian country.

"Most experienced violence from the same partner or ex-partner for many years, whilst four had experienced more than one abusive relationship. The women experienced marked financial duress. Their male partners failed to take responsibility for shared financial matters, spent money to the detriment of their children, manipulated situations by omission or commission to ensure their wife or partner was legally responsible for debts, claimed half of their partner's superannuation, declared low incomes to the Australian Tax Office to reduce child support payments, and frequently failed to pay child support," says Dr Healey.

Particularly pernicious was men's use of legal processes to threaten women with financial ruin, and prolong and contest child contact orders and property settlements. "Furthermore, the violence affected their ability to work, earn a steady wage, build a career, or study, exacerbated by welfare payment restrictions," says Dr Healey.

Maintaining a stable home, especially for dependent children, was a major challenge during and after the relationship. Many of the women continued to experience emotional and psychological impacts years after separation, with one now living on a disability pension as a result of violence-induced ill health.

According to Professor Humphreys and Dr Healey, there is a policy void at both national and state levels when it comes to supporting survivors' efforts to move beyond the devastating, long-term economic and health impacts of family violence.

For more information:
ri.unimelb.edu.au/msei



Making Melbourne's growth areas healthier and more liveable



The *Place, Health, Liveability* research program is a collaboration between built environment, population health researchers at the University of Melbourne, and the North West Metropolitan Melbourne Regional Management Forum.

The project is being led by:

- + Professor Billie Giles-Corti, Director of the McCaughey VicHealth Centre for Community Wellbeing in the Faculty of Medicine, Dentistry and Health Sciences;
- + Associate Professor Carolyn Whitzman, from the Urban Planning Program in the Faculty of Architecture, Building and Planning; and
- + Dr Iain Butterworth, the Manager of Public Health and Western Area at the Department of Health's North and West Metropolitan Region.

The research program originates from a think-tank organised by the University in partnership with the Victorian State Government Departments of Health and Human Services in December 2010, Dr Iain Butterworth explains.

"The need for a whole-of-government approach for planning for liveable and sustainable growth areas, supported by high-quality evidence and the engagement of key stakeholders, was identified as a priority," he says.

According to Associate Professor Whitzman, the partnership seeks to address three issues: how liveability can be defined and measured from a health perspective; the impact of current planning policies on the health of people living in Melbourne's growth areas; and how integrated planning can work to improve health and liveability outcomes across Melbourne.

Professor Giles-Corti observes that health outcomes do not only derive from genetics, or quality of health care, but a range of interrelated social determinants of health.

These include affordable and appropriate housing; access to employment and education opportunities; green space and other leisure opportunities; good social infrastructure like community centres and libraries; healthy food; input into local decision-making; and community safety.

"It is these attributes that make a community 'liveable'," says Professor Giles-Corti.

"It is vital to deliver these amenities to facilitate healthy living, particularly in both inner Melbourne and outer suburbs, where population growth is outstripping the capacity of services to meet needs."

Place, Health, Liveability received an important boost from an Interdisciplinary Seed Grant from the Melbourne Social Equity Institute in 2011, which facilitated a literature review on how to conceptualise and measure liveability. Since then, the program has grown and attracted funding from other sources, such as the Australian Urban Research Infrastructure Network to develop a GIS-based index of walkability and a data integration project to model affordable housing and economic development indicators with health outcomes, as well as internal University funding to research the building of affordable family-friendly housing in central Melbourne.

Associate Professor Whitzman has also integrated aspects of the project into teaching at both undergraduate and postgraduate levels.

Building partnerships is important for the program, and relationships have been developed with the Departments of Health, Transport, Human Services, Justice, Planning and Community Development, as well as the Growth Areas Authority, Places Victoria, VicHealth, the City of Melbourne and the Urban Development Institute.

"By engaging in policy-relevant research, *Place, Health, Liveability* is working to improve wellbeing outcomes for all Melburnians," Associate Professor Whitzman says.

For more information:
ri.unimelb.edu.au/msei

Stories from home

An exhibition entitled *Stories from Home* was the focus of a collaborative art-research project by researchers and artists from the University of Melbourne's School of Population Health and the Faculty of VCA and MCM, and the residents of the Bell Bardia Estate in Heidelberg West, Melbourne.

The exhibition provided the residents with a creative space to express their own ideas of home and explore their sense of belonging to their community.

Selected images from the project are now on permanent display at the Banyule Community Health Centre.

The success of the exhibition has now inspired other new approaches to community engagement to promote local inclusion and a sense of safety, according to lead researcher, health sociologist Dr Deborah Warr from the McCaughey Centre in the University of Melbourne's School of Population Health.

"Residents in vulnerable and poor areas had expressed issues of feeling stigmatised because of where they lived," says Dr Warr.

"When places get a negative reputation this usually rubs off onto residents as well.

"People in other neighbourhoods perceive they need to avoid particular places and people.

"This leads to stereotyping and what is known as 'place stigma'."

There is little knowledge of the effects of ongoing stigmatisation about place, and this is what led Dr Warr to develop an alternative to a typical research project.

She obtained funding for the project from the University's Interdisciplinary Seed Grant provided by the Melbourne Social Equity Institute.

"The idea of the project was to consider how residents themselves could become involved in creating representations of their own neighbourhoods that could be used to challenge negative attitudes among the wider community," says Dr Warr.

For more information:
ri.unimelb.edu.au/msei



Sustainability

“ We have an ‘emissions gap’ between cuts in greenhouse gas emissions proposed in most current government policies and what is scientifically recommended to avoid the worst effects of climate change. ”

Roadmaps and roadblocks to climate action

University of Melbourne social scientists are asking some difficult questions about human nature and the political animal.

After analysing international strategies on how to achieve post-carbon economies – that is, an economy not based on carbon fuel – and finding that many of the plans are technologically achievable within realistic budgets, the social scientists are now trying to understand why we are not putting them into action.

The urgent need for a unified, global response to climate change has been consistently identified in academic and policy literature, says Professor John Wiseman from the Melbourne Sustainable Society Institute (MSSI).

“The United Nations recommends we limit global temperature rise to two degrees Celsius above pre-industrial levels, requiring emissions to peak by 2020 and then rapidly decline. Many climate scientists argue the target needs to be lower than two degrees to avoid potentially disastrous climate tipping points.

“Yet we have an ‘emissions gap’ between cuts in greenhouse gas emissions proposed in most current government policies and what is scientifically recommended to avoid the worst effects of climate change,” Professor Wiseman says.

“Given this urgency, we are trying to understand the specific barriers in both politics and society to implementing these plans, and how they can be overcome.”

Professor Wiseman and Taegan Edwards from MSSI have combed through 18 post-carbon economy transition strategies, nine each from government and non-government sources.

The reports analysed include strategies developed by NGOs like Australia’s Beyond Zero Emissions, Al Gore’s The Climate Project and the Earth Policy Institute; eminent university academics from Stanford, University of California, Davis and Germany’s Potsdam Institute; and government-led strategies from the UK, EU, China, India, Korea, Germany, Denmark, California and Australia.

Ms Edwards says it was encouraging to find that in many of the strategies, there were no major technological barriers to achieving power generation entirely from renewable sources.

“One of the non-government sources, Zero Carbon Australia, has a strategy to produce 100 per cent of stationary energy from wind and solar-based renewables by 2020. They estimate this will cost AU\$37 billion per year over 10 years, or approximately 3 per cent of Australian GDP.

When it came to identifying barriers to implementing a carbon-free economy, Professor Wiseman said the greatest obstacle was to secure broad and sustained social and political support for the transition.

“Among the highest priorities are strengthening public understanding of the urgency of action to reduce the risks of runaway climate change, and exposing and overcoming the vested interests, particularly in the fossil fuel, media and finance industries, working to block the opening up of pathways to a post-carbon economy.

“We are turning the scenario on its head, and asking some of the world’s best thinkers to imagine that the world of 2050 has prevented runaway climate change. We are asking ‘how did we get here?’”

That question is being posed to some of the transition strategy authors and leading post-carbon thinkers as part of the next phase of the research.

For more information:
www.sustainable.unimelb.edu.au/content/pages/post-carbon-pathways





From ‘waste management’ to ‘resource recovery’

The Melbourne Sustainable Society Institute (MSSI) is funding a ‘warts and all’ research project on the interaction between the University’s waste and recycling system and its users.

Rubbish to Resource – Transforming Perceptions and Systems at the University of Melbourne is a six-month project, consisting of a review of existing literature on recycling systems and behaviour and a study of the University’s current waste and recycling infrastructure. The project aims to find weak links and design interventions that can be researched for their potential to change staff and student behaviour.

The sustainability researcher working on the project, Patrick Gilmour, says investigations have highlighted that most people simply put whatever waste they’ve got in the nearest bin, whether it is recyclable or not.

‘There is a marked boost in recycling rates in places where recycling and landfill bins are side-by-side,’ Patrick says.

‘So, while we want to work on changing underlying cultural, ethical and habit-based elements of behaviour, we also need to make sure that there’s a recycling bin right alongside each landfill bin.’

Property and Campus Services replaced single landfill bins, with paired recycling and landfill bins at the University of Melbourne sports field in August. Since then, the proportion of ‘obvious recyclables’ (bottles, cans and tins) being sent to landfill went from 16 per cent to less than 1 per cent by volume.

‘The great thing about pairing recycling and landfill bins is that you have an impact on people’s practices in other environments too,’ says Patrick.

‘Choosing the right bin becomes habit rather than a decision you have to think about.’

Property and Campus Services Waste and Recycling Coordinator, and supervisor of the project, Judith Alcorn, says the project has already proved itself extremely valuable.

‘What we have uncovered has greatly enhanced our ability to understand and manage the University’s waste and recycling system,’ Judith says.

‘We are well on our way towards transforming from a ‘waste management’ to a ‘resource recovery’ model.’

Judith says a one-size-fits-all approach for waste management at the University of Melbourne is inappropriate because of the University’s size and its differing faculty systems.

‘In 2013 we will systematically look at each hub or large building on campus and improve the systems in each,’ says Judith.

‘We work with representatives from each building to make clear what is recyclable and what is not.’

‘We are also developing individualised resource recovery centres in each building to make it easy for people to recycle – and this will complement the overarching system.’

‘It is important that we follow through and see that rubbish is properly processed from the minute it is chucked in the bin to the very end of the process. We don’t want rubbish to just be ‘out of sight, out of mind.’

The research project report will be available in early 2013 on the MSSI website and the Achieving a Sustainable Campus website.

For more information:
www.sustainable.unimelb.edu.au

Sustainability script: just what the doctor ordered

A printed ‘sustainability prescription’ has been developed for GPs to give to patients, explaining how healthy behaviour is also good for the environment. The concept is part of a new research project funded by the Melbourne Sustainable Society Institute (MSSI) and delivered by the Nossal Institute for Global Health.

The pilot project investigates what patients think about GPs promoting positive health actions that benefit the environment. Suggested actions, which can be tailored to each patient, include switching from driving to walking, cycling or public transport, growing fresh food at home, spending more time in nature, eating less meat and drinking more tap water.

About 500 patients at six GP clinics around Australia have been surveyed to collect their responses, including their attitude to GPs offering such a tool, their willingness to undertake the suggested actions, and their views on the connection between sustainable living and their own health.

If patients’ responses to the prescription are positive, it could be developed as an online tool for GPs nationally to customise, print and provide to their patients.

The project is being delivered by Associate Professor Grant Blashki, Melbourne GP and Health Equity theme leader at MSSI, and project coordinator, Suzie Brown, from the Nossal Institute for Global Health.

“It’s becoming increasingly obvious that many of the health promotion messages we give to our patients are not only good for their health but good for the environment too,” says Dr Blashki.



“We think that the metaphor of a prescription is such a powerful one in general practice and hope it can also be applied to encourage environmental sustainability.

“However, we don’t want GPs to preach to patients or make them feel uncomfortable, so the trial is really about finding out what patients think about receiving such a script from their GP.”

For more information:
www.sustainable.unimelb.edu.au

Materials

“ Around 1,000 paintings were lost into the swollen stream... locked in a storage room, most of the pieces of the Warmun Community Art Collection were recovered, but were water-damaged. ”



Saving the Warmun Community Art Collection

In March 2011, heavy floods destroyed buildings and cut all basic services at the Warmun Aboriginal Community. Fortunately there was no loss of life, but most of the works from the Warmun Art Centre contemporary collection were lost.

The highly significant historical Warmun Community Art Collection was salvaged but sustained water and mould damage. The Centre for Cultural Materials Conservation (CCMC) was asked to undertake the conservation work, which has brought together Gija and Western knowledge to save this important art.

After weeks of heavy rainfall, the township of Warmun, in the East Kimberley region of Western Australia, was a disaster zone. The population was taken to safety at Kununurra, 200 km to the north. Most houses and public buildings were destroyed, including the thriving Warmun Art Centre. Around 1,000 paintings were lost into the swollen stream. Most of the pieces of the Warmun Community Art Collection were recovered, but were water-damaged.

"The Collection consists of around 340 items that were specifically created by Gija elders in the 1970s through the 1980s to teach successive generations Gija language, law, history and culture," explains Associate Professor Robyn Sloggett, Director of the CCMC, who is also the leader of the Materials Conservation Theme at the Melbourne Materials Institute.

With the help of workers from the nearby Argyle Diamond Mine, the artworks were transported by helicopter to an air-conditioned room in Kununurra. Conservators from the CCMC were entrusted with the treatment of the collection.

"Many of the paintings and carvings were wet, some were covered with mud and flood debris, and mould had quickly begun to form on most of the items," says Marcelle Scott, conservator and lecturer at the CCMC.

About 35 staff and students from the CCMC participated in the conservation work. Sophie Lewincamp, paper conservator and lecturer at the CCMC, is the coordinator of the conservation effort.

"We informed and consulted the custodial elders of the community at every stage of the treatment." They decided that the CCMC's work would be limited to stopping further damage. "We had to take it back to the pre-disaster state," says Sophie.

Most of the work consisted of removing mud and mould, consolidating the paint, and preventing further structural degradation by gluing surfaces back together, filling gaps and bubbles, and flattening warped canvases.

The pieces were treated with their purpose in mind. "It's different from a museum approach," says Sophie. "This collection is used for teaching; the artworks need to be used and accessed. It was something that we thought about the whole way through the conservation process"

The CCMC and Warmun Community partnership has developed as a two-way relationship in which traditional and Western knowledge is exchanged.

"We provide conservation knowledge and they provide cultural knowledge," says Sophie.

For more information:
materials.unimelb.edu.au



Materials for medicine

Imagine a time when therapeutic drugs could be delivered directly to the parts of the body that need them most, reducing the negative side effects that are all too common as we battle to fight cancer, cardiovascular disease and much more.

Professor Frank Caruso and his multidisciplinary team are making this dream a reality.

Leader of the Materials for Medicine research theme in the Melbourne Materials Institute, Professor Caruso engineers nanoscale materials with his team of chemists, engineers and biologists from the Department of Chemical and Biomolecular Engineering at the University of Melbourne.

Professor Caruso's team builds capsules and particles with physicochemical properties that are customised to meet the needs of a particular application. Ranging in size from tens of nanometres to micrometres, they are used for therapeutic delivery, diagnostics, and imaging.

Current research applications in targeted drug delivery include

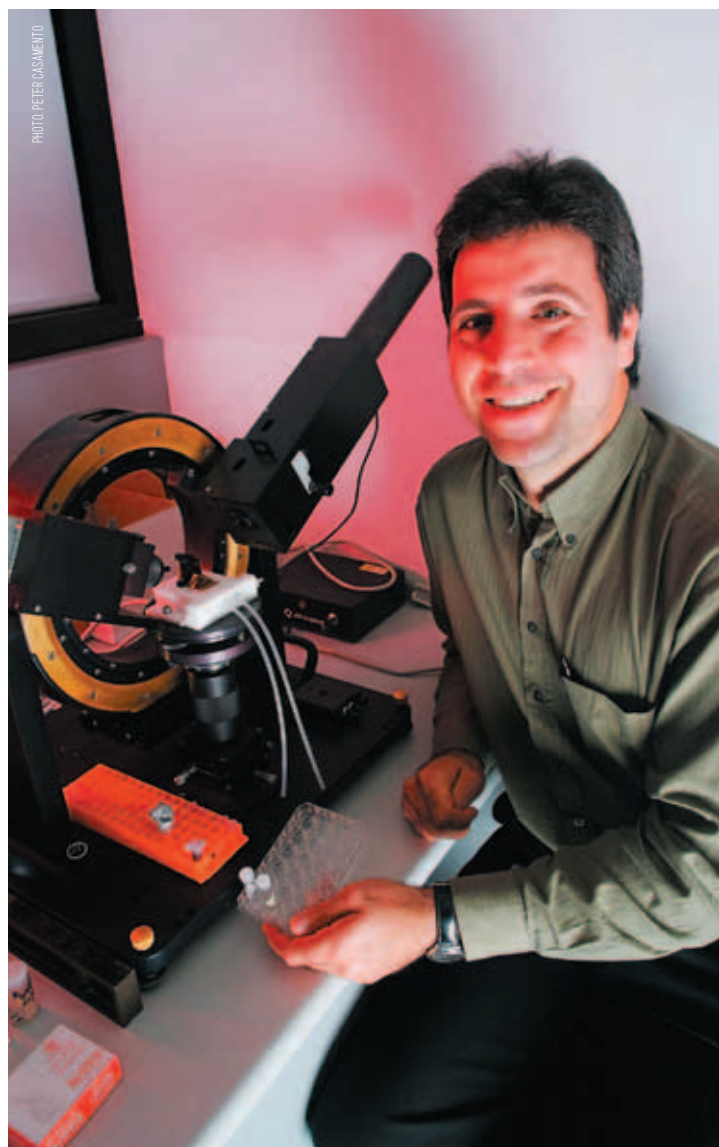
colorectal cancer treatment, auditory nerve damage repair and HIV vaccine delivery. The nano-engineered capsules are not only a vehicle for drug delivery. In collaboration with the Baker IDI Heart and Diabetes Institute, the team is investigating potential imaging applications by designing capsules targeting blood clots and loading them with MRI contrast agents. This will enable surgeons to detect and diagnose blood clots more accurately.

In both applications, some of the greatest challenges are to understand the interactions with biological systems and to engineer materials at the nanoscale to control and modulate the desired biological responses.

Professor Caruso's research endeavours and leadership towards solving these challenges are supported by an Australian Research Council Laureate Professor Fellowship, which was awarded in 2012.

Professor Caruso's high-calibre work over the last 10 years has put him amongst the world's Top 100 Materials Scientists, ranking 17th according to Thomson Reuters's 'Science Watch'. It has also resulted in a number of significant awards, including the inaugural American Chemical Society ACS Nano Lectureship Award in 2012 and the Royal Society of Victoria Medal for Scientific Excellence, also in 2012.

For more information:
materials.unimelb.edu.au



Seeing the light

One-and-a-half million people worldwide are progressively becoming blind due to Retinitis Pigmentosa (RP) and 25 million are losing sight because of age-related macular degeneration (AMD), a number expected to triple by 2025.

In these forms of blindness, the cells that convert light into electrical signals have died.

Using groundbreaking technology, a team of researchers at the Melbourne Materials Institute (MMI) have been using diamond for the fabrication and encapsulation of electrodes to directly stimulate the nerves inside the retina.

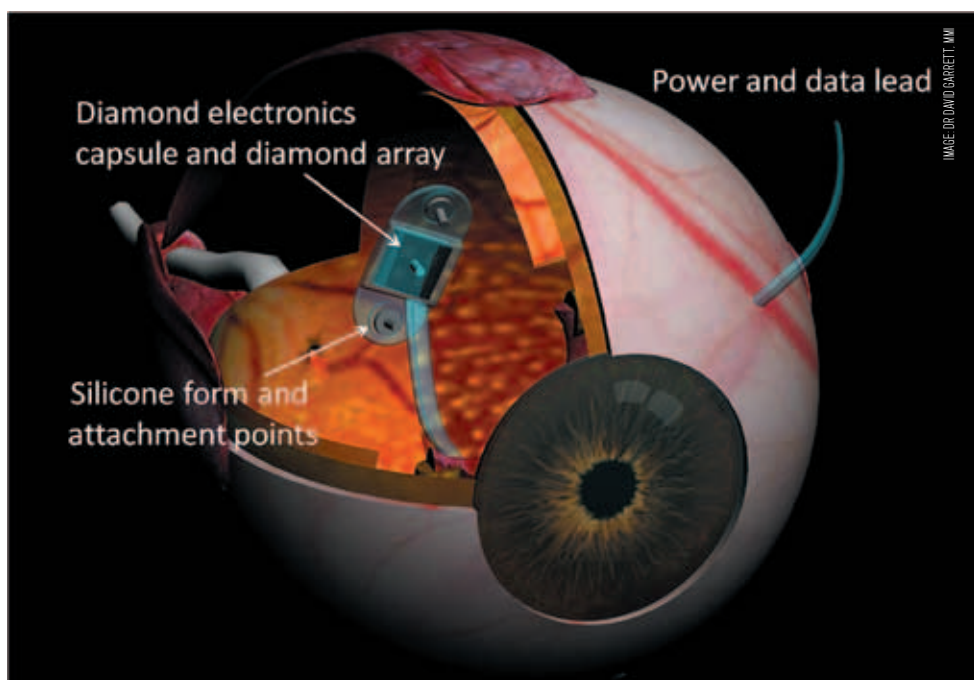
The MMI is involved in the development of a high-acuity bionic eye device, one of two retinal implant prototypes being built by Bionic Vision Australia (BVA).

“The high-acuity prototype is being designed with the long-term goal of providing detailed vision across a limited visual field with a resolution of the order of 1,000 pixels,” explains MMI Director Professor Steven Prawer.

“Simulations suggest that this will allow face recognition and reading of large print, abilities which RP and AMD-affected people report missing the most.”

At the centre of the high-acuity technology lies a four-by-four-millimetre black box. Made of diamond grown in a ‘super microwave oven’ by combining methane with hydrogen at temperatures over 1,000°C, the box incorporates a diamond electrode array connected to a chip.

The chip will relay electrical signals, sent wirelessly from a camera mounted onto glasses, to the electrodes, which will stimulate retinal nerve cells responsible for passing on these signals to the brain.



Chosen for its durability, biocompatibility and electrical properties, diamond has proven not only to be suitable to electrically stimulate ganglion cells in the retina but also to outperform traditional materials such as platinum.

Dr David Garret from the University of Melbourne’s School of Physics explains the concept behind the electrode array: “Imagine a TV screen where each pixel is an electrode transmitting an electrical signal to the visual part of the brain. The more pixels, the higher the resolution.”

Meanwhile, in a separate and dramatic development, a BVA demonstration in August 2012 revealed the success of Australia’s first implant of an early prototype bionic eye with 24 platinum electrodes. Ms Dianne Ashworth, who lost her vision due to RP, says that when the device was switched on for the first time, all of a sudden she could see a little flash. “It was amazing,” she says.

“Every time there was stimulation there was a different shape that appeared in front of my eye.” Ms Ashworth and two further patients will continue to work with the research team over the next 18 months. This early feedback from patients is vital as researchers continue developing the technology for devices with more electrodes, which can provide greater visual acuity.

For more information:
bionicvision.org.au

A microscopic image of neural tissue, likely a retina or optic nerve, showing a dense network of red-stained nerve fibers and blue-stained cell bodies or nuclei. The background is dark, and the top right corner shows a bright, hazy area.

Neuroscience

“ For the majority of conditions, many more years of careful research will be required before safe and effective stem cell treatments can be developed. ”

Bridging the expectation gap in stem cell science

The possibility that stem cells may one day be used to treat ailments such as macular degeneration, multiple sclerosis, diabetes and numerous other conditions has captured the public's imagination and given hope to many.

However, finding out what the latest breakthrough may mean for those who hope to benefit is often not straightforward and a problem that Associate Professor Megan Munsie, the Head of the Education, Ethics, Law & Community Awareness Unit at Stem Cells Australia, is working on.

Associate Professor Munsie says there is no doubt that Australians view stem cell research favourably.

"A recent survey listed stem cells as the area of biotechnology with the highest level of awareness, acceptability and perceived usefulness," says Associate Professor Munsie.

"There is also no doubt that stem cell scientists have made enormous progress over the last decade in understanding how to grow and control stem cells."

Clinical trials are now underway around the world to evaluate potential new therapies involving stem cells. However, for the majority of conditions, many more years of careful research will be required before safe and effective stem cell treatments can be developed.

For those seeking cures, the rate of the progress can be frustratingly slow, says Associate Professor Munsie.

"Having heard about the great promise of stem cells, some Australians are not prepared to wait and are choosing to pursue experimental, unproven and potentially unsafe stem cell treatments," she says.

"Their quest is often aided by Dr Google."

Simply type in stem cells and the illness or condition that you are interested in, and in a matter of seconds a vast list of impressive-looking websites will be provided.

"Many of these sites offer 'promising' stem cell treatments that are stated as being 100 per cent safe, but lack any real evidence to back up their claims," Associate Professor Munsie warns.

"Often charging between \$9,000 and \$60,000 per treatment, these sites are effectively selling hope and exploiting the high expectation many have in stem cell science," she says.

For patients contemplating experimental treatments – particularly those who have been told that there is nothing else that can be done for them – navigating through the maze of information can be confronting.

Stem Cells Australia is addressing this challenge by working with patient support groups, community organisations, doctors and other health professionals to get the facts about the real progress in stem cell science out into the community.

"The ongoing task for Stem Cells Australia is to bridge the expectation gap in stem cell science, ensuring that the community maintains its faith in this exciting area of medical research, but with the understanding that real progress will take time," Associate Professor Munsie says.

She highlights five signs that should make those seeking stem cell treatments wary:

- + Claims based on patient testimonials;
- + Multiple diseases treated with the same stem cells;
- + The source of the stem cells or how the treatment will be done is not clearly documented;
- + Claims there is no risk involved in the treatment and unsubstantiated 'improvements' in treated patients; and
- + High cost of treatment or hidden costs.

Stem Cells Australia is a key thematic initiative of the Melbourne Neuroscience Institute. "We are grateful for the support of the Melbourne Neuroscience Institute. MNI was instrumental in establishing Stem Cells Australia and continues to foster the initiative by partnering for strategic events, providing opportunities for collaborative research and acting as a vehicle for the promotion of stem cell research," Associate Professor Muncie says.

For more information:
www.stemcellsaustralia.edu.au



Music, mind and wellbeing: from Pythagoras to neuroscience

Music, Mind and Wellbeing researchers have developed a new account of the auditory system which explains how the plasticity of neural pathways allows us to adapt to auditory environments and cultures.

This fundamental research provides a basis for a theory of music that can be integrated within a neurobiological framework and applied equally across all music cultures and styles. It will also help to understand the role that music may play in the health and wellbeing of individuals and communities.

Not only is Auditory neuroscience crucial to understanding music, and music behaviours can tell us much about the auditory system. A key aspect of the new theory is that sound recognition mechanisms initiate early in the auditory pathways to support the processing of higher-level features such as pitch.

Associate Professor Neil McLachlan from the Melbourne School of Psychological Sciences says researchers tested this by asking people with varying musical expertise to match the pitches of a range of common and uncommon musical chords, and to rate the dissonance and familiarity of each chord.

“As we expected, participants with more music training were better at recognising chords and matching their pitches,” Associate Professor McLachlan says.

“We also found that dissonance ratings increased when participants couldn’t match the pitches of the chord,” he says.

“We even trained non-musicians to match the pitch of a random selection of chords and then showed that they rated the chords that they had learnt as more consonant.”

Associate Professor McLachlan describes these findings as

extraordinary because for over 2,500 years since Pythagoras people have believed that only chords with simple integer proportions in the frequency of their pitches (such as $3/2$ or $5/4$) were consonant.

In 1863 Herman Helmholtz described the harmonics of a string, and proposed that dissonance was caused by the rapid beating of mistuned harmonics that occurs whenever strings are not tuned to these simple proportions (e.g. in a perfect fifth interval the frequencies of the 2nd and 3rd harmonics of the strings align). Since then over a 100 experimental research papers have been written in support of Helmholtz’s theory, and it was even used as evidence for Arian racial superiority, since only European music has harmony.

In attributing harmony to simple proportions of string length Pythagoras thought he had discovered a cosmological principle, and influenced European aesthetics for millennia (via ideas such as the harmony of the spheres and the purity of simple mathematical proportions).

Whereas we propose that by discovering a way of reproducibly tuning chords, Pythagoras trained his brain (and the brains of the millions of people who followed), to prefer chords tuned to simple frequency proportions.

“We now understand that dissonance in music is caused by failure of neural recognition mechanisms, a theory that is consistent with a broader conceptualisation that dissonance occurs whenever we cannot understand what we sense,” says Associate Professor McLachlan.

“This psychological explanation of musical dissonance allows us to integrate music theory with other psychological concepts such as emotional arousal and theory of mind, and apply these concepts to new ways of enhancing people’s wellbeing through engagement with learning and making music,” he says.

Associate Professor McLachlan has been working closely with the Melbourne Neuroscience Institute (MNI).

“The MNI provides a strategic support role for Music, Mind and Wellbeing,” he says.

“The MNI has assisted us in establishing philanthropic support structures for the initiative, gaining support for grant bids, and acting as an advocate for initiative support.

“This support ensures that initiatives such as ours can flourish.”

For more information:
cmmw.unimelb.edu.au



Human brain imaging

Professor Roger Ordidge joined the University of Melbourne in 2011 as Chair of Imaging Science and Director of the Melbourne Brain Imaging Unit. Since 1977, he has had a keen interest in imaging the human brain and, in particular, played a key role in the development of magnetic resonance imaging.

The Melbourne Brain Imaging Unit currently houses a state-of-the-art Positron Emission Tomography/Computer X-ray Tomography (PET/CT) scanner.

In 2013, a 7 Tesla Siemens whole-body MRI research scanner will be installed with up-to-the-minute technology. The field strength of a normal scanner is 3 Tesla; 7 Tesla represents a dramatic increase in field strength and, hence, scanner performance. The scanner will be used to study the human brain in normal and diseased states. Studies will be performed into multiple sclerosis, Alzheimer's disease and stroke, to name just a few of the areas of research which will be developed on this system.

Professor Ordidge believes that the range of applications of MRI continues to expand

in both diagnosis and disease research. He uses MRI as a research tool rather than as a diagnostic device so that more accurate and diverse information can be used to understand the disease process.

"I also try to improve the methodology, applications and technology involved in scanning," he says.

In terms of challenges for this technology, Professor Ordidge observes that MRI relies on superconducting magnets that require liquid helium at very low temperatures.

"There may be, on the horizon, a future lack of helium since its source, natural radioactivity, produces a very limited supply that is rapidly being depleted," he says.

The Melbourne Neuroscience Institute (MNI) has been integral in ensuring the establishment of this state-of-the-art imaging equipment.

"Without close collaboration with MNI, we would not have progressed to the point we are at now," says Professor Ordidge. "This sophisticated technology will make a substantial impact on our ability to research and diagnose different brain disorders."

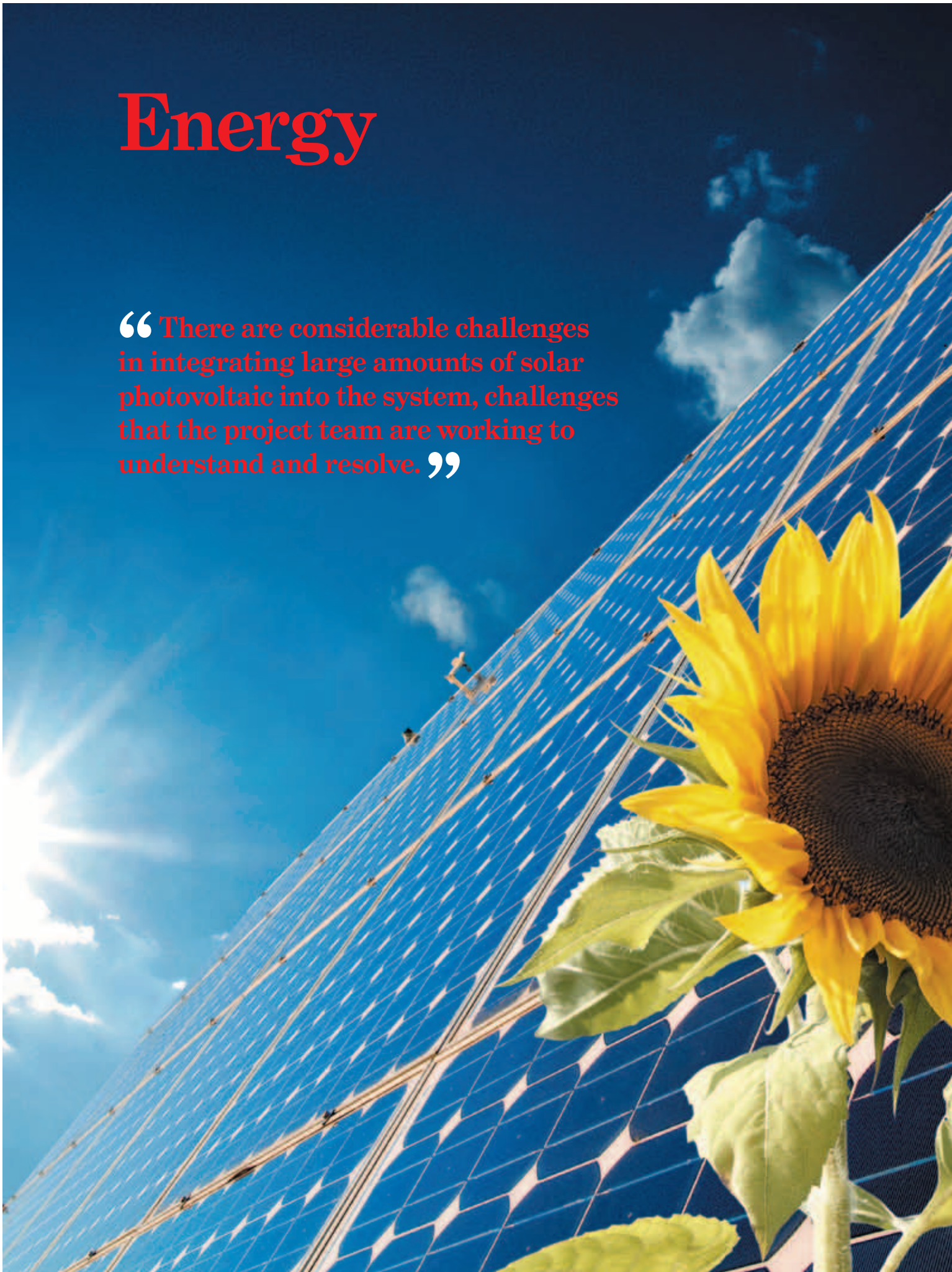
For more information:
www.neuroscience.unimelb.edu.au



PHOTO: PETER CASAMENTO

Energy

“There are considerable challenges in integrating large amounts of solar photovoltaic into the system, challenges that the project team are working to understand and resolve.”





Facilitating the photovoltaic revolution

Transformation of our electricity supply system is essential if Australia is to realise a low carbon future, according to Dr Roger Dargaville from the University of Melbourne's School of Earth Sciences.

A Melbourne Energy Institute (MEI) project is exploring how each element of the current design of the system – from the norms that underpin it to the finance that supports it, the regulatory regime that guides it and the technology it consists of – will need to change if this transformation is to become a reality.

This project brings Dr Roger Dargaville and Research Fellow Dylan McConnell at the School of Earth Sciences together with Associate Professor Fiona Haines at the School of Social and Political Sciences (SSPS), Associate Professor Peter Christoff at the Melbourne School of Land and Environment (MSLE) and PhD candidate Anne Kallies from Melbourne Law School to explore how this can be done.

The project team is currently focusing on one particular technology, solar photovoltaic (PV) panels on householder rooftops. The reasons for this choice are twofold, according to Dr Dargaville.

“Firstly, solar PV arguably poses the greatest challenge to the electricity network as generation is shifted from a central to a distributed model,” he says.

“But secondly, it contains significant potential for transformative change as people both produce as well as consume electricity. This can change their attitude towards this essential service as they become, in sociological jargon, ‘prosumers’.”

Dr Dargaville believes Australia has excellent climatic conditions for solar PV use.

Further, under the current market design solar PV has the potential to reduce the cost of electricity by decreasing the price retailers pay for electricity at the time the market (or ‘spot’) price of electricity is at its highest – the middle of a hot summer’s day. Technically at least, this technology has the potential to play a significant role in a low carbon energy sector.

“But there are considerable challenges in integrating large amounts of solar PV into the system, challenges that the project team are working to understand and resolve,” says Dr Dargaville.

“On the one hand, poor transition planning might see the electricity grid become unreliable, with disruptions producing a bumpy road to a low carbon system. On the other hand, those with a key interest in the current structure of the market may convince government to ignore the need for transformational change.”

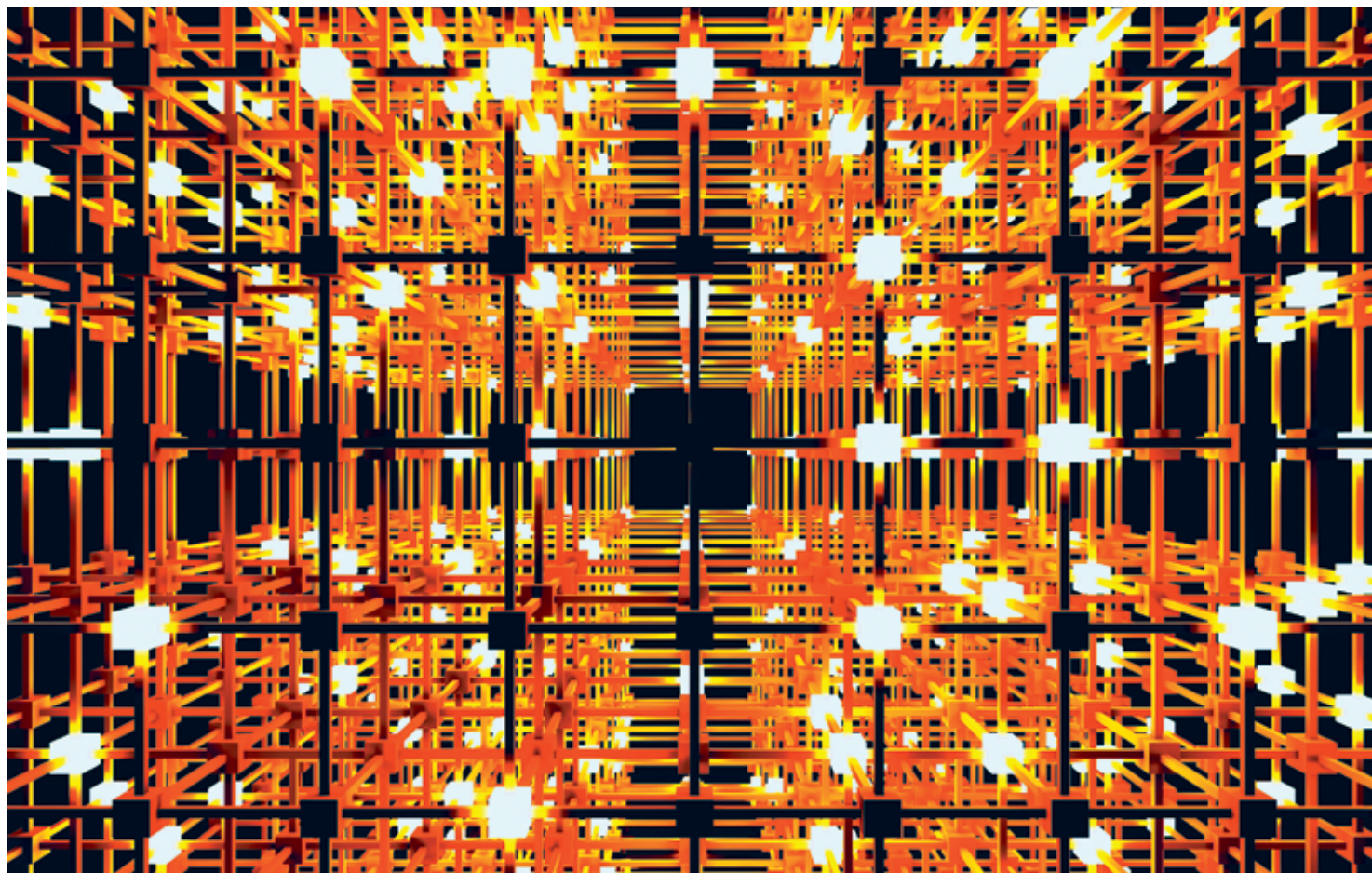
In this case, Australia would be unable to meet its political commitments to decarbonise its economy and will continue to be a major per capita emitter of greenhouse gases.

Moreover, it would fail to learn important lessons for how to live in an environmentally sustainable manner and, in doing so, it will fall further and further behind in terms of worldwide moves to ‘green’ the electricity sector and create a more sustainable economy.

The research team is using funds supplied by a University Interdisciplinary Seed Grant to build links across the University and with external partners to analyse these challenges and develop strategies, both technical and regulatory, that can ensure a smooth transition to the integration of solar PV as part of the necessary electricity revolution in a carbon-constrained world.

For more information:
www.energy.unimelb.edu.au





Centre for Market Design

The Centre for Market Design is a collaboration between the University of Melbourne, the Commonwealth Treasury, and the Victorian Department of Treasury and Finance.

The objectives of the Centre are to:

- + Undertake research in market design and its associated academic disciplines, and to publish in high-quality refereed academic journals;
- + Support an innovative microeconomic policy agenda and the solution of significant social and economic problems through the design of policy mechanisms which rely on fundamental and applied economic research; and
- + Build capability in market design and experimental economics in participating universities and jurisdictions.

In support of these primary objectives the Centre will:

- + Create collaborative linkages between researchers and policy experts;
- + Provide access to research infrastructure and experimental economics laboratory facilities;
- + Provide access to a worldwide network of expertise and advice on market design issues;
- + Train a new generation of researchers and policy experts in market design and its supporting disciplines; and

- + Show leadership in market design and its application to policy within Australia and internationally.

The Melbourne Energy Institute (MEI) contributes to the energy program in the Centre by providing support for a Lecturer in Energy Market Design. The position is held by Dr Leslie Martin, who, as an economist, focuses on energy, industrial organisation, and the environment.

Her recent work has focused on estimating the impact of trade liberalisation and market reform policies on greenhouse gas emissions from manufacturing firms in India.

Dr Martin is currently studying the impact of power cuts and generator use on the energy efficiency of firms in industrialising countries. As part of this project, she conducted a survey of energy use, including a detailed inventory of capital stock, for 400 small enterprises in the machine parts and tools sector in Tamil Nadu, India. The survey included a contingent valuation of willingness to pay for improved electricity reliability.

Dr Martin is also launching two projects, currently in early design stages, that have direct relevance to Australia's low carbon energy transition. The first asks how best to price the system-wide cost of the intermittency associated

with renewable energy generation as the fraction of renewables increases.

The second addresses market design issues involved with the implementation of real-time pricing in competitive retail markets. Currently, residential customers with relatively flat load profiles subsidise customers that consume more electricity on peak days.

The rollout of smart meters removes a technology barrier that had been preventing retail firms from charging customers their true system costs or rewarding customers that moderate their consumption on peak days.

Research questions include: identifying the extent to which consumers are aware of their consumption profiles; measuring the impact of providing consumers with shadow billing services to encourage opt-in to time-of-use plans; and understanding the potential consequences of competitive screening by retail firms.

For more information:
www.cmd.org.au



The Peter Cook Centre for Carbon Capture and Storage Research

The Peter Cook Centre for Carbon Capture and Storage Research was launched on 14 August 2012 by the Hon. Michael O'Brien, Victorian Minister for Resources and Energy.

The Cooperative Research Centre for Greenhouse Gas Technologies (CO₂CRC) will direct research at the new Centre, which has been sponsored by Rio Tinto with \$3 million in funding over three years.

The Melbourne Energy Institute of the University of Melbourne played an important role in initiating and securing partnership for the Peter Cook Centre.

A further \$3 million in Rio Tinto funding over 3 years will support the CO₂CRC Otway Project, Australia's first demonstration of geological carbon dioxide storage, as a field site for carbon storage research.

The Centre will integrate CO₂CRC research capabilities at the University of Melbourne, forming a world-class hub for research into carbon capture and storage (CCS) technology and building the kind of critical mass vital to the national development and deployment of large-scale CCS, which will be a major part of

Australia and the world's drive to manage climate change.

Incorporating extensive research already underway at the University of Melbourne, the Peter Cook Centre for CCS Research will initially host over 30 scientists working on CCS, including a recently funded Professor of Carbon Storage supported by the Victorian Government.

The Centre, named for the eminent geologist and founder of CO₂CRC Professor Peter Cook, will link researchers with the CO₂CRC Otway Project Subsurface Storage Laboratory, which has been safely storing carbon dioxide deep underground since 2008.

Victoria is a natural location for the development of CCS, as the future mining of the State's large brown coal reserves is dependent on new low-emission technologies. Victoria also has significant offshore CCS storage potential.

For more information:
www.pcookccscentre.com.au



Broadband

“This project examines how communications technologies can be used to connect older people living independently in their own homes.”

Alleviating social isolation in older people

Lack of adequate access to interaction with other people can increase feelings of social isolation. This is particularly true for many older Australians who may be isolated in their own homes unless carers, family or friends visit. Social isolation is associated with a range of physical and mental health problems and is therefore a significant health concern, particularly for an ageing population.

In the past, researchers have proposed several interventions to address social isolation for older people, including home visitation, group educational classes, and telephone contact. However, there has been little research examining the possibilities offered by emerging information and communications technologies. While there has been a growing interest in recent years in the design of technologies for older people, much of this research has focused on developing technologies that aim to meet health and safety needs.

This project examines how communications technologies can be used to connect older people living independently in their own homes. The project team developed a user-friendly iPad application, Enmesh (Engagement through Media Sharing), which enables photographs and simple messages to be exchanged. The application was designed specifically to meet the needs of socially isolated older people.

The project team collaborated with Benetas, an aged care provider, and developed a trial whereby a group of older people and their care managers were provided with iPads enabled with the Enmesh application. The trial focused on an older age group who were genuinely socially isolated. The majority of participants were aged in their 80s and 90s.

The trial was conducted over a period of six weeks, and participants were able to exchange photographs and messages. Overall, the results of the trial were very positive. The ability to record and share photographs and messages had a positive effect on participants' wellbeing and played a role in alleviating feelings of social isolation. Importantly, this trial involved evaluating the use of technology in a particular social setting. Participants were introduced to each other in a face-to-face setting, and care managers were invited to take part in the trial. These two features of the trial were both crucial in ensuring the success of the project.

Speaking about their experiences with the technology, participants found that it was useful in alleviating social isolation. One of the users, who was also the most active in sending messages, found the study to be very useful. This user had had a very bad time with depression and found that the study, and being able to communicate with others, had made a significant difference.

The findings from this research project were published in a white paper leading to a formal meeting between the research team and the Age Discrimination Commissioner, the Hon. Susan Ryan AO. The outcomes from this project fed into the development of an ARC Linkage Project that is funding a longitudinal study on the use of the iPad application to ameliorate social isolation.

For more information:
www.broadband.unimelb.edu.au



Teacher professional learning in virtual environments

Many teachers are currently unable to access professional learning due to distance from metropolitan areas and difficulty of release from classes at appropriate times. High-speed broadband provides the opportunity to rethink approaches for professional learning of teachers, increasing access to educational services for teachers living in remote, rural and outer suburban areas.

Broadband-enabled technologies allow for a re-conceptualisation of educational services, including the creation of virtual classrooms that can stream a dynamic environment allowing for regular updates.

Researchers are designing, developing and trialling a proof-of-concept virtual environment as a new model of delivery of professional learning for teachers of mathematics. The research team is creating a virtual environment where participants can observe and explore teacher and student

thinking, through observation of a classroom containing scripted interactions between teacher and student avatars.

The research project will explore the use of innovative features to deepen participants' understanding of issues associated with the teaching and learning of a particular topic, in this case decimal numbers. In the virtual environment, participants can view an individual student's work; hear the 'thinking' of a particular student to provide insight into their understanding; listen to a justification from the teacher for their choices; complete tasks to demonstrate understanding of student thinking; and ask an expert for more information. The content for the trial is adapted from an existing resource, *Teaching Number in the Middle Years CDROM*, developed by Vicki Steinle, Kaye Stacey and others.

The proof-of concept virtual environment targets one mathematics topic for teachers, but the technology has the capacity to support many topics across a wide range of subject areas for both pre-service and in-service teachers. The creation of a virtual classroom allows participants to observe and explore teacher and student thinking enabled by a virtual environment that provides the basis for in-school and at-home professional learning.

The research will determine the effectiveness of the proof-of-concept virtual environment for professional learning of teachers, including the ability to highlight pedagogical issues involved in teaching mathematics and the appeal of the environment for participants. The virtual environment incorporates extensive, well-researched resources to support effective mathematics teaching and provides currently unavailable opportunities for participants to be immersed in a range of classroom situations.

This interdisciplinary research project is a collaboration between the Melbourne Graduate School of Education, the Department of Computing and Information Systems and the Institute for a Broadband-Enabled Society.

For more information:
www.broadband.unimelb.edu.au



HD 3D telemedicine

Many people throughout rural and regional Australia have difficulty accessing specialist medical services.

Telemedicine offers the ability to increase access to services across the nation, delivering medical expertise via a broadband connection, no matter where the patient and clinician are located. Consultations have traditionally been reliant on 2D video and voice communications.

However, the advent of High Definition 3D (HD3D) technologies delivers increased realism, enhanced colour fidelity and greater depth of field, providing the clinician with more information for clinical diagnosis and treatment.

This project builds upon the previously funded IBES research that investigated the use of 3D video conferencing to improve clinicians' ability to diagnose and treat patients.

The latest project aims to develop an advanced telemedical tool kit to allow the provision of specialist medical and allied health services to Victorians living in outer metropolitan, regional and rural areas which as closely as possible replicates a face-to-face consultation.

The project is developing and evaluating telemedicine applications that involve high definition 2D and 3D transmissions for psychiatry, oncology and wound management. In conjunction with the video stream, basic physiological data monitoring can also be made available to clinicians. The initial proof of concept is being trialled in residential aged care centres and rural and regional hospitals in Western and Northern Victoria.



The project is funded by the Victorian Government's Broadband-Enabled Innovation Program (BEIP). IBES and the University of Melbourne are partners in this project, which is being led by the University of Ballarat. Other project partners include VERSI, AARNet, VERNet, Northern Health, Melbourne Health, Heritage Lakes, Ballarat Health, Horsham and Nhill Hospitals, Ballarat District Nursing and Healthcare, Grampians Integrated Cancer Services, Grampians Rural Health Alliance, West Wimmera Nursing Service and Wimmera Health Care Group.

For more information:
www.broadband.unimelb.edu.au

Stimulating Interdisciplinary Research

Interact 2012





Melbourne Research has supported 21 projects in 2012 through Interdisciplinary Seed Funding Grants, 28 projects in 2011, and 24 projects in 2010.

Each of these projects is consistent with the broad research objectives of one or more of the Melbourne Research Institutes or designated theme areas. In conjunction with these Melbourne Research supported projects, a number of interdisciplinary projects are being supported by the Institutes.

A snapshot of some of the research projects funded in 2012 is provided below. For full details of all projects and contributing researchers see: www.research.unimelb.edu.au/rgc/grants/find/schemes/uom/idseed/interact

Society

Addiction models: are they relevant to problem gambling? [MNI]

Problem gambling affects approximately one million Australians, and is associated with significant adverse psychosocial outcomes. Based on numerous similarities between problem gambling and drug addiction, theorists have proposed that neural adaptation involved in addictive processes (i.e., tolerance, withdrawal, as well as impulsive-compulsive tendencies) may also be involved in the aetiology, development and maintenance of problem gambling behavior.

This project applies an empirically grounded neurobiological model of drug addiction to problem gambling, which lacks such well-developed models. We present an innovative framework to understand such a common and disabling condition, with direct relevance for treatment and public policy.

Energy

Wind Turbine Syndrome [MEI]

There has been significant debate in Australia and internationally about the possible health effects of exposure to low frequency sound (infrasound) generated by wind turbines. This study will review the objective evidence for such effects and develop a laboratory model for investigating the physiological effects of infrasound. A media analysis has also been initiated to look at the prevalence of these issues in different countries and its relationship to attitudes to wind turbines in these locations. Resolving these issues is important to the sustainable energy sector as evidenced by recent changes in legislation for the location of wind turbines.

Environment

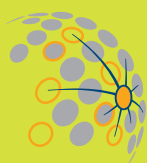
Museum collections, climatic conditions and monitoring in-situ physical changes [MMI]

Recent concerns about the reality of climate change, together with the recognition that museums are located in diverse environments, are driving heritage professions to reconsider the international museum standards of $20^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and relative humidity of $50\% \pm 5\%$.

To better understand an object's range of mechanical responses to its surrounding environment, this project is developing a laser speckle sensor to obtain spatial data from the surface of historical artifacts as the climate changes. Spatial data from the laser speckle unit is integrated with temperature, relative humidity, pressure, noncontact temperature and moisture sensors to quantitatively obtain dimensional information and develop 'damage functions' for unique cultural artifacts.

Conceptions of human–nature relationships and sustainable action: development and preliminary testing of an interdisciplinary theoretical framework [MSSI]

This project develops an interdisciplinary understanding of ways in which conceptions of human–nature relationships influence actions that either benefit or harm the environment and so influence sustainability. Public and academic understandings of human–nature relationships are extremely variable. A preliminary conceptual model has been developed, synthesising theoretical approaches primarily from within anthropology, psychology and ecology. Initial evaluation of the model will explore links between situational framing of social relations, subjective experiences and understandings of nature. Subsequent evaluation will test the ability of the model to predict.



Research Institutes

A Global Research Powerhouse

Health

Understanding the mechanism of action of a new type II diabetes drug [Bio21]

Around two million Australians have type II diabetes (T2D). Globally, the significance of T2D is enormous and the market for T2D drugs is growing. Many major drugs, e.g. Viagra®, Gemzar® and Evista®, were discovered by chance to be effective against diseases different from their initial targets.

MLR-1023 is a potential T2D drug that could be the next serendipitous blockbuster. It was developed in the 1970s for ulcers and was safe, but showed no efficacy. Recently, a small US company Melior discovered its anti-T2D properties. We are collaborating with Melior to determine how MLR-1023 interacts with its target, the enzyme Lyn.

Breaking walls of words: photo elicitation to explore cultural representations of living with depression [MSEI]

Different views exist about causes and treatment of depression. This is further complicated in crosscultural settings by language barriers, access to services and different cultural understandings of depression. There is a need to understand how different cultural groups understand and experience depression.

This project explores how people from Vietnamese and East Timorese communities explain living with depression through visual images. Participants are provided with cameras to capture images representing their experiences of living with this condition, then interviewed about their photos to identify cultural representations of depression and how public goods like health, education, housing and employment play a role in the day-to-day management of this condition.

Technology

Investigation of 3D v 2D for improved learning outcomes [IBES]

Advances in 3D development tools and display technologies has made them much more accessible in recent years. The ability to create 3D videos and interactive 3D models can now be achieved at relatively low cost. In this research project we consider how these new 3D technologies can be used to advantage in education and training. In a series of investigations we will examine whether the provision of 3D instructional and training material (instead of similar representations in 2D) can improve the learning processes and outcomes of students.

This research will lead to a better understanding of how 3D technologies and tools can be designed to improve learning in broadband-enabled environments.

KEY:

MNI Melbourne Neurosciences Institute
MSSI Melbourne Sustainable Society Institute
IBES Institute for a Broadband Enabled Society
Bio21 Bio21 Institute
MMI Melbourne Materials Institute
MSEI Melbourne Social Equity Institute
MEI Melbourne Energy Institute

Infectious diseases and immunology



RENDERED IMAGE OF THE DORSET INSTITUTE CREATED BY GRUNSWIN ARCHITECTS

Protecting Australia from infectious disease pandemics

As the only institute of its kind in the Southern Hemisphere, the Peter Doherty Institute for Infection and Immunity will play a pivotal role in the response to outbreaks of infectious disease, in the investigation of emerging infectious agents and in combating the increasing numbers of drug-resistant pathogens in hospitals and the community.

Infectious diseases are the second-biggest killer worldwide, accounting for four in every ten deaths worldwide¹. Over 15 million people die every year from existing, emerging and re-emerging infectious diseases.

The evolution and spread of infectious diseases has accelerated over the last few decades. A new pandemic health issue has emerged almost every year, and since the 1990s, around 30 new infectious diseases have emerged in humans.

A report by the World Health Organization shows that over 1,000 epidemics of infectious diseases including avian flu, swine flu, polio and cholera were detected globally in the five years from 2007 and 2012. Another study which considered the economic cost of these epidemics found that, from 1995 to 2008, emerging infectious diseases cost the global economy USD\$120 billion².

A range of factors promote the continuing spread of infectious diseases: population growth; changing climate; the increasing size of cities; significant growth in the import and export of food products; and increased international travel.

In 2006, one of Australia's most respected economists Warwick McKibbin and a colleague Alexandra Sidorenko prepared a paper for the Lowy Institute for International Policy. The paper considered the most likely impacts created by an influenza pandemic as it spread and affected more people, using four scenarios/levels of infection: mild, moderate, severe and ultra.

For Australia, the paper suggested that even under a mild scenario involving low loss of life, the country would suffer significant economic consequences. It would increase costs to key mining and agricultural industries and significantly hit export trade, putting it in the top five most exposed countries of the 20 included in the study³. The 2009 influenza pandemic, although considered clinically mild, did have disproportionate economic impacts, and the future risk of a more severe pandemic caused by a more virulent influenza strain or other emerging virus remains as real as when the study was conducted.

Australia and the Asia-Pacific region need a sophisticated system to manage and respond to all infectious disease threats, including pandemics.

The Doherty Institute is set to respond to the challenge of pandemics. The Institute is a partnership between the University of Melbourne and Melbourne Health, focused on combining research into infectious disease and immunity with teaching excellence, reference laboratory diagnostic services, epidemiology and clinical services.

Named after the esteemed Nobel Laureate (1996) and Laureate Professor at the University of Melbourne, Peter Doherty, the Institute will see around 700 staff and postgraduate students share resources, equipment and knowledge in a world-class facility being constructed at the gateway to the internationally renowned Parkville biomedical precinct.

Once operating in early 2014, the Doherty Institute will contain:

- + specialised physical containment laboratories and other state-of-the-art infrastructure;
- + integrated teaching spaces to support the next generation of scientists; and
- + capacity to host conferences, regional meetings and information sessions.

The seven organisations bought together to form the Doherty Institute are:

- + University of Melbourne's Department of Microbiology and Immunology;
- + Microbiological Diagnostic Unit Public Health Laboratory, The University of Melbourne;
- + Victorian Nosocomial Infection Surveillance System;
- + Victorian Infectious Diseases Reference Laboratory;
- + Victorian Infectious Diseases Service;
- + Victorian Life Sciences Computation Initiative; and
- + World Health Organization Collaborating Centre for Reference and Research on Influenza.

For more information:
www.doherty.unimelb.edu.au



¹ World Health Organization, *Fact sheet No.310*, 2011.

² Marsh Inc., *The economic & social impact of emerging infectious disease: Mitigations through detection, research & response*. (Online) (Cited 2011).

³ Warwick J. McKibbin & Alexandra A. Sidorenko, *Global macroeconomic consequences of pandemic influenza*, 2006, p. 24.

Biotechnology research for the 21st century

Biotechnology is increasingly being used to develop new medicines and sustainable food and energy sources, as well as to ameliorate our impact on the environment.

The Bio21 Molecular Science and Biotechnology Institute (Bio21 Institute) undertakes interdisciplinary research in the molecular and chemical sciences that underpins developments in biotechnology. Opened in 2005, the Institute brings together over 600 researchers from different University faculties and the biotechnology sector, including Australia's largest biotechnology company, CSL Ltd.

The expertise of Institute researchers in the molecular biosciences, chemical biology and nanobiotechnology is supported by key platform technologies in cellular imaging and molecular characterisation that also provide an important resource for other researchers in the Parkville Biosciences Precinct.

Research at the Bio21 Institute addresses a diverse spectrum of problems that confront society, including diseases and illnesses such as cancer, Alzheimer's disease, diabetes and malaria that are some of society's most pressing health challenges.

Using sophisticated technologies, including nuclear magnetic resonance spectroscopy, mass spectrometry and advanced microscopy, researchers are working to understand the molecular basis of these and other diseases. In many cases, fundamental research can lead to novel solutions in the field or clinic. For example, research conducted on the common fruit-fly has led to a novel approach for controlling the spread of insect-borne diseases such as dengue fever. Dengue fever affects 50–100 million people worldwide, and is increasing in incidence across the tropical north of Australia. Bio21 Institute researchers isolated a bacterium from fruit-flies that can infect mosquitoes and prevent transmission of the dengue virus. As part of a major multi-institutional field trial conducted near Cairns, Queensland, they have shown that it is possible to introduce mosquitoes carrying this bacterium into the environment. This is one of the first studies to successfully engineer natural insect populations and it has enormous potential for controlling other insect-borne diseases such as malaria.

The strengths of the Bio21 Institute in the areas of chemical biology and nanobiotechnology are critical for developing new tools for probing biological systems as well as translating fundamental biological discoveries to the clinic or field.

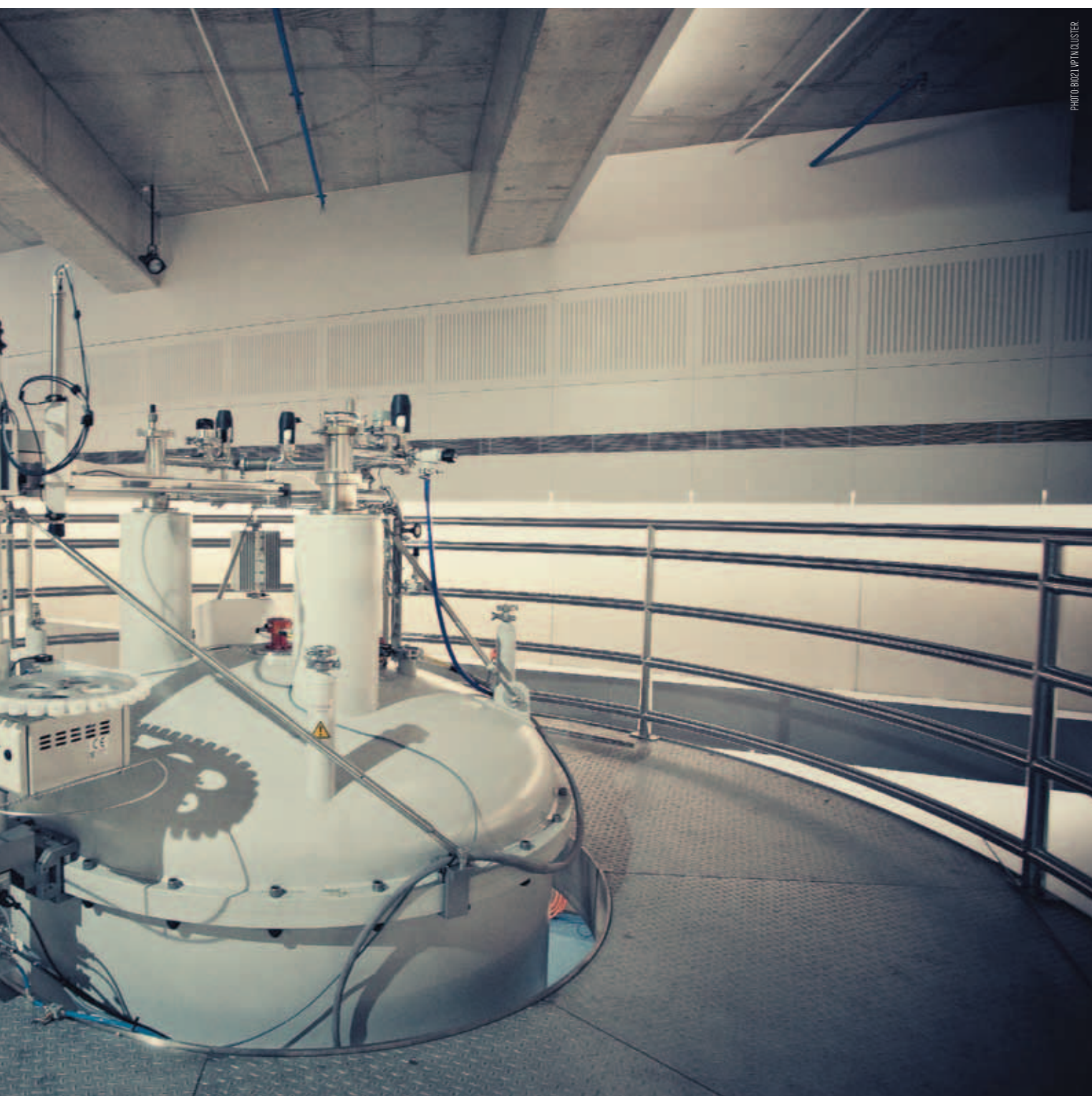
Bio21 Institute researchers, working with collaborators from medical research institutes, hospitals and CSIRO, are leading the development of new nanomaterials, including dendrimers, quantum dots and magnetic nanocrystals. These materials can be tailored to carry drugs to different tissues or used to non-invasively monitor diseases such as cancer and stroke in patients using MRI or PET imaging.

The strengths of Institute researchers in the chemical sciences are also being used by the Victorian Solar Cell Consortium to develop new materials and devices for producing revolutionary plastic solar cells. Bringing Victoria one step closer to achieving a sustainable future, scientists from the Bio21 Institute and University of Melbourne, in collaboration with CSIRO, Monash University and industry partners, have produced flexible plastic solar cells printed with light-sensitive ink to convert sunlight into energy, with the aim of incorporating solar cells into everyday materials such as clothes and roofing.

The Bio21 Institute's vision to develop a 'School to Bench to Workplace' environment bringing together school, research and industry will help sustain the future of the biotechnology industry in Australia.

For more information:
www.bio21.unimelb.edu.au





Pneumonia diagnostic tool could improve outcomes for children with the disease

Pneumonia is the commonest cause of death in children under the age of five. It is estimated that over 1.5 million children die of this disease every year – about one in eight childhood deaths, and one death about every 20 seconds.

Many of the millions of children who contract pneumonia each year never get to a health worker, but even when they do, making the diagnosis and assessing the severity of the disease can be difficult. Front-line health workers in developing countries rarely have doctors to advise them, and even more rarely have access to modern diagnostic methods such as x-ray machines.

The strongest sign that a child with cough or difficult breathing has pneumonia is the respiratory rate. World Health Organization and UNICEF have long promoted the use of 'fast breathing' (at least 50 breaths per minute under 12 months and 40 breaths per minute from 12 months to 5 years of age) as an accurate way for front-line health workers to diagnose pneumonia. Unfortunately, low-

level health workers often find accurate respiratory rate counting difficult, and in a busy clinic with a queue of a hundred patients every morning it can be difficult even for experienced health workers to find an extra minute with each patient.

Enter 'Team StethoCloud' – a group of four University of Melbourne students who came together in January 2012 to compete for Microsoft's annual 'Imagine Cup', a major global software competition for students.

They developed StethoCloud, a cloud-powered, mobile-hybrid stethoscope used to diagnose pneumonia. By connecting a stethoscope to a smart phone, a front-line health worker or even their unskilled assistant can transmit diagnostic information into a cloud service. This cloud service then analyses a patient's breathing sounds for respiratory rate and for patterns that might indicate the presence of pneumonia.

The team was mentored by Associate Professor Jim Black from the Nossal Institute for Global Health, Associate Professor Chris Leckie from the Department of Computing and Information Systems, and Professor Nigel Curtis from the Department of Paediatrics.

"I'm confident that this project will turn into a real-life solution that actually is going to improve outcomes for children with pneumonia," says Associate Professor Black.

Even more exciting, this approach has created an ever-expanding research platform. Recordings taken in a research setting will be supplemented by real-world breath recordings as health workers use StethoCloud in the field. The increasing database of sounds will be useful not only to finetune the respiratory rate algorithm, but it will also allow machine learning algorithms to explore the sounds themselves. There is reason to be optimistic that this approach will reveal hitherto unknown aspects of respiratory sounds that may allow more accurate diagnosis of pneumonia and other respiratory illnesses including asthma.

Team StethoCloud reached the top 20 in the global finals of the Imagine Cup. As finalists, they are in the running for a start-up grant from Microsoft, and they have already formed StethoCloud Pty Ltd and plan to bring their device to the developing world market.

For more information:
www.stethocloud.com



PHOTO: DR. HUN WENG CHUNG



THE
NOSSAL
INSTITUTE
FOR GLOBAL
HEALTH

Half a century of insight for Australia's longest-standing research institute

The Melbourne Institute celebrated its 50th birthday in 2012.

Established by Professor Ronald Henderson in 1962, the Melbourne Institute has been providing powerful economic and social insights for half a century.

The Melbourne Institute was the first economics research institute in an Australian university and engaged in a wide range of research areas including macroeconomic forecasting, financial economics and social economics, and is best remembered for its work on poverty and the development of the Henderson Poverty Line.

Currently the Melbourne Institute undertakes research across four key areas – socioeconomic disadvantage, public sector performance, productivity and living standards, and health and wellbeing. In each of these areas, the Melbourne Institute remains focused on building the evidence base for reform and contributing to public policy.

In 2012 the Melbourne Institute and *The Australian* held the eighth Economic and Social Outlook Conference. Since the first conference in 2002 this event has quickly established itself as Australia's pre-eminent forum for public policy debate and analysis. A focus of this year's conference was on Australia's future and how Australia can survive in this volatile world. Speakers included Deputy Prime Minister and Treasurer the Hon Wayne Swan MP, the Hon Malcolm Turnbull MP and Senator and Minister for Finance and Deregulation Penny Wong.

In its 50th year the Institute continued its tradition of producing powerful research with the release of the latest findings from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. The HILDA Survey is Australia's only large-scale nationally representative longitudinal household survey that interviews the same households and individuals each year, showing how Australian lives have changed over time.

In addition to HILDA, the Melbourne Institute is involved in the collection and analysis of survey data through the Medicine in Australia, Balancing Employment and Life (Mabel) survey and Journey's Home, a national survey about the living and housing challenges that people may be facing, along with the measurement of regular economic and social indicators to provide the tools and data to help inform policy.

The Melbourne Institute is Australia's leading and longest-standing research institute and this success and longevity are owed to its independence and to the quality of research that underpins all its recommendations.

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