

VICTORIA UNIVERSITY

RESEARCH HIGHLIGHTS

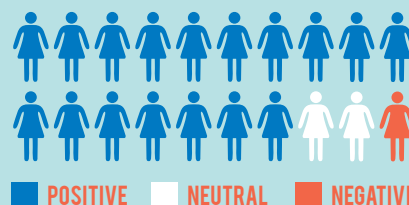
**EXCELLENT
ENGAGED &
ACCESSIBLE**

 **VICTORIA
UNIVERSITY**
MELBOURNE AUSTRALIA

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GRADUATE RESEARCH STUDENT 'OVERALL SATISFACTION' WITH VU RESEARCH TRAINING (FROM 315 RESPONSES IN VU ANNUAL COURSE MONITORING 2011)



GRADUATE RESEARCH STUDENT 'SKILL DEVELOPMENT' WITH VU RESEARCH TRAINING (FROM 14 RESPONSES IN THE NATIONAL POSTGRADUATE RESEARCH EXPERIENCE QUESTIONNAIRE 2011)



FUNDING SOURCES FOR VU RESEARCH:

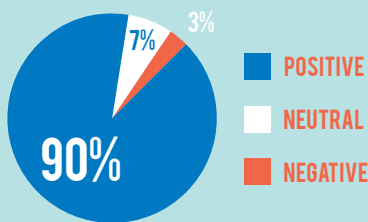
26%
AUSTRALIAN COMPETITIVE GRANTS

38%
LOCAL, STATE AND COMMONWEALTH GOVERNMENT

36%
AUSTRALIAN INDUSTRY AND INTERNATIONAL



GOALS & EXPECTATIONS



GRADUATE RESEARCH STUDENT EXPERIENCE MEETING 'GOALS AND EXPECTATIONS' WITH RESEARCH TRAINING (FROM 324 RESPONSES IN VU ANNUAL COURSE MONITORING 2011)

RESEARCH SUPERVISION

86.4%
POSITIVE

(FROM 323 RESPONSES IN VU ANNUAL COURSE MONITORING 2011)

IN 2012 THE AUSTRALIAN RESEARCH COUNCIL RATED VU:

'WELL ABOVE WORLD STANDARD' (ERA RATING 5) IN:

- HUMAN MOVEMENT & SPORTS SCIENCE (TOP 8 IN AUSTRALIA)
- ELECTRICAL & ELECTRONIC ENGINEERING (TOP 4 IN AUSTRALIA)
- PHARMACOLOGY & PHARMACEUTICAL SCIENCE (TOP 4 IN AUSTRALIA)

'ABOVE WORLD STANDARD' (ERA RATING 4) IN:

- APPLIED MATHEMATICS
- MEDICAL PHYSIOLOGY

'WORLD STANDARD' (ERA RATING 3) IN:

- 10 OTHER AREAS

VICTORIA UNIVERSITY'S RESEARCH AND RESEARCH TRAINING VALUES:

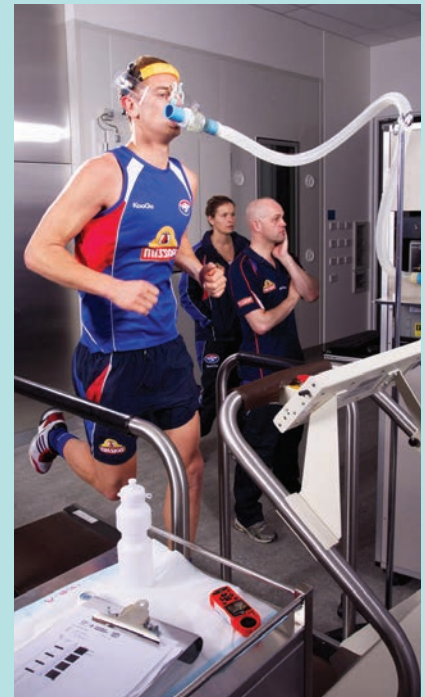
- RIGOUR AND EXCELLENCE IN CRITICAL INQUIRY
- INNOVATION, RELEVANCE AND IMPACT
- INTEGRITY AND ETHICS IN RESEARCH CONDUCT
- PARTNERSHIPS AND COLLABORATION
- INTELLECTUAL FULFILLMENT

"WE TAKE OUR PARTNERSHIPS SERIOUSLY, BECAUSE WE KNOW THEY ARE THE KEY TO PRODUCING RELEVANT RESEARCH AND REAL-WORLD OUTCOMES."

\$6.14M

TO LEAD RESEARCH COLLABORATIONS ON WATER MANAGEMENT, EDUCATION, CLINICAL EXERCISE SCIENCE AND ACTIVE LIVING

(CRN COMMONWEALTH FUNDING 2012-14)



WELCOME

Welcome to Research Highlights and the opportunity to see how Victoria University researchers are making a difference through excellence and engagement in research.

It's an exciting time for research at Victoria University, with more Australian competitive grant funding than ever before and significant support provided by the Commonwealth Government's Collaborative Research Network (CRN) initiative. Victoria University is proud to be leading nearly 20 CRN research projects on water management, education, clinical exercise science and active living, with partners at the University of Melbourne, Deakin University, Edith Cowan University and CSIRO.

These projects will receive \$6.14 million in Commonwealth funding between 2012 and 2014 and have already generated new research positions and income in their first year. More broadly our network of research partnerships continues to grow far beyond Melbourne's west to include partners around the world.

Thanks to these strong links with government, industry and the community our research both informs and is informed by those at the coalface. Whether working alongside pre-school teachers in education, Olympic athletes in performance training or the Chinese government in sustainability planning we take our partnerships seriously, because we know they are the key to relevant research and real-world outcomes.

Through the University's institutes and research centres we are growing capability around our research foci of sustainable environmental technologies; applied informatics; food and nutritional sciences; creative arts and writing; education, diversity and lifelong learning; medical and health sciences; strategic economics; diversity and wellbeing; sport, exercise and active living; and supply chain, logistics and transport.

In 2012 the Australian Research Council rated Victoria University above world standard in several of these research focus areas. The University ranked 'well above world standard' (ERA rating 5) in human movement and sports science, electrical and electronic engineering, and pharmacology and pharmaceutical science. We ranked 'above world standard' (ERA rating 4) in both applied mathematics and medical physiology and 'world standard' (ERA rating 3) across 10 other areas.

Meanwhile new graduate research initiatives including coursework components in PhD programs and extra peer support from Research Ambassadors ensure development of our junior researchers. The latest annual course monitoring surveys at Victoria University put graduate research student satisfaction at 85%. Over 86% reported a positive experience of research supervision and 90% were satisfied they had met their goals and expectations.

Our vision is for an excellent, engaged and accessible university with world-renowned research providing creative, evidence-based solutions where they're needed. Through the hard work of our researchers and the commitment of our partners that vision is becoming a reality.

I hope you enjoy this snapshot of Victoria University research and I invite you to consider what our distinctive approach to research could do for you, your organisation or your community.

Warm regards,

**PROFESSOR WARREN PAYNE
PRO VICE-CHANCELLOR
RESEARCH & RESEARCH TRAINING
VICTORIA UNIVERSITY**

**"VICTORIA
UNIVERSITY
RESEARCHERS
ARE MAKING
A DIFFERENCE
IN OUR WORLD
THROUGH
EXCELLENCE
AND
ENGAGEMENT
IN RESEARCH."**





EXERCISING HOPE FOR DIABETES

Research shows exercise early in life can fend off diabetes and heart disease, even for those predisposed to the diseases.

A study by Victoria University's Professor Glenn McConnell with University of Melbourne's Associate Professor Mary Wlodek tested whether exercise could 'reprogram' rats predisposed to diabetes and heart disease due to being born underweight.

"Those born small are programmed for a higher chance of disease later in life because of their underdeveloped heart, pancreas and other organs," Professor McConnell said. "But from what we found it appears likely you can reprogram yourself by exercising early in life."

The study focused on beta cells, which are produced in the pancreas and release insulin to regulate blood glucose. Those born small for their gestational age have less beta cells to release insulin and regulate their blood glucose.

In trials on rats born small, those exercised from one month of age showed small improvements in beta cell mass when tested at two months of age. But surprisingly, four months later, despite no further exercise, their beta cell mass was the same as the healthy control group.

In essence they had been successfully reprogrammed, so that their pancreas had regained a normal beta cell mass. Another group of born small rats were not exercised and showed no improvement.

"We knew exercise was good for controlling blood sugar levels in people with diabetes, but to actually see the pancreas' beta cell mass normalised after exercise – and to see the prospect of diabetes diminish with that – has been a major breakthrough," he said.

Professor McConnell said these findings implied more physical activity for kids could set them up for better health later in life, even helping those predisposed to diabetes and heart disease to change their likely fate.

Diabetes is a chronic disease with serious complications. It currently affects an estimated 1.8 million Australians with about 275 adults developing the disease every day, according to Diabetes Australia. Maintaining a healthy weight, being physically active and following a healthy eating plan can reduce a person's risk of developing type 2 diabetes by up to 60%.

More trials are now planned with sheep – a larger mammal model with more similar hormones and reproductive physiology to humans than rats. Professor McConnell is also developing an exercise study on adult men who were born small.

Professor McConnell has been awarded five National Health and Medical Research Council project grants as the lead researcher and several Diabetes Australia Research Trust grants. The 'born small' rat study was supported by \$325,000 of NHMRC funding and forms part of a Collaborative Research Network between Victoria University and the University of Melbourne.

Professor McConnell has researched type 2 diabetes for over 20 years, specialising in the factors regulating skeletal muscle glucose uptake during exercise. He is research leader in Exercise Science at the Institute for Sport, Exercise and Active Living and also leader of the Biomedical and Lifestyle Diseases research unit. He won a 2012 Vice-Chancellor's award for research excellence, leadership and an outstanding publication record in high impact journals.

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1.8M

AUSTRALIANS ARE AFFECTED BY DIABETES

275 ADULTS DEVELOP DIABETES EVERY DAY

MAINTAINING HEALTHY WEIGHT, EXERCISING AND HEALTHY EATING CAN REDUCE RISK OF DEVELOPING TYPE 2 DIABETES BY UP TO 60%

"WE KNEW EXERCISE WAS GOOD FOR CONTROLLING BLOOD SUGAR LEVELS IN PEOPLE WITH DIABETES, BUT TO ACTUALLY SEE THE PANCREAS' BETA CELL MASS NORMALISED AFTER EXERCISE – AND TO SEE THE PROSPECT OF DIABETES DIMINISH WITH THAT – HAS BEEN A MAJOR BREAKTHROUGH."



Pictured left: Professor Glenn McConnell



GIVING PAPUA NEW GUINEA'S WOMEN A VOICE

Dr Ceridwen Spark has travelled high and low across Papua New Guinea collecting stories of women with the power to inspire change.

In PNG for four months on an Endeavour Research Fellowship, Dr Spark researched the lives of female leaders at a time of great social change in their communities.

The biographies of these women inform six short documentary films, which challenge the idea women have little to contribute in their male-dominated society.

One subject is a nun who was instrumental as a peace-builder in Bougainville. Another is the country's first female village magistrate, making the elderly lady one of the top authorities for administering traditional justice on Manus Island.

"There are all these terrific women in Papua New Guinea doing these inspiring things so I sought to document them and make their stories accessible to a wide audience," Dr Spark said.

But the Pawa Meri or 'Power Women' project is about more than celebrating women's stories: it's also about training local women as directors and filmmakers, and educating school children across the country about the roles women play as leaders.

"I didn't want my research to simply gather dust on a bookshelf," Dr Spark said. "From the very beginning the films have been about opening up discussion with people across Papua New Guinea – especially the younger generations – about gender and leadership."

On completion, the films will go to secondary school teachers around PNG, along with discussion guides on the gender issues raised. International or film festival audiences are secondary as the focus remains capacity-building, she said.

The documentary films are being made by local PNG women, who receive training in everything from interview techniques to camera angles, sound recording and studio editing. In a country where access to media training is so limited, this is significant.

With the 2012 elections resulting in three women elected to PNG's parliament Dr Spark, who was born and raised there, says times are clearly changing.

"This project is contributing to that sense of change and momentum by featuring strong women in the public domain where they've traditionally not been well represented. The project is providing opportunities for up-and-coming women filmmakers to tell these and ultimately other stories."

Pawa Meri is a partnership between Victoria University and the Centre for Social and Creative Media at University of Goroka in the Eastern Highlands province of Papua New Guinea. It has been supported by a \$313,000 AusAid grant and a \$20,000 Endeavour Research Fellowship.

Dr Spark said this support was critical in allowing her to spend time in Papua New Guinea.

"Being there to build relationships with people on the ground has made such a huge difference to how this project is turning out," she said. "In PNG everything hinges on social relationships, so living in Goroka for four months was crucial in establishing a sense of connection with my collaborators at the University of Goroka and with the women as subjects and directors for the films."

Dr Spark is a Postdoctoral Research Fellow.

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FILMS COVER:

6 - WOMEN DIRECTORS
- WOMEN SUBJECTS, THEIR FAMILIES AND COMMUNITIES
- THE PROVINCES OF MANUS, MOROBE, EASTERN HIGHLANDS AND THE AUTONOMOUS REGION OF BOUGAINVILLE

"I DIDN'T WANT MY RESEARCH TO SIMPLY GATHER DUST ON A BOOKSHELF. FROM THE VERY BEGINNING THE FILMS HAVE BEEN ABOUT OPENING UP DISCUSSION WITH PEOPLE ACROSS PAPUA NEW GUINEA – ESPECIALLY THE YOUNGER GENERATIONS – ABOUT GENDER AND LEADERSHIP."



Pictured left: Dr Ceridwen Spark



Jason Templar
Senior Sergeant

VICTORIA POLICE

VICTORIA

COUNTERING VIOLENT EXTREMISM

A landmark study on perceptions of violent extremism in Australia has found media stereotyping may significantly threaten community safety, particularly for Muslim community members.

The national study by Professor Michele Grossman and Dr Hussein Tahiri of Victoria Police with the Australian Multicultural Foundation interviewed 542 Muslim and non-Muslim community leaders, young people and government staff on perceptions of violent extremism.

While participants saw the prospect of home-grown terrorism as fairly low due to Australia's democratic system, relatively peaceful culture and geographic isolation, major concerns were identified over relentless media stereotyping that linked Islam and terrorism.

"A substantial number thought there was potential for peaceful Muslims to become radicalised because the steady diet of negative media about Islam was so pervasive and humiliating," Professor Grossman said. "People felt commercial media were guilty of practising their own form of extremism through sensationalised, imbalanced and inaccurate representations of the connection between Islam, extremism and terrorism."

The high level of distrust, cynicism and disenchantment with media reporting on Australia's Islamic community was seen across all groups of participants.

"Commercial media were also seen as ignoring diverse or moderate views within the broader Australian Muslim community for commentary in favour of controversial or radical Muslim figures on the fringes," she said.

Media's potentially positive role in fostering knowledge about Islam as a religion, the place of Muslims in the community and a realistic understanding of radicalisation in Australia was also recognised. It was suggested media spokespeople representing the moderate

majority of Australian Muslims be promoted.

The media's role was just one aspect of the project, funded by \$234,000 from the National Counter Terrorism Committee. It also investigated the role of police, government and community members in understanding and preventing violent extremism, including a focus on the internet and social media.

The 200-page report, received by the Federal Government in 2012, has been described by independent reviewer Professor Kevin Dunn from the University of Western Sydney as a "milestone in our understanding of these issues" that provides an "important snapshot" of community attitudes and beliefs around countering violent extremism. The report is being prepared for public release to the general community.

It's one of a series of projects from Professor Grossman's ongoing research partnership with Victoria Police, which began in 2006 with a Footscray Police forum on youth and the local Sudanese community. This forum initiated a major two-year study on youth and community policing, with Professor Jenny Sharples, culminating in the 'Don't Go There' report, which has significantly informed Victoria Police's youth strategy.

Professor Grossman said gathering relevant voices through qualitative research was important as communities themselves often had solutions to the problems.

"My role as researcher is to aid dialogue between agencies like Victoria Police and the community to understand more about each other and develop robust partnerships, whether it's to improve attitudes, change behaviour or even counter violent extremism," she said.

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542

PARTICIPANTS INTERVIEWED FROM ALL 8 STATES AND TERRITORIES IN AUSTRALIA

THE STUDY INVOLVED PARTICIPANTS FROM 34 ETHNIC AND CULTURAL BACKGROUNDS AND 6 FAITH GROUPS, INCLUDING MUSLIM, CHRISTIAN, JEWISH, HINDU, BUDDHIST, SIKH AND THOSE WHO DID NOT IDENTIFY WITH ANY RELIGION

"PEOPLE FELT COMMERCIAL MEDIA WERE GUILTY OF PRACTISING THEIR OWN FORM OF EXTREMISM THROUGH SENSATIONALISED, IMBALANCED AND INACCURATE REPRESENTATIONS OF THE CONNECTION BETWEEN ISLAM, EXTREMISM AND TERRORISM."



Pictured left: Professor Michele Grossman and Senior Sergeant Jason Templar



UNDERSTANDING BOWEL DISEASE

Researchers have shed light on how inflammatory bowel disease develops and how it might be better treated.

Neuroscientist Dr Kulmira Nurgali has proven the disease not only damages the gut lining, as previously known, but also kills one in five neurons inside the gut wall and permanently alters function in many remaining neurons.

“Neurons become hyperactive and hypersensitive following inflammation, meaning they don’t function how they used to,” Dr Nurgali said. “This begins a negative cycle as the dysfunctional neurons lead to more inflammation and in turn more neuron damage.”

Neurons are nerve cells that process and transmit information by electrical and chemical signaling. The network of neurons and nerves in the intestinal wall, known as the enteric nervous system, controls all gut function from the movement of food through the system to secretion of enzymes and digestion. As Dr Nurgali demonstrated, it is disruption of these neurons that leads to bloating, diarrhoea and constipation in those suffering inflammatory bowel disease.

The disease, often in the form of ulcerative colitis and Crohn’s disease, affects more than 60,000 Australians and costs the economy nearly \$3 billion a year.

Dr Nurgali said defining exactly how a disease worked was crucial in knowing where to intervene with better treatment.

“There is currently no effective cure, while treatment involves surgical removal of the damaged part of the intestine and suppression of symptoms,” she said. “Our research has already indicated drugs protecting enteric nervous system neurons from damage during inflammation would help prevent or slow the disease.”

Since conducting her initial research using guinea pigs, Dr Nurgali has begun similar research on human enteric neurons with Professor Simon Brookes at Flinders

University in a major study supported by the National Health and Medical Research Council.

“This research was previously almost impossible, but thanks to recent developments in technology and access to human tissue samples from the Victorian Cancer Biobank we are able to push on much further in this area,” she said.

Since joining Victoria University in 2010 Dr Nurgali has gathered a team consisting of a dozen research assistants, postdoctoral researchers and honours students. Another major part of her research focus is tackling side effects of chemotherapy for cancer sufferers.

Studies with Victoria University cancer expert Dr Crispin Dass and Western Health’s Dr Paul Senior are investigating the enteric nervous system’s role in nausea, diarrhoea, constipation, appetite loss and vomiting associated with chemotherapy.

In some cases, chemotherapy causes severe intestinal inflammation and bowel perforation, yet the drugs to alleviate these side effects themselves have side effects causing neurological, cardiovascular, gastrointestinal and renal impairments.

“The search for new ways to safely prevent the side effects of anti-cancer chemotherapy is crucial and we think the enteric nervous system plays a role,” she said. “It’s amazing the enteric nervous system has had so little attention. It’s a whole nervous system with roughly the same amount of neurons as the spinal cord and may hold the key to many illnesses.”

Dr Nurgali is an internationally recognised postdoctoral researcher with nearly 20 published journal papers in the field of enteric neuroscience.

FOR MORE INFORMATION EMAIL [KULMIRA.NURGALI@VU.EDU.AU](mailto:kulmira.nurgali@vu.edu.au) OR VISIT [VU.EDU.AU/RESEARCH/BLD](http://vu.edu.au/research/BLD)



INFLAMMATORY BOWEL DISEASE, OFTEN IN THE FORM OF ULCERATIVE COLITIS AND CROHN’S DISEASE, AFFECTS MORE THAN 60,000 AUSTRALIANS AND COSTS THE ECONOMY NEARLY

\$3B A YEAR



INFLAMMATORY BOWEL DISEASE KILLS 1 IN 5 NEURONS INSIDE THE GUT WALL AND PERMANENTLY ALTERS FUNCTION IN MANY REMAINING NEURONS

“OUR RESEARCH HAS ALREADY INDICATED DRUGS PROTECTING ENTERIC NERVOUS SYSTEM NEURONS FROM DAMAGE DURING INFLAMMATION WOULD HELP PREVENT OR SLOW THE DISEASE.”



Pictured left: Dr Kulmira Nurgali



KEEPING THE WATER FLOWING

Research on microscopic invertebrates is helping authorities face a major issue in global water management.

In an extensive three-year study Professor John Orbell and Research Fellow Dr Robin Mitra scoped the spread of tiny 'bryozoan' creatures in Victoria's waterways, improved methods for identifying bryozoan species and investigated ways to eradicate them.

Professor Orbell said colonies of these pests were responsible for clogging water pipes, pumps, filters and water-usage meters across many of the world's water networks.

"These tube-shaped animals with tentacles are each less than a millimetre long but together form clump-like colonies that are very pervasive and become a big problem for water authorities," he said. Clumps of bryozoans look similar to moss, which is why they are often referred to as 'pipe moss' or 'tobacco weed'.

Water managers in Victoria alone spend tens of thousands of dollars a year to clean water distribution systems blocked by bryozoan colonies through a process known as 'biofouling'.

"There is currently no ideal way of controlling or eradicating bryozoans, but the first step towards winning the battle is to know our enemy," Professor Orbell said.

The \$400,000 research project funded by Greater Wimmera Mallee Water and Tamarama Estate resulted in successful identification of up to ten species infesting the Northern Mallee Pipeline system, including species never before seen in Australia.

As well as information gathered through extensive field trips, researchers learnt a great deal through their work in the labs. There they managed the highly complicated task of germinating the organisms, which was valuable for studying their reproduction.

Along with University of Melbourne researchers they developed a new scanning electron microscope method

to identify the bryozoan's egg-like structures, known as statoblasts, which distribute their organism's genetic material far and wide.

Professor Orbell said the different statoblasts of each species could hold the key to species-specific control methods for them.

"Some of the more problematic species have gas-filled flotation cells attached to their statoblasts," he said. "This is a potential Achilles' heel since these cells could be ruptured by exposing them to pulsed electromagnetic fields."

Professor Orbell said the most effective control currently available was aggressive super chlorination, that there were health concerns associated with this method.

"We're getting closer to winning this battle and it's important that we do," he said.

"But these organisms have been around almost unchanged since Precambrian times, 500 million years ago, so they know a thing or two about survival."

The Northern Mallee Pipeline in north-west Victoria replaced older channels diverting water from the Murray River with pressurised pipelines, reducing water loss and providing better water quality.

Professor Orbell is a chemist associated with the Institute for Sustainability and Innovation, which specialises in applied research on drinking water, wastewater, recycled water, stormwater and industrial water applications.

He is a Fellow of the Royal Australian Chemical Institute and has received several awards in the fields of physical and environmental chemistry including a Johns Hopkins University Research Scholarship and a Vice-Chancellor's award for excellence in research.

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"THESE ORGANISMS HAVE BEEN AROUND ALMOST UNCHANGED SINCE PRECAMBRIAN TIMES,

500

MILLION YEARS AGO, SO THEY KNOW A THING OR TWO ABOUT SURVIVAL."

"THESE TUBE-SHAPED ANIMALS WITH TENTACLES ARE EACH LESS THAN A MILLIMETRE LONG BUT TOGETHER FORM CLUMP-LIKE COLONIES THAT ARE VERY PERSVASIVE AND BECOME A BIG PROBLEM FOR WATER AUTHORITIES."



Pictured left: Professor John Orbell



RECYCLING WASTE TO POWER DESALINATION

Water scientists have shown the viability of a new desalination technology that uses almost no electricity and could save huge amounts of water.

Project leader Associate Professor Mikel Duke said the three-month trial at Newport Power Station proved desalination of wastewater – which usually relies on large amounts of electricity – could instead be powered by an industry's own waste heat.

“The membrane distillation technology uses waste heat to evaporate wastewater through a fine membrane,” Associate Professor Duke explained. “The evaporated water condenses on the other side of the membrane as treated water – at above tap water standard – for re-use around the plant.”

The trial conducted at Ecogen Energy's gas-fired Newport Power Station showed the system used 50% less electricity to desalinate water than traditional techniques. An updated design was then shown to use 95% less electricity.

“It has now been proven to work and as energy and water become increasingly scarce this technology is a major development,” he said. “If it were scaled up to a continuously operating industry of similar size to the Newport Power Station it could desalinate 7 million litres of water per day, which is the equivalent of supplying fresh water to 25,000 Melburnians.”

Associate Professor Duke said many factories and industrial settings produced enough waste heat for this system to operate, but currently that heat is not harnessed.

“One of the most exciting outcomes of our tests is that the system can use waste heat as low as 30°C,” he said. Conventional evaporative desalination systems require 70°C or higher.

“We've seen several industrial cases where there is far more waste heat available than what's needed to treat

the entire site's wastewater currently going to the sewer,” he said. “There are a lot of industries keenly watching this technology. We're already in consultation with the mining, manufacturing and dairy industries as well as water utilities to move to larger pilot trials.”

The technology is relevant to many industries as saline wastewater from industrial processes is a common trade waste issue businesses must manage, both internally and in negotiation with water authorities.

“Membrane distillation technology is just emerging globally, so our demonstration project on an industry site puts us at the forefront of international progress,” Associate Professor Duke said.

The project was supported by the Smart Water Fund, led by Water Quality Research Australia and Victoria University's Institute for Sustainability and Innovation, with support from City West Water, GWM Water and Integrated Elements.

The Institute for Sustainability and Innovation specialises in developing sustainable solutions for industry and community partners through water treatment technology, resource management, environmental and behavioural research.

The Institute is a world leader in membrane technology with Australian Research Council projects reducing water use in the dairy industry with Dairy Innovation Australia Limited, improving membrane durability and performance with Siemens Water Technologies and treating waste water more sustainably with Sunchon National University, Korea.

Associate Professor Duke is Principal Research Fellow in the Institute for Sustainability and Innovation and chairs the Membrane Society of Australasia.

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THE DESALINATION SYSTEM USES

95%

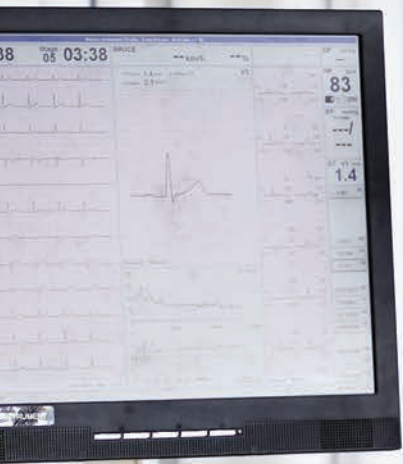
LESS ELECTRICITY THAN TRADITIONAL TECHNIQUES

THE DESALINATION SYSTEM CAN USE WASTE HEAT AS LOW AS 30°C. CONVENTIONAL EVAPORATIVE DESALINATION SYSTEMS REQUIRE 70°C OR HIGHER

“MEMBRANE DISTILLATION TECHNOLOGY IS JUST EMERGING GLOBALLY, SO OUR DEMONSTRATION PROJECT ON AN INDUSTRY SITE PUTS US AT THE FOREFRONT OF INTERNATIONAL PROGRESS.”



Pictured left: Associate Professor Mikel Duke



Mortara INSTRUMENT



PREDICTING VITAL SIGNS

Surgery will be safer than ever before with computers predicting patients' vital signs and providing early warning of complications during surgery.

Preliminary results from the PhysAnalyser program, developed by Victoria University's Centre for Applied Informatics (CAI), show its potential to revolutionise medical operations by giving around 20 seconds prediction on blood pressure, heart rate and other vital signs.

CAI Director Professor Yanchun Zhang said his team had developed algorithms to read and compress patient's body-function data in real-time.

"Where existing approaches to this technology are inefficient, too slow and not fully automatic, our team have succeeded with a program that analyses tremendous amounts of streaming data, collected from many sensors, in a short time," he said.

Data taken each 3 milliseconds includes heart rate, arterial pressure, venous pressure and airway resistance. This information then feeds online displays of the patient's predicted vital signs. The program can also trigger real-time warnings, query surgical decisions and store information from an operation.

Professor Zhang is leading the \$445,000 Australian Research Council Linkage Project with Royal Brisbane and Women's Hospital and Nanjing University of Finance and Economics in China.

He said their clear goal was reducing clinicians' workloads and enhancing their medical performance without compromising service quality.

"Anaesthetists perform a vital role in monitoring the patient and adjusting the flow and type of anaesthetics to the patient during an operation," he said. "Early awareness of possible complications is vital for an anaesthetist or surgeon to correctly react to a given situation."

The PhysAnalyser can also be used to monitor intensive care patients after surgery and has been successfully tested with data from an operating theatre and intensive care units. Further tests to improve the system's efficiency and effectiveness continue.

"The end point of all this technology is to improve success rates and reduce mortality in surgery and intensive care units by arming doctors with information and time to act on it," Professor Zhang said.

Information and communication technologies play an increasingly important role in healthcare, from electronic medical records to communication systems, health portals and the organisation of research data.

The Victoria University team behind the technology includes Senior Research Fellow Dr Jing He, who won a 2012 Vice-Chancellor's award for her outstanding publication record and international research reputation, Professor Xun Yi, Postdoctoral researcher Dr Guangyan Huang and PhD student Peng Zhang.

Industry partners include Professor Michael Steyn and Associate Professor Kersi Taraporewalla from Royal Brisbane and Women's Hospital and Professor Jie Cao from Nanjing University of Finance and Economics.

The Centre for Applied Informatics is a leading research group in computing, information technology and IT applications. The centre engages experts and government bodies around information technology applications with social benefit. Whilst the centre is multidisciplinary, research is focused on e-technology with high commercialisation potential.

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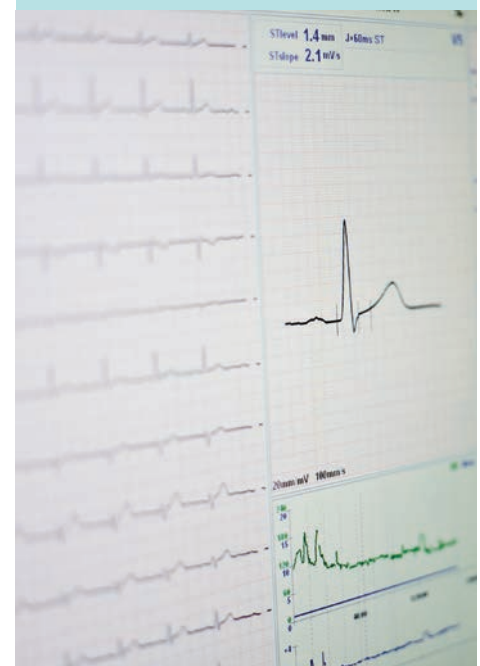


**THE PHYSANALYSER GIVES
20 SECONDS
PREDICTION ON BLOOD PRESSURE,
HEART RATE AND OTHER VITAL SIGNS**

**DATA IS TAKEN EACH
3 MILLISECONDS
ON HEART RATE, ARTERIAL
PRESSURE, VENOUS PRESSURE
AND AIRWAY RESISTANCE**

**THIS FEEDS INTO THE ONLINE PHYSANALYSER
TECHNOLOGY, WHICH CAN COMPRESS
AND PROCESS 3 SECONDS OF DATA IN
30 MILLISECONDS**

**"THE END POINT OF ALL THIS
TECHNOLOGY IS TO IMPROVE
SUCCESS RATES AND REDUCE
MORTALITY IN SURGERY AND
INTENSIVE CARE UNITS BY ARMING
DOCTORS WITH INFORMATION
AND TIME TO ACT ON IT"**



Pictured left: Professor Yanchun Zhang



PREDICTING DROUGHT

One of the most accurate models yet for predicting drought has been developed through a PhD research project.

Dr Shishutosh Barua's groundbreaking research produced an index capable of accurately forecasting drought conditions six months before they occur.

"This early detection of droughts will help water managers to implement drought mitigation strategies, such as deciding on water restrictions or storing water, before droughts occur," Dr Barua said.

The water engineer developed his Nonlinear Aggregated Drought Index (NADI) in a study on the Yarra River catchment, which stretches from beyond Warburton to Port Phillip Bay and provides most of Melbourne's water.

Dr Barua said most prediction models focused on rainfall as the single variable, which did not adequately represent the variety of drought conditions.

"My model measures water storage, stream flow, water in the soil and evaporation to gain a broader and more accurate assessment of a catchment's dryness," he said. "Once dryness has been assessed, past circumstances such as recent drought conditions and rainfall patterns are added to the equation to predict future drought conditions."

As part of the study, Dr Barua tested the index's capacity to detect major droughts in Victoria's past. By entering historical data from the Bureau of Meteorology and Melbourne Water the NADI was able to accurately detect the intensity and severity of the state's droughts in 1967/68, 1982/83 and from 1997 to 2010.

When entering the historical data into the standard rainfall-based drought prediction models – Deciles and the Standardized Precipitation Index – both models were less accurate than NADI, especially for Deciles.

"When big rainfall events occur for short periods, Deciles show that the drought is over which is clearly not the case," Dr Barua said. "NADI fluctuates more accurately in and out of droughts and mirrors the reality much more closely."

Dr Barua said the latest 13-year drought – officially the worst on record – showed how vulnerable we were to water shortages in Australia. He said he hoped his tool would allow governments and water authorities to better prepare for the next inevitable drought.

"There have been frequent droughts in the past 60 years and it is likely droughts will become more frequent in coming years according to climate change scenarios," Dr Barua said.

Bureau of Meteorology acting deputy director of Climate and Water Dr Dasarath Jayasuriya applauded the research.

"It represents a significant contribution to managing the social, economic and environmental impacts of droughts," Dr Jayasuriya said. "With further development the methodology could potentially assist in managing droughts more effectively globally."

Since completing his PhD under the supervision of Professor Chris Perera and Dr Anne Ng, Dr Barua has worked at the Victorian Department of Sustainability and Environment and the Bureau of Meteorology as a hydrologist.

Victoria University's Water Resources Research Group works closely with the Institute of Sustainability and Innovation, the water industry and other universities.

The group's expertise includes water resource planning, integrated urban water management, hydrological modeling, water infrastructure management and river water quality modeling.

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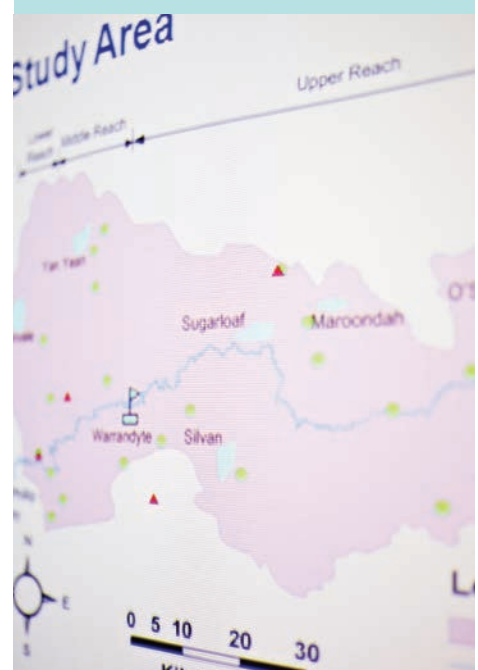


THE MODEL PREDICTS DROUGHT BASED ON WATER STORAGE, STREAM FLOW, WATER IN THE SOIL, EVAPORATION, PAST DROUGHT CONDITIONS AND RAINFALL PATTERNS

THE NEW MODEL CAN PREDICT DROUGHT CONDITIONS SIX MONTHS IN ADVANCE

VICTORIA HAS EXPERIENCED DROUGHT IN 18 OF THE PAST 45 YEARS

"THIS EARLY DETECTION OF DROUGHTS WILL HELP WATER MANAGERS TO IMPLEMENT DROUGHT MITIGATION STRATEGIES, SUCH AS DECIDING ON WATER RESTRICTIONS OR STORING WATER, BEFORE DROUGHTS OCCUR."



Pictured left: Dr Shishutosh Barua



021 EVT
VIC - ELECTRIC VEHICLE TRIAL

PLANNING CHINA'S ELECTRIC VEHICLE INDUSTRY

Researchers are helping China launch an electric vehicle industry in a bid to tackle carbon emissions and air pollution.

Centre for Strategic Economic Studies researchers Dr Alex English and Dr Kim Sweeny have developed an electric vehicle roadmap with China's Energy Research Institute.

Their report suggested government purchasing policies and infrastructure programs to achieve a competitive electric vehicle industry. They also gave advice on taxes, industry subsidies and rebates for vehicles with lower emissions and recommended a focus on battery technology and charging station networks as critical steps in making electric vehicles more attractive.

"The success of electric vehicles remains dependent upon overcoming three major barriers: battery technology, high upfront cost and inadequate infrastructure," Dr English said.

He said while China had been established in automotive component exports for some time, it was now poised to make a serious attempt at becoming a global leader in producing electric vehicles by 2020.

"China recently emerged as the world's largest manufacturer and market for motor vehicles," Dr English said. "While launching itself on the international market with a new generation of low cost vehicles, China is also targeting the cutting edge of innovation with a strong commitment to new energy vehicles."

With the number of vehicles in China projected to reach 360 million by 2030 the project aims to have 94 million of those as electric vehicles, each able to travel 400km per charge from a fully integrated network including solar and mobile charging stations.

Dr Sweeny said while China's economy was usually associated with negative environmental impacts, significant

positive opportunities existed in the nation's massive domestic market and highly skilled and low-cost production sectors, especially in bringing innovative products and clean technologies to market through mass production.

"The scale of China's domestic market and access to international markets ensures that if China can make low-cost energy efficient products, then not only will they capture a significant share of the global market but they will also force producers in other countries to adopt advanced, clean tech approaches," Dr Sweeny said. "Both these effects would generate significant global energy savings and lower carbon emissions."

Since 2009 the Centre for Strategic Economic Studies has collaborated with China's Energy Research Institute on research to guide policies for reducing China's energy use and emissions. The electric vehicle industry plan is one project in that program. It was funded \$165,000 by the Australian Department of Climate Change and Energy Efficiency as part of bilateral support for energy efficiency research. Other China-based projects for the Centre include planning sustainable cities, policies for developing ultra-efficient air conditioners and rebalancing China's economic structure.

The Energy Research Institute of the National Development and Reform Commission is China's leading energy research organisation, playing a key role in shaping and informing the government's energy and climate change policies.

The Centre for Strategic Economic Studies was established in 1993 and has developed a reputation for high quality research outputs in applied economics with a focus on the processes of economic, technological, environmental and social change in the Asia Pacific region.

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CHINA IS PROJECTED TO HAVE

360M

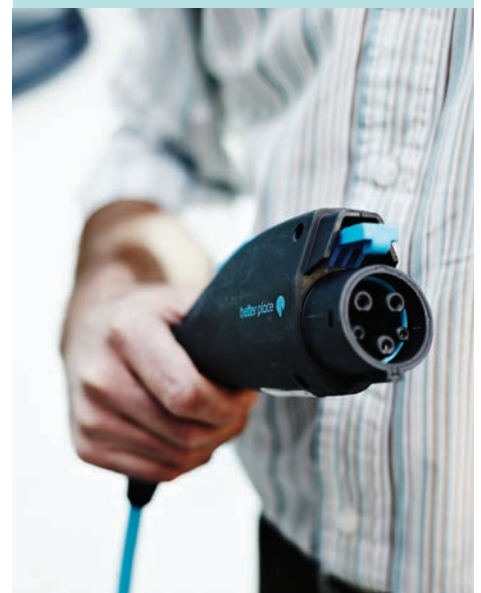
VEHICLES BY 2030 AND

500M

VEHICLES BY 2050

CHINA'S ELECTRIC VEHICLE TARGETS ARE
500,000 VEHICLES
BY 2015,
94 MILLION
BY 2030

"THE SUCCESS OF ELECTRIC VEHICLES REMAINS DEPENDENT UPON OVERCOMING THREE MAJOR BARRIERS: BATTERY TECHNOLOGY, HIGH UPFRONT COST AND INADEQUATE INFRASTRUCTURE."



Pictured left: Dr Kim Sweeny and Dr Alex English (Department of Transport car)



MENTORING BETTER TEACHERS

Early childhood research is improving teacher quality and laying the groundwork for rollout of a state-wide mentoring program.

Victoria University's early childhood team is leading implementation and evaluation of a \$1.3 million mentoring program with Deakin University for the Department of Education and Early Childhood Development.

So far, mentors have helped two cohorts of new or professionally-isolated teachers develop teamwork, leadership and teaching skills at 113 kindergartens and day care centres across Victoria.

Lead researcher Associate Professor Andrea Nolan said mentees had gained confidence in their practical skills, while also developing a stronger sense of identity as professionals in the field.

"Teachers said it helped them so much to have someone outside their centre, with experience in the field, to talk through problems with and arrive at solutions rather than just going it alone," she said.

"We measure success in how this mentoring influences their teaching because in the end it's all about the children having the best quality education and care so they can reach their potential."

Mentors and mentees in the program meet regularly to discuss progress on areas they identified for improvement. St Albans kindergarten teacher Maria Tenaglia said the working relationship with her mentor Kirsten Agius had been a valuable one.

"It's really helped me to evaluate new ideas and approaches in my practice, and I think that's made me a better teacher," she said.

The program is part of a larger project informing government and education providers on models for mentoring of early childhood teachers, ahead of an industry move to Victorian Institute of Teaching (VIT) registration.

Currently, primary and secondary teachers have comprehensive teacher development programs as part of their VIT registration, while as of 2012, the qualified yet unregistered teachers in early childhood education do not.

Associate Professor Nolan said the evaluation had taught them valuable lessons, not only about the benefits of mentoring for early childhood teachers, but also the drivers and support services necessary to sustain a state-wide mentoring program.

"The importance of this research is in understanding how a mentoring program like this can work successfully in the early childhood sector, given all its complexity and diversity that make it so unlike the primary and secondary education environments," she said.

Victoria's Minister for Children and Early Childhood Development, Wendy Lovell, attended graduation of the program's first cohort in mid-2012 to publicly thank researchers for how comprehensively designed and delivered the program had been.

Associate Professor Nolan has developed a national profile in early childhood research and is also working on New Zealand's rollout of teacher mentoring and induction programs.

While Associate Professor Nolan boasts an impressive record of academic publications, she also maintains a strong commitment to making her research accessible to a non-academic audience through contributions to Early Childhood Australia's 'Research in Practice' series.

"I'm passionate about my research but also about getting results into the field where they influence how teachers teach and children learn," she said. "That's why I'm a researcher."

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113

TEACHERS HAVE BEEN MENTORED ACROSS VICTORIA.

IN MELBOURNE, PORTLAND, WARRNAMBOOL, HAMILTON, ARARAT, HORSHAM, BALLARAT, GEELONG, BENDIGO, MILDURA, SEYMOUR, SHEPPARTON, BENALLA, WANGARATTA, WODONGA, BAIRNSDALE, SALE, MOE AND MANSFIELD

MENTOR REFLECTING ON PROGRAM'S IMPACT: "ENGAGED, RE-INVIGORATED, EXCITED, STRESS-FREE TEACHERS MAKE FOR HAPPY, ENGAGED RELATIONSHIPS WITH CHILDREN."

"TEACHERS SAID IT HELPED THEM SO MUCH TO HAVE SOMEONE OUTSIDE THEIR CENTRE, WITH EXPERIENCE IN THE FIELD, TO TALK THROUGH PROBLEMS WITH AND ARRIVE AT SOLUTIONS RATHER THAN JUST GOING IT ALONE."



Pictured left: Kirsten Agius and Maria Tenaglia



GREENING ACROSS CULTURES

Research is helping migrant communities, government staff and housing agencies understand each other on sustainable living.

Professor Anne-Marie Hede interviewed members of Melbourne's Vietnamese and Sudanese communities on attitudes and behavior for saving water and electricity, recycling, growing vegetables and composting.

The consumer behaviour expert found keen support for green living but also barriers to taking action: interestingly not those outsiders had assumed.

When interviewed for the project, landlords, estate agents and government workers suggested the Sudanese were too focused on basic survival in their new land to worry about sustainability.

"They also believed Sudanese, having come from Africa, did not necessarily equate Australia with drought affliction and did not, as a consequence, worry about conserving water," she said.

These views were not, however, echoed by members of the Sudanese community who understood the importance of sustainability, valued growing their own vegetables and were keen to learn more about saving energy.

What stopped many of the Sudanese participants from living green was their housing situation.

"Most of those living in public housing have no access to recycling, while composting had been stopped due to health concerns," Professor Hede said. "Gaining a plot in one of the estate's community gardens often involved long waits and no other space was available."

Another problem was shared billing in public housing, meaning despite one household working hard to reduce energy consumption they did not always see a reduction in their bills, which sometimes became a disincentive to change habits.

The Vietnamese community was seen by landlords, estate agents and government workers as very attuned to ideas of sustainability and this perception was reinforced by the Vietnamese participants in the study. However, many expressed frustration at the difficulties of accessing and understanding government subsidies and rebates.

Professor Hede said the findings provided an evidence base for programs tackling these issues and has recommended an expansion of community gardens at housing estates, trials in recycling, individual energy billing and incentives for neighbours in estates to reduce costs collectively. The study has also highlighted the importance of tailoring communications on subsidies and rebates in each community's language.

"Also, it's important to educate landlords and government agencies about the positive attitudes Vietnamese and Sudanese communities already have about sustainability," she said.

Sustainability Victoria CEO Stan Krpan said the research would inform better engagement programs.

"A key challenge with sustainability programs is accessibility. This research helps us understand the particular needs of cultural and linguistically diverse communities and how we can better tailor services," he said.

The project involved Victoria University's Community Engagement Coordinator Elleni Bereded-Samuel and Postdoctoral Research Fellow Dr Judith Mair. It was funded by the Victorian Government Sustainability Fund, led by Maribyrnong City Council and Victoria University. The Real Estate Institute of Victoria and Western Alliance for Greenhouse Action also lent support.

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NEARLY 3 OUT OF 4 AUSTRALIAN ADULTS ARE CONCERNED ABOUT CLIMATE CHANGE

RETAIL ELECTRICITY PRICES INCREASED BY

84%

IN MELBOURNE BETWEEN 2007 AND 2012

IN TOTAL, THERE WERE 42 PARTICIPANTS IN 6 FOCUS GROUPS CONDUCTED IN VIETNAMESE AND DINKA, WITH THE STAKEHOLDER INTERVIEWS CONDUCTED IN ENGLISH

"IT'S IMPORTANT TO EDUCATE LANDLORDS AND GOVERNMENT AGENCIES ABOUT THE POSITIVE ATTITUDES VIETNAMESE AND SUDANESE COMMUNITIES ALREADY HAVE ABOUT SUSTAINABILITY."



Pictured left: Professor Anne-Marie Hede, Deng Ajak and Cuc Lam



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758.8

VELOTRON
WILD TRAK

VELOTRON
WILD TRAK

GIVING ATHLETES THE EDGE

Victoria University sports scientists are developing new ways to give Australia's elite athletes the competitive edge.

Dr David Rouffet's research in the Institute for Sport, Exercise and Active Living (ISEAL) led to performance improvements of 1% for Australia's top cyclists, including Anna Meares and Shane Perkins, who won sprint gold and sprint bronze respectively at the 2012 London Olympic Games.

"The improvement we can achieve may not sound like much but is in fact massive for an elite sprint cyclist," Dr Rouffet said. "The gap between the 3rd and 4th times for the men's sprint qualifier in London was 0.8% – our work can be the difference between winning a medal or not."

The major innovation was a small computer used to measure pedal power. Developed by Victoria University engineers Ian Fairweather, Robert Stokes and Rhett Stephens, the 72-gram Torxtar™ is small enough to fit beneath bicycle saddles in training and competition.

"This provided a unique opportunity for coaches and athletes to evaluate pedal power generation in a competition environment, which is considerably more useful than relying solely on data from a stationary bike ergometer in the lab," he said.

Researchers worked on the method with coaches, athletes and scientists from Cycling Victoria, Cycling Australia, the Victorian Institute of Sport and the Australian Institute of Sport leading up to the 2012 Olympics.

It's one of almost 20 collaborative projects between Victoria University, the Australian Sports Commission and Australian Institute of Sport (AIS). Worth around \$1 million, the projects include Tennis Australia, Gymnastics Australia and other peak sporting bodies as partners.

AIS director Matt Favier said the decision to partner with ISEAL was based on its research depth and quality facilities.

"What makes the Institute unique is that it brings together all the best people to form a critical mass of expertise," he said.

Other projects cover athlete development, bike set-ups to maximise speed in BMX supercross, nutritional supplements to enhance performance, and fabrics worn to improve kicking and goal shooting in Australian football and netball.

While most research in the partnership focuses on athletic performance and sports participation, ISEAL Director Professor Hans Westerbeek and Senior Research Fellow Dr Camilla Brockett are leading research into bureaucratic structures for elite sport.

Sports Policy factors Leading to International Sporting Success (SPLISS) involves researchers from the Netherlands, United Kingdom, Belgium and Australia investigating how sport is organised and financed; how talented athletes are identified, supported, coached and exposed to international competition; and how sports facilities and research operates in 16 countries.

Professor Westerbeek said the goal was to understand which government programs, in isolation or integration, were most likely to achieve Olympic medals and international titles.

"We know it's not as simple as putting more money in to get more medals out," he said. "While investment is hugely important we want to shed more light on what happens in the middle of that complex equation."

ISEAL is building a strong reputation for quality research and meaningful partnerships in elite and grassroots sport, active living and social and management sciences.

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TORXTAR™ COMPUTER WEIGHS JUST 72 GRAMS

WHEN USED IN TRAINING IT LED TO PERFORMANCE IMPROVEMENTS OF 1% FOR AUSTRALIA'S TOP CYCLISTS

THE GAP BETWEEN THE 3RD AND 4TH TIMES FOR THE MEN'S SPRINT QUALIFIER IN LONDON WAS

0.8%

THERE ARE 19 COLLABORATIVE PROJECTS BETWEEN VICTORIA UNIVERSITY, THE AUSTRALIAN SPORTS COMMISSION AND AUSTRALIAN INSTITUTE OF SPORT



Pictured left: Dr David Rouffet



UNLOCKING THE SECRETS OF BONES

Researchers have discovered a hormone produced in bones that may hold the key to better treatment and control of type 2 diabetes.

Institute for Sport, Exercise and Active Living researcher Dr Itamar Levinger highlighted the important link while studying the effects of physical activity on bone metabolism, sugar control and cardiovascular risk.

Studies have shown that bones do not just provide structural support for our muscles, but actually help regulate glucose in our bloodstream through a protein molecule called undercarboxylated osteocalcin (ucOC).

“Our team has shown that changes in ucOC after physical activity correlate with the reduction in blood glucose levels,” Dr Levinger said. “We are now looking into exactly how ucOC and muscles interact to increase glucose uptake after exercise.”

Dr Levinger has further shown that bone structure, not just bone metabolism, may contribute to sugar control.

“These hormones are actually produced on the surface of the bone’s internal cavities,” he said. “Therefore, bones with larger internal cavities could potentially produce more hormones, while denser bones with less internal space could produce less of these hormones associated with blood sugar control.”

The body’s regulation of glucose in the bloodstream is an important biological function. Problems with this process can lead to obesity, type 2 diabetes and an increased risk of cardiovascular disease.

Dr Levinger said better understanding glucose control opened possibilities for diabetes prevention and management through new drugs to interact more effectively with the system’s pathways.

“Current drug therapy, designed to control blood glucose levels in people with type

2 diabetes, may be limited and have negative effects on bone health,” he said. “By better understanding the connection between our bones and blood sugar control we hope to open the door to drugs controlling blood glucose via the bones, which could improve both blood sugar control and bone health.”

Diabetes is a chronic disease with serious complications. It currently affects an estimated 1.8 million Australians with about 275 adults developing the disease every day, according to Diabetes Australia.

The cost of diabetes to the Australian community and the individuals affected is significant: Government health budgets are impacted to the extent of an estimated \$6 billion each year, while people living with diabetes are hit with increased personal health costs.

Dr Levinger is a Heart Foundation Postdoctoral Research Fellow. His research involves major collaborations with Professor Ego Seeman and others at Austin Health and the University of Melbourne, as well as partners at Western Health and Deakin University.

His work has been funded by the Helen Macpherson Smith Trust, the Diabetes Australia Research Trust and the Heart Foundation. It is also supported through the federally-funded Collaborative Research Network.

Dr Levinger completed his PhD at Victoria University in 2008 and has already established a strong research reputation in his field; with over 20 research papers published in leading journals. He has expertise in exercise rehabilitation for patients with cardiovascular and metabolic diseases and strong relationships with industry and research bodies in those areas.

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BONES NOT ONLY PROVIDE STRUCTURAL SUPPORT FOR OUR MUSCLES, BUT ACTUALLY HELP REGULATE GLUCOSE IN OUR BLOODSTREAM

DIABETES IMPACTS GOVERNMENT HEALTH BUDGETS TO THE EXTENT OF AN ESTIMATED

\$6B EACH YEAR

“BY BETTER UNDERSTANDING THE CONNECTION BETWEEN OUR BONES AND BLOOD SUGAR CONTROL WE HOPE TO OPEN THE DOOR TO DRUGS CONTROLLING BLOOD GLUCOSE VIA THE BONES, WHICH COULD IMPROVE BOTH BLOOD SUGAR CONTROL AND BONE HEALTH.”



Pictured left: Dr Itamar Levinger



PREVENTING HOUSE FIRE DEATHS

Research is helping authorities understand house fire risk through one of the most comprehensive fire fatality databases in the world.

A research team led by Professor Dorothy Bruck has built the database over five years, recording 150 variables from coronial files on more than 400 fatalities caused by house fires in Victoria, New South Wales and Queensland.

“Fire crews arrive and take basic information but nothing like the data we collect, so while they know about the fire they know very little about the victim,” she said. “Coroner’s files are such a rich source of information allowing detailed investigations about who is dying in house fires and why.”

In one study researchers looked at Coroners’ records for the 95 fire victims tested for blood alcohol and found 58% had positive results, most with high levels of intoxication exceeding 0.10% Blood Alcohol Concentration.

Professor Bruck said few of those intoxicated victims had obstacles, such as barred windows or blocked exits, preventing their escape from the fire.

“The implication is that at least some intoxicated victims might have survived had they been roused in time,” she said.

But the biggest issue appeared to be the combination of heavy drinking and smoking. The study showed victims who’d been drinking were nearly five times more likely to die in fires involving ‘smoking materials’ like discarded cigarettes.

The database has also allowed the first detailed look at the role of mental illness in house fire death. In about half the 101 Victorian deaths examined victims were either definitely or probably suffering from a diagnosable mental illness. Interestingly, this group were six times more likely to have a history of careless smoking – as evidenced by cigarette

burns in carpets, clothes and furniture – than those without a mental illness.

Meanwhile the group’s research on human behavior in fire has led to new standards for smoke alarm signals being adopted by the US National Fire Protection Association. Similar changes are under consideration in Australia.

A further study, supported by an Australian Research Council Linkage Project and the Australian Building Control Board, suggested nearly half of house fire deaths could be prevented with interlinked smoke alarms throughout houses.

The research program originally launched by Professor Bruck and Professor Ian Thomas five years ago has attracted several honours, PhD and postdoctoral researchers who help code files and analyse data. Professor Bruck received a 2012 Vice-Chancellor’s award for outstanding career performance in research and research leadership based on the international quality, impact, recognition and success she’s achieved.

Another member of the research team, Dr Michelle Ball, said the research was now moving onto development of a fire survivors database.

“With this we’ll be able to compare the two databases and ask what it is about the people who die versus the survivors,” Dr Ball said. “This is the next critical step in understanding and preventing death in house fires.”

The team works within the University’s Centre for Environmental Safety And Risk Engineering and partners with the Metropolitan Fire Brigade, Country Fire Authority, Bushfire Collaborative Research Centre, Office of the Emergency Services Commissioner and others.

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DATABASE INCLUDES 150 VARIABLES ON MORE THAN 400 FATAL FIRES IN VICTORIA, NEW SOUTH WALES AND QUEENSLAND

OF 95 VICTIMS TESTED FOR BLOOD ALCOHOL,

58%

HAD POSITIVE RESULTS, MOST WITH LEVELS EXCEEDING 0.10% BAC

“CORONER’S FILES ARE SUCH A RICH SOURCE OF INFORMATION ALLOWING DETAILED INVESTIGATIONS ABOUT WHO IS DYING IN HOUSE FIRES AND WHY.”



Pictured left: Erin Doolan, Donna Wheatley, Dr Lin Xiong, Dr Michelle Ball and Kirsten Meyer



MAPPING INDUSTRIAL RELATIONS

The first ever survey on HR practices in Australian multinational companies shows trade unions still play a major role in our industrial relations landscape.

Victoria Graduate School of Business director, Professor Pauline Stanton, said while trade union density had declined to less than 20% of the Australian workforce, research showed almost 60% of multinationals based in Australia recognised trade unions for collective bargaining on at least some of their sites.

“Despite the general decline of trade unions, clearly they remain a force to be reckoned with,” Professor Stanton said.

However, the study of more than 200 multinationals also showed 86% of human resource directors in these companies preferred to deal directly with employees than through unions.

“Many managers believe dealing directly with staff, when done well, can actually lead to more effective organisations and more engaged staff,” Professor Stanton said. “It’s also a question of power: from the perspective of HR managers there is a big difference between dealing with the collective power of a union or the individual employees.”

The study highlighted how despite their preferences, human resource directors in multinationals couldn’t always have their way, especially in highly unionised sectors such as retail, wholesale and manufacturing.

“Multinationals are having to balance pressure for developing globally integrated HR policies on the one hand, while adapting to local environment demands on the other,” she said.

This view is supported by PhD student Gitika Sablok who found highly unionised foreign owned multinationals were more likely to use ‘quality circles’ and less likely to use formal performance appraisals, suggesting trade union presence has some impact on HR management practices.

Quality circles are problem solving groups that discuss issues of quality, production or service delivery in the workplace.

Ms Sablok also found multinationals from Europe and Asia where more likely to adopt a dualistic approach – engaging with trade unions but also using direct approaches with employees – than those from the US.

“These companies are practising a more sophisticated form of strategic human resource management that recognises working with unions, as well as engaging directly with employees, can be a beneficial company strategy particularly where unions are entrenched,” Ms Sablok said.

Such companies often also have Australian HR representatives on their global HR committees, bringing with them important insights on the local industrial relations landscape.

A full report from the nation-wide survey was launched at Victoria University by Australian Human Resource Institute president Peter Wilson. This research is part of an even larger-scale Australian Research Council Discovery Project through the University of South Australia which will compare Australian multinationals with those in 10 countries. Victoria University is collaborating with an international network including King’s College London, Universidad Autónoma de Madrid and the University of Montreal.

Professor Stanton has over 80 peer-reviewed publications in international and domestic journals and has consulted widely in strategic human resource management to industry.

The Victoria Graduate School of Business boasts close ties to industry and partners in China, Singapore, Hong Kong, Malaysia, Germany, India and the United States.

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**UNION DENSITY IN AUSTRALIA:
1976 = 50.2%
2011 = 18%**

60%

**OF MULTINATIONALS IN AUSTRALIA
RECOGNISED TRADE UNIONS**

**IN 200 MULTINATIONALS,
86% OF HR DIRECTORS
PREFERRED TO DEAL
DIRECTLY WITH
EMPLOYEES THAN UNIONS**



Pictured left: Gitika Sablok and Professor Pauline Stanton



ALIGNING EDUCATION QUALIFICATIONS

Victoria University researchers have taken the guesswork out of deciding education pathways, credit transfers and equivalent levels by aligning every post-secondary qualification in Australia.

Work-based Education Research Centre deputy director Associate Professor Shelley Gillis said their success in the federally-funded project had bolstered Australia's position as a world leader in designing qualification frameworks.

"This project will ensure that Australian qualifications continue to be highly regarded nationally and internationally and that this country retains its reputation as an educational leader and innovator," she said.

The previous Australian Qualifications Framework covered 14 qualification types – from Certificate I to PhD – across school, vocational and higher education sectors.

By calibrating the 14 qualifications onto a single level framework, the researchers identified overlaps and similarities between some qualifications. For example the Victorian Certificate of Education and Certificate III had similar levels of complexity, as did honours and postgraduate diplomas, meaning the number of qualification levels could be reduced to 10. Importantly, this has made finding pathways and credit transfers between them much easier.

"Prior to this study it was uncertain how different qualifications within and across sectors related to each other, as there was no explicit taxonomy of learning outcomes or reference levels that described exactly what each qualification involved," Associate Professor Gillis said.

"This calibration clearly defined each level and in doing so improves the ability of Australian students to move around the country and the world whilst having their qualifications recognised more easily."

Their recommendations, adopted by the Federal Government, now underpin a new Australian Qualifications Framework

defining every post-secondary education qualification delivered in Australia.

The Australia Qualifications Framework Council had acknowledged the need to update the framework with a more explicit and transparent levels structure, and had begun industry consultation towards that end. But when Associate Professor Gillis and Professor Margaret Wu proposed their rigorous approach to defining qualification levels through complex survey design and psychometric analysis, the Federal Government were so impressed they commissioned the pair for the \$114,000 study.

Associate Professor Gillis and Professor Wu from the University's Work-based Education Research Centre are acknowledged amongst the few with expertise to undertake this type of research in Australia.

Following this success, the Australian Government has since commissioned them to apply their methodology to empirically align the Australian Core Skills Framework with Adult Literacy and Life Skills surveys, which are used in national planning and OECD reports.

"This project is aimed at getting more frequent and accurate information on the literacy and numeracy progression of particular groups of adult learners against national goals," Associate Professor Gillis said.

This project received funding of \$171,000 under the National Vocational Education and Training Research Evaluation Program.

These are just two of the high profile research projects undertaken by WERC. As well as research and development activities, the centre also undertakes product development, capacity building and publishing functions.

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THE AUSTRALIAN QUALIFICATIONS FRAMEWORK DEFINES

10 LEVELS

FROM CERTIFICATE I TO PHD ACROSS SCHOOL, VOCATIONAL AND HIGHER EDUCATION SECTORS

"THIS PROJECT WILL ENSURE THAT AUSTRALIAN QUALIFICATIONS CONTINUE TO BE HIGHLY REGARDED NATIONALLY AND INTERNATIONALLY AND THAT THIS COUNTRY RETAINS ITS REPUTATION AS AN EDUCATIONAL LEADER AND INNOVATOR."



Pictured left: Associate Professor Shelley Gillis



STREAMLINING PORT LOGISTICS

Logistics researchers have fostered industry cooperation over projects that will inform port planning for decades to come.

The Institute for Supply Chain and Logistics, in partnership with IMIS/Aurecon consultancy, tracked 75,000 containers from origin to destination through the Port of Melbourne. They recorded everything from ship and container size to timing, truck type and route taken. From this data – the most comprehensive collected in Australia – researchers mapped 250 stages in the movement of containers at the port and freight rail terminal. These freight movements were then forecast to 2050.

The Institute has now completed similar studies on port container chains in Adelaide, Sydney and Brisbane using the methodology developed in Melbourne.

Lead researcher Dr Hermione Parsons said accurate mapping of supply chains, which they first achieved in the Port of Melbourne study, allowed better planning and streamlining of port activities.

“This research forms an authoritative basis for strategic public and private sector planning, policy, strategy forecasting, implementation and investment for the next 30 years,” she said. “It’s also a significant step towards reducing traffic congestion and greenhouse gas emissions associated with Port of Melbourne activities.”

The exceptional detail of the study was made possible by companies agreeing to provide commercial in confidence data for every container moved during the sample period.

Over 200 transport operators service the Port of Melbourne with 25 of these operators responsible for around 75% of the work. By building trust with industry partners, researchers were able to include data from all these major players among the 105 importers and exporters, container parks, freight

forwarders, stevedores and rail operators involved in the study. Australian Customs and Border Protection Services and Australian Quarantine Inspection Service also provided data.

“This cooperation is unprecedented in Australia,” Dr Parsons said. “The industry is highly competitive and most businesses operate on low profit margins, hence there is often a reticence to share information on customers or business relationships. However, as an independent and impartial research institute with a focus on business relationships we managed to overcome that hurdle.”

In 2010 the study was awarded a national university Business and Higher Education Round Table (BHERT) award for collaboration in research. In 2012 the Institute was appointed preferred supplier to the federal Bureau of Infrastructure, Transport and Regional Economics.

Dr Parsons said the efficiency, productivity and global competitiveness of supply chains were vital not only to business success, but for the wellbeing of the economy as a whole.

The supply chain industry is one of Australia’s largest economic sectors, contributing 14.5% to GDP, employing more than 1.2 million people and contributing \$90 billion to the Australian economy each year.

The Port of Melbourne is Australia’s largest container and general cargo port, handling 37% of the nation’s container trade. Forty-two container shipping lines and cargo carriers make around 3,200 ship calls a year to Melbourne, providing services to major ports around the world.

The Port of Melbourne study was funded by the Port of Melbourne Corporation, the Victorian Department of Transport and Essential Services Commission.

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THE PORT OF MELBOURNE HANDLES

37%

OF AUSTRALIA'S CONTAINER TRADE

THE SUPPLY CHAIN INDUSTRY CONTRIBUTES AROUND 14.5% TO AUSTRALIA'S GDP, EMPLOYS MORE THAN 1.2 MILLION PEOPLE AND CONTRIBUTES \$90 BILLION TO THE AUSTRALIAN ECONOMY EACH YEAR

**42 CONTAINER SHIPPING
LINES AND CARGO
CARRIERS MAKE 3,200
SHIP CALLS A YEAR
TO MELBOURNE**



Pictured left: Dr Hermione Parsons and Peter van Duyn



SPROUTING HEALTHIER GRAINS

Research on common breakfast cereal grains has uncovered new possibilities for preventing cancer and diabetes.

Dr Osaana Donkor from the Advanced Food Systems Research Unit initially identified the health benefits of bread and cereal grains and then went on to uncover how those benefits increased greatly after germination.

“Currently we use non-germinated seeds in our cereals but this research suggests using germinated seeds could have major public health benefits in preventing common chronic diseases such as cancer and diabetes,” Dr Donkor said.

In the Sanitarium-funded trial Dr Donkor and his team analysed the bioactive compounds and antioxidants in barley, brown rice, buckwheat, oats, rye, sorghum and wheat.

The research identified high levels of antioxidants, which act by mopping-up the reactive oxygen that can cause genetic deformation and cancer in cells.

Dr Donkor also identified arabinoxylan carbohydrates, which have been reported to improve metabolic control in people with type 2 diabetes.

“Arabinoxylan is also associated with the formation of short-chain fatty acids, the reduction of serum cholesterols and improved adsorption of calcium and magnesium,” he said.

While the presence of these compounds was expected, the breakthrough came when comparing their levels in grains before and after germination. The research team, including Associate Professor Todor Vasiljevic and Professor Lily Stojanovska, found all these compounds with major health benefits were present in much greater amounts after the seed germinated.

“We saw how inbuilt indigenous enzymes start releasing these compounds in germination, essentially unlocking the energy built within these food materials,” Dr Donkor said.

“This means through germination we can increase the nutritional components of these grains and in turn improve the nutritional value of breakfast cereals by making them germinate before being dried for use,” he said. “This could have a major public health impact in helping prevent cancer and diabetes.”

Sanitarium’s strategic research manager Dr John Ashton said the research collaboration had proven fruitful.

“The Victoria University team was able to carry out the studies efficiently, complete the project on time and obtain successful results,” he said. “The pilot data will be used by Sanitarium to plan further research which will hopefully lead to novel sprouted grain products being developed.”

Dr Donkor completed his medical, forensics and analytical chemistry undergraduate studies with Victoria University back in 2003, then achieved a major breakthrough with his PhD identifying how particular peptides in yoghurt are able to reduce hypertension.

Now as a researcher in the Advanced Food Systems Research Unit – which won a 2012 Vice-Chancellor’s award for excellence in research and research training – he is part of a cutting edge team working closely with the Institute for Sustainability and Innovation.

Advanced Food Systems research tackles the challenges of sustainability and healthy diet for a growing population through scientific and technological advancements.

The Research Unit’s expertise include food processing, nutraceuticals, dairy science and microbial and enzyme technology.

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OXIDATION IN THE HUMAN BODY PRODUCES CHEMICALS CALLED FREE RADICALS, WHICH HAVE BEEN LINKED TO SEVERAL DISEASES INCLUDING CANCER. OXIDATION CAN BE ACCELERATED BY STRESS, CIGARETTE SMOKING, ALCOHOL, SUNLIGHT, POLLUTION AND OTHER FACTORS

ANTIOXIDANTS ARE COMPOUNDS IN FOODS THAT NEUTRALISE FREE RADICALS. PLANT-BASED FOODS, INCLUDING CEREALS, CONTAIN SIGNIFICANTLY MORE ANTIOXIDANTS THAN NON-PLANT FOODS

“CURRENTLY WE USE NON-GERMINATED SEEDS IN OUR CEREALS BUT THIS RESEARCH SUGGESTS USING GERMINATED SEEDS COULD HAVE MAJOR PUBLIC HEALTH BENEFITS IN PREVENTING COMMON CHRONIC DISEASES SUCH AS CANCER AND DIABETES.”



Pictured left: Dr Osaana Donkor



TESTING OIL RIGS

Researchers are testing the engineering limits for oil rigs to withstand tsunamis and blazing infernos.

Centre for Environmental Safety and Risk Engineering researcher Dr Maurice Guerrieri said the \$400,000 project with oil services company Aker Solutions involved testing precisely how much heat and wave pressure offshore oil platforms could withstand.

“Due to the recent number of devastating earthquakes followed by tsunamis in the Indian and Pacific Oceans, there is urgency in researching the performance of offshore oil rig structures from a multi-physics perspective, specifically the combined effects of fluid, fire and structural interactions,” Dr Guerrieri said.

For the study a 40-tonne section of rig was flown from Singapore to the Centre’s purpose built fire-testing facilities in Werribee.

Once the parts were assembled, Dr Guerrieri tested the performance of a 47cm-wide steel drivelock connector – one joint within the large structure – in five stages, simulating the forces endured by offshore rigs under various fire and tsunami conditions.

Dr Guerrieri said the rig’s drivelock assembly was tested because it was the part that would undergo combined pressure, bending and fire forces when used in offshore oil rigs.

The drivelock assembly was housed in a specially constructed furnace and blasted at 1,100 degrees celcius. The part was then put under pressure from 15,000 psi to 20,000 psi – covering and exceeding the range of pressures in the world’s deepest oceans more than 10km below the surface.

In another test massive amounts of force were applied in different directions to simulate wave activity.

“It was a huge engineering test requiring all aspects of engineering from structural, mechanical to heat and transfer engineering all working together,” Dr Guerrieri said. “We really pushed the fluid pressure, bending force and fire exposure to absolute limits but through the beauty of the engineering design it held.”

The results were measured against the American Petroleum Institute standards for fire testing rig parts, with the tests witnessed and endorsed by Lloyds Engineers.

Dr Guerrieri said firms like Aker Solutions contacted the Centre for Environmental Safety and Risk Engineering based on its global reputation for state-of-the-art fire engineering testing and relevant research expertise.

The Centre’s research facilities include a fire test room to study fire behaviour and smoke movement in enclosed spaces, two furnaces to test structural components in fire and calorimeters, which measure ignition time, mass loss, combustion products, heat release rate and other data from burning materials.

Since the Aker Solutions project, the Centre also possesses the world’s only registered test rig in accordance with API standards for fire testing of certain parts.

The Centre for Environmental Safety and Risk Engineering carries out research on the spread of smoke and fire in buildings, fire extinguishment and the way structures respond to fire.

The Centre’s research staff have experience in areas of structural behavior and design, heat transfer, mechanical systems, human behaviour in fire, risk assessment, management and detection systems and environmentally sustainable building design.

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40T=

**WEIGHT OF TEST RIG FLOWN
IN FROM SINGAPORE**

1,100°C

**TEMPERATURE OF FIRE APPLIED
TO TEST RIG**

20,000 PSI

PRESSURE APPLIED TO TEST RIG



Pictured left: Dr Maurice Guerrieri



OPENING DOORS TO OPPORTUNITY

Education specialists are charting the path to better quality teaching and more engaged learning at schools and universities.

The Victoria Institute for Education, Diversity and Lifelong Learning team is leading implementation of a US-based university-readiness program at nearly 20 schools and universities across Australia and New Zealand. While leading the \$1.4 million federally-funded project, researchers will also evaluate the program's viability in the local context.

The Advancement Via Individual Determination (AVID) program includes training and support for teachers on engaging and collaborative strategies to teach reading, writing, inquiry, collaboration and organisational skills. It targets primary, secondary and tertiary teachers.

The Institute's Associate Professor Katie Hughes said AVID also aims to build support around underachieving students, especially those with no university aspirations, to successfully enter and persist in tertiary education.

"Your past, ethnicity or parent's experience with education shouldn't matter when it comes to your future but research shows they do," Associate Professor Hughes said. "International experience sees those barriers to access and success overcome, empowering students with a choice to go to university, rather than having that choice made for them based on their postcode."

Lead researcher Claire Brown said one key to the program was in challenging barriers to education as early as possible.

"You can't just wait until year 11 or 12 to help these students get to university: You need to go right back to the early years and teach them skills to engage with education success, then continue that support right through," she said.

An inquiry-based methodology is used to engage students in deep thinking,

develop curiosity for learning and persistence in completing tasks. Students are taught to become independent learners and build lifelong learning skills that are transferrable to university and the workplace.

The Victoria Institute identified AVID as the most effective university-readiness system in a global scan. AVID began 32 years ago in the United States with one teacher attempting to narrow the achievement gap between students from university-going backgrounds and those from underprivileged backgrounds.

It has since grown to include over 500,000 students in 5,000 schools in the US and around the world.

Adjunct Professor Jim Donohue is working with the Victoria Institute after 14 years researching AVID in the US and Canada.

He said that with support from AVID, many students who weren't expected to enter tertiary education had ended up at the most selective US universities. US Data from 2011 on 27,783 AVID graduates showed 89% applied for university and 74% were accepted.

"Previous research also shows schools implementing AVID strategies experience whole-school reform as students and teachers raise their learning aspirations and strive for excellence," he said.

The research team spent much of 2012 preparing to launch the program in 2013. This has included training schools in data collection and research methods, empowering them to drive their own institutional change. Researchers expect the number of schools and universities involved to grow rapidly.

The Victoria University team is partnering with schools and universities across Australia funded by the Department of Education, Employment and Workplace Relations.

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US DATA FROM 2011 ON

27,783

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Pictured left: Adam Usher, Associate Professor Katie Hughes, Claire Brown, Professor Roger Snee, David Lee, Associate Professor Bill Eckersley

PROJECT PARTNERS

Victoria University values its research partnerships with business, government and not-for-profit organisations. Here are just some of those we've worked with.

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