

# UNSW

ISSUE 2 2017

magazine



## Beat the blues

Immerse yourself in  
art and tech at  
the Big Anxiety Festival

### Age of the plyscraper

Stronger wood reinvents  
the high-rise

### Knack of the hack

The lab behind Australia's  
hottest cyber hackers

### Too hot in the city

Cooling down our  
urban heat islands

# UNSW congratulates Sarah Contos

The Art & Design graduate has won the Ramsay Art Prize for young contemporary artists with her quilt *Sarah Contos Presents: The Long Kiss Goodbye*.



Photo: Saul Steed

“Contos’ 21st-century quilt spills over and, like a new epic history tableaux, celebrates power women in all their glory” – Ramsay Art Prize judge Leigh Robb

## From the Vice-Chancellor



Welcome to Winter 2017 edition of UNSW Magazine.

As a doctor, one of the most satisfying things I have witnessed over recent decades is how mental health has been brought out of the shadows. The awful stigma attached to mental illness has increasingly been replaced by an openness and honesty, coupled with the realisation that many of us will have bouts of severe anxiety and depression.

In this edition we highlight the liberating transformation of social attitudes – and its celebration later this year in The Big Anxiety Festival of Interactive Arts and Mental Health, a seven-week event that will bring together artists, scientists and technological innovators in a collaboration between UNSW Art & Design and the Black Dog Institute for Mental Health. The festival will explore new methods of communicating the experiences of mental illness and recovery.

There’s also a profile of Scientia Professor Helen Christensen, the head of the Black Dog Institute and a champion of using new technologies to treat mental illness. Helen and her team have pioneered innovative ways of engaging with sufferers and developing self-help programs using mobile platforms. This is what makes UNSW so special!

Technology is taking us in many wonderful and surprising directions. Who ever thought we might one day build skyscrapers out of wood? You can read about timber towers constructed of specially manufactured wood stronger than concrete, opening up new vistas for sustainable living in our cities. And still on the urban theme, Mat Santamouris is applying technology to map out heat islands in our existing concrete ‘jungles’ and finding new ways to cool them down.

All in all, another engaging edition. I highly recommend it.

**Professor Ian Jacobs**

# In this issue



Photo: Quentin Jones

10

- 22/ Too hot in the city**  
The researchers working to cool down our urban heat islands
- 24/ School of rock**  
The surprise discovery pushing back the origins of life

04

## Upfront

- 04/ FYI**  
University news and research
- 07/ Distant voices, secret lives**  
Su Goldfish’s 40-year search for her lost family

- 08/ Leadership appointments**  
Meet the new Pro-Vice-Chancellors in Research, Indigenous and International



- 26/ Books**  
Greg Austin – What I’m reading, plus reviews

## Features

**10/ The age of plyscrapers**  
Wood as strong as steel has changed the high-rise horizon

**13/ Meetings with remarkable dingoes**  
How our native dogs are reshaping the landscape

**14/ The Big Anxiety Festival**  
Sydney-wide event to showcase new methods of fighting mental illness

**16/ A trend we must reverse**  
Helen Christensen on how digital devices can lower suicide rates

**19/ The man behind the mask**  
Uncovering the mystery beneath Nolan’s Ned Kelly face

**20/ The knack of the hack**  
The brains behind Australia’s most successful student cyber hackers



**Cover image:** Nick Cubbin

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Greta Bradman and Australian Mental Health Prize Advisory Group chairwoman Ita Buttrose launch the 2017 prize

Photo: Gabrielle Duntley

Award-winning Australian soprano and mental health advocate, Greta Bradman, has launched the 2017 Australian Mental Health Prize, seeking nominations to recognise Australians who have made outstanding contributions to either the promotion of mental health or the prevention and treatment of mental illness.

“I am delighted to join the Australian Mental Health Prize Advisory Group,” said Mrs Bradman. “I’ve experienced first-hand how debilitating mental illness can be and I understand that although it can take time to find a treatment plan to suit an individual, effective treatment is out there.

“I have witnessed the impact of mental health issues on people within the performing arts too, an area that until recently has received little to no attention from researchers.”

### SPOTLIGHT ON PERFORMERS’ MENTAL WELLBEING

Scientia Professor Philip Mitchell, Head of the UNSW School of Psychiatry, said the University established the prize to raise awareness on what is working in the field of mental health for the sake of those living with the burden of mental illness.

Chairwoman of the Australian Mental Health Prize Advisory Group, Ita Buttrose, hopes the prize will help reduce the stigma around mental illness as well as help improve mental health care in Australia.

“The number of people with mental illness accessing treatment is half that of people with physical disorders, mainly due to stigma and lack of awareness of treatment options. We urgently need to turn this around.”

Nominations are open until 31 August. Visit [australianmentalhealthprize.org.au](http://australianmentalhealthprize.org.au).

### UNSW 1st in NSW, 45th in world

Academic excellence and an enviable international outlook have helped UNSW climb four places to 45 in the QS World University

Rankings for 2017-18.

The result puts UNSW as the highest-ranked university in Sydney and in NSW, and third in Australia, behind the Australian National University (20) and the University of Melbourne (41). Since 2014, UNSW has moved up seven

places in the rankings. It scored a maximum 100/100 on the QS International Faculty Index, based on its proportion of international faculty members. Typically, universities located in places with large expatriate populations, like UAE, Hong Kong and Switzerland,

score highly on this measure, so UNSW’s perfect score highlights its attractiveness to overseas staff.

QS also gave UNSW high marks for its proportion of international students (97.8/100) and academic reputation (96.4/100).

### BRIEFS

#### \$20 MILLION IN RESEARCH GRANTS

UNSW has won more than \$20 million in the latest round of grants from the Australian Research Council (ARC), including two prestigious Australian Laureate Fellowships, 13 Future Fellowships and funding under the ARC’s Industrial Transformation Research Program. Professor Jill Bennett and Professor Fedor Sukochev were among the 17 Laureate Fellows. Bennett’s project involves research on immersive visualisation that allows users to see through the eyes of others. Sukochev’s work is in mathematical methods with physical world applications.

#### NEW DISABILITY INNOVATION INSTITUTE

Disability researchers at UNSW are putting the finishing touches on a groundbreaking initiative to help transform the lives of people with disability by harnessing research and innovation across all faculties and disciplines. The Disability Innovation Institute, to be launched this year, will be a platform to combine disability studies with research in STEM (Science, Technology, Engineering and Medicine) and HASS (Humanities and Social Sciences).

#### FRANCE-AUSTRALIA TRANSPORT RESEARCH

UNSW and French researchers will work with transport operators to optimise new ‘on-demand’ solutions to improve public transport congestion, economy and safety. The research alliance, which aims to develop the transport solutions in Newcastle, involves UNSW, public transport giant Keolis, Keolis Downer and France’s transport research institute IFSTTAR. They hope to expand the applications internationally.

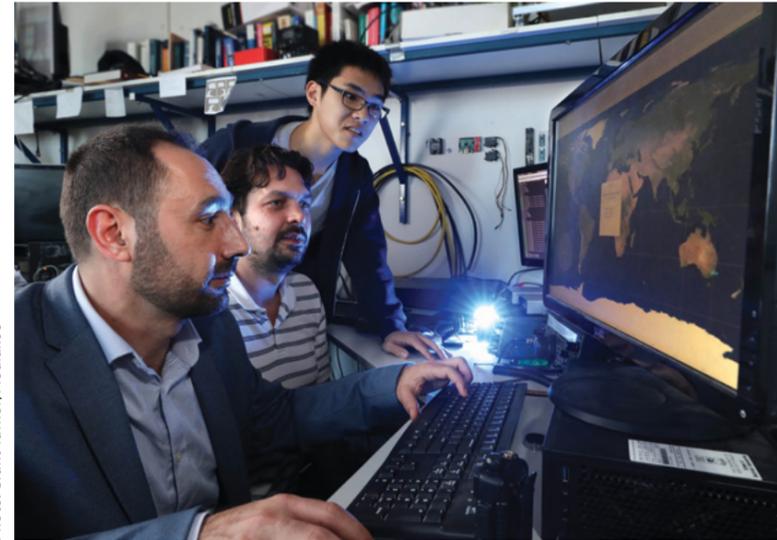


Photo: Grant Turner/Mediakoo

## Thrilling rescue of ‘lost’ Aussie satellites

Two Australian satellites, feared lost after being deployed from the International Space Station (ISS), have been recovered by a team led by UNSW engineers after weeks of a fraught – and at times heart-stopping – recovery operation.

“It was like something out of *Apollo 13*,” said Elias Aboutanios (pictured above left), project leader for UNSW-ECO, the first Australian-built satellite in 15 years to go into space. “Our satellite was orbiting at 27,000 kmh almost 400km above our heads. We couldn’t see it, couldn’t inspect it, and had almost no data to work with.”

Three Australian research satellites – two built at UNSW – blasted off on 19 April from Cape Canaveral as part of the international QB50 mission, a swarm of 36 small satellites (known as ‘cubesats’) designed to explore the little-understood region above Earth known as the thermosphere.

Within 30 minutes of deployment from the ISS, both UNSW-ECO and INSPIRE-2 were meant to transmit a beacon. But no signal was detected from either by the ground teams at UNSW’s Australian Centre for Space Engineering Research (ACSER) or the Australian National University when the cubesats flew over Sydney, which they do twice a day.

Through a complex series of collaborations, including colleagues at the ANU and the University of Sydney, a Dutch sound technician and the International Space University in France, the team eventually solved the puzzle late in June.

“For more than three weeks, we were looking in the wrong part of the sky for our satellite – we couldn’t have known that,” said Aboutanios. “But the procedures we put in place, the scenarios we ran and the solutions we developed, they all paid off.”

– Wilson da Silva

### Need to Know

#### NUW UNIVERSITY ALLIANCE

A new alliance of three of Australia’s leading universities will focus on finding solutions to the challenges facing communities in NSW. The NUW Alliance will see the University of Newcastle, UNSW Sydney and the University of Wollongong exploring and delivering ways to add value in health, education, technology and business development. The alliance will be the first grouping of its kind in Australia.

#### INNOVATION LEADER APPOINTED



Dr Elizabeth Eastland (above) has been appointed to the position of Director Entrepreneurship. Over the last seven years, Dr Eastland has founded and led the University of Wollongong’s globally recognised innovation accelerator, iAccelerate. She has also been responsible for CSIRO’s innovation strategy and delivering Australia’s first national deep-tech accelerator.

#### QUAD BIKE STUDY HIGHLIGHTS RISKS

A groundbreaking UNSW study of quad bike safety on farms and other workplaces has found that one in two riders has crashed and about two-thirds of the crashes involved rollovers. Riders aged 70 years or older had double the risk of injury compared with young adult riders, and mustering livestock on farms was identified as a particularly high-risk activity.



#### MURRAY-DARLING WETLANDS STUDY

A 30-year-long UNSW study of wetlands in eastern Australia has found that construction of dams and diversion of water from the Murray-Darling Basin have led to a more than 70% decline in waterbird numbers. The finding of severe degradation due to reduced water flow has significant implications for managing the development of other rivers in Australia and around the world. The study is published in the journal *Global Change Biology*.

#### FORMER PRINCIPAL APPOINTED HONORARY PROFESSOR

Former headmaster of Sydney Grammar School Dr John Vallance (below) will join UNSW as Honorary Professor for the Public Understanding of the Humanities. Dr Vallance will contribute to the celebration of the importance of the humanities as part of a rounded scientific, professional and technical education. He will also encourage collaboration between the tertiary and secondary education sectors to drive educational outcomes.



## Emotion-sensing clothing wins Young Design Award



Men's clothing that lights up according to the wearer's mood, a device that calms autistic toddlers and a virtual exercise coach, all created by UNSW graduates, have dominated the 2017 Young Designer of the Year Awards.

Lilian Hambling, a UNSW Art & Design graduate, won the coveted Young Designer of the Year Award for E-motion, a clothing range

that allows men to communicate non-verbally. Sensors in the garments respond to the wearer's pulse, muscle tension and proximity, converting the physical information into coloured light animations that emulate different emotions like a pounding heart, rush of adrenaline and the feeling of 'butterflies'.

Hambling explains that by enabling "men to be more openly

expressive, the stereotypical expectations of masculinity can change; instead of hiding them away, feelings – such as love, anger, fear and sadness – can be displayed as interactive gestures".

Industrial Design graduate Era Camilet won the Design Innovation Award for HUG, a self-regulation and early warning system that lets parents of autistic children know when their child is about to have an aggressive outburst.

"HUG helps minimise injury and provides parents with a convenient, calming and socially acceptable way of tracking and managing their child's behaviours," says Camilet.

Jessi Wilkinson, also an Industrial Design graduate, won the Design Technology Award for Stride: Running Coach, a wearable virtual trainer for beginner to intermediate runners. Stride uses sensor technologies including heart-rate monitoring earbuds, a wearable sensor pod, and muscle-tech running tights to provide real-time audio feedback on running style.

– Fran Strachan

### Bright young science communicators

Two of Australia's freshest new voices in science communication have been unearthed at UNSW, and are already brightening up the conversations in their areas of health research.

Ursula Sansom-Daly and Denton Callander were selected from more than 100 talented entrants as winners of UNSW-ABC Radio National's Top 5 Under 40 initiative. The quest aims to discover early-career researchers with a flair for communication, and to develop those instincts with a two-week media residency at the ABC, held in July.

Sansom-Daly, a psycho-oncologist with the School of Women and Children's Health, is using her new skills to diversify the view of how young people experience cancer and cancer survivorship.

"For young people who survive cancer it's a paradox. They want their friends and loved ones to recognise the enormity of what they've been through but they often don't want to be treated any different. That's a fine line for family and loved ones to tread."

Callander, a researcher at The Kirby Institute, hopes to see his area of sexual health and sexuality



discussed in the media in a way that's more honest and fun.

– Gabrielle Dunlevy

Look out for Ursula Sansom-Daly and Denton Callander in the ABC's coverage of Science Week, 12-20 August.

### BRIEFS

#### VC STRESSES NEED TO HELP REFUGEES

Universities must play their part in tackling the plight of refugees, "the greatest moral issue of our time", UNSW President and Vice-Chancellor Professor Ian Jacobs told a World Refugee Day event. Professor Jacobs told the audience that the world had become preoccupied with keeping people out and creating barriers. Fortunately, there were leaders such as German Chancellor Angela Merkel who felt the moral obligation to act, he said. "We must follow that example and find solutions, and universities ... must play their part."

#### FOOTBALL UNITED BOOST FOR MYANMAR

UNSW Football United and the Myanmar Red Cross Society have agreed to expand Football United activities to every university community in Myanmar that wishes to engage. The Football United sport for social change program will contribute to building the capacity of the emerging nation to promote social inclusion. Myanmar Red Cross will introduce this initiative to its more than 100 university Red Cross branches.

#### ULTRATHIN MATERIAL FOR SPLITTING WATER

UNSW chemists have invented a new, cheap catalyst for splitting water with an electrical current to produce clean hydrogen fuel. The technology is based on the creation of ultrathin slices of porous metal – organic complex materials coated onto a foam electrode, which the researchers have unexpectedly shown is highly conductive of electricity and active for splitting water. The research by Associate Professor Chuan Zhao, Dr Sheng Chen and Dr Jingjing Duan, is published in *Nature Communications*.

Photo: Grant Turner/Mediakoo



## Distant voices, secret lives

Su Goldfish's 40-year search for her lost family has been captured in a powerful new documentary, writes Clare Morgan.

Su Goldfish enjoyed an idyllic childhood growing up in Trinidad but could never shake her curiosity about how her European parents Manfred and Phyllis had ended up on this tropical island.

Her German father offered no answers, telling her: "I drew a line when you were born, and made a decision to never look back." But Su was determined to uncover the truth. She has documented her 40-year journey into her father's secret past in her film *The Last Goldfish*, which enjoyed a sold-out premiere at the Sydney Film Festival and was nominated for the Documentary Australia Foundation Award for Australian Documentary.

It tells the story of how Goldfish, manager of the Creative Practice Lab in the School of the Arts & Media, discovered the truth about her father's past: he was Jewish and had been married to another woman with whom he had two other children. In November

1938, on Kristallnacht, he was arrested and detained in a labour camp.

His wife Marthe begged the SS to free him, promising they would leave the country immediately. Miraculously, the Nazis agreed and the family set sail for the West Indies – the only place that would take them without a visa. But the marriage dissolved; Manfred then married Phyllis and along came Su, their only child. Marthe also remarried and took their children to another country.

"I was so excited, after I got over the teenage fury of being excluded from this knowledge," she says. "But he then lied about knowing where my half-siblings were and was very anxious about me contacting them."

Part of her film is an exploration of that anxiety, and the guilt that often comes with surviving trauma. "I think my father's guilt because he survived meant he couldn't talk about what happened to him," Goldfish says.

It is also a reminder of how the inter-generational impact of loss and displacement endured by refugees and their families is being echoed in the world's current wave of refugees.

Goldfish's happy life in Trinidad was interrupted by the Black Power Movement of 1970 and an attempted military coup, which prompted Manfred to move the family to Sydney when she was 14.

In her new home, a friend of Goldfish suggested her surname sounded Jewish. When she asked her father, "Are we Jewish?", it was as if she had pulled a stray thread that caused the whole garment to slowly unravel.

Yes, he had been Jewish but he wasn't anymore. Persistent probing loosened more threads. He had lost almost all his family in the concentration camps. He drew a family tree but insisted no one was left, telling his



Su and Manfred

daughter: "You are the last Goldfish."

"Whenever I came close to getting anywhere, he would shut down the conversation," Goldfish says. The idea to make the film coalesced after Goldfish interviewed her father for a film assignment in 1996.

Goldfish eventually tracked down her half-siblings and travelled to Canada to meet them. "I still felt there must be Goldfish family out there ..." A breakthrough came when she was contacted by a researcher in Germany who was working on a book about Jews from the town of Ulm. This led her to the town of Bad Ems, where Manfred had been born and where his parents had run a kosher hotel.

Goldfish travelled to Germany to find out what happened. "It turns into an amazing adventure. Some of it's very sad but basically it's a fantastic story."

*The Last Goldfish* will be released in October.

# PVC appointments break new ground

The University has appointed three new Pro-Vice-Chancellors to address strategic areas: Professor Ana Deletic (Research), Professor Megan Davis (Indigenous) and Laurie Pearcey (International). Deletic will help lead UNSW's strategy to become a world-class research environment; Davis is UNSW's first in the Indigenous portfolio; and Pearcey will implement the University's global impact strategy.

## Professor Ana Deletic reflects on her new job, women in engineering, and how nationalism stunts research.

### Where and when were you born?

Belgrade, Yugoslavia (at the time), 1965.

### How has this shaped you?

As I come from the Balkans, I think I can understand how it is necessary to balance different interests. And when it comes to solving complex problems, I think I've got some understanding of how difficult things can be. My family has a bit of an interesting background. My great-uncle is one of the guys who started the First World War – one of the gang behind the assassination of Archduke Franz Ferdinand. The political situation of Yugoslavia was complex and complicated, and if you understand that, a lot of other things seem rather simple.

### What do you hope to achieve in your new position?

I want the University of New South Wales to become one of the best in Australia and placed within the top 50 in the world. It's a very good university as it is, but not number one, so we're hoping to lift it up – at least to be in the top three.

### You are the only woman to have won the Victoria Prize, and at a time when you were the only female professor in civil engineering in Australia's Group of

### Eight research-intensive universities. Does that make you a trailblazer for female engineers in the country?

I'm not the only female professor [in civil engineering] anymore; it's good news that there are a few now. However, it is a shame that I'm still the only female winner of the Victoria Prize. I come from a different part of the world, where being a woman in engineering is not as rare – my mother-in-law was one. In general, I have never had a problem with being female among males. Both Monash and UNSW have a very good strategy in trying to include women in STEM, particularly engineering. We're trying our best.

### How much of a problem is gender inequality in higher education?

I think Australia is slightly behind places such as the UK on this issue, and definitely behind the US. I think it's a bit harder here; it's a broader cultural issue. In the past five years, there have been lots of initiatives and awareness in this area; but when I arrived here, it was much worse. So I've seen big progress.

In engineering – which is the worst [field for gender inequality] – it's to do with the culture, which goes beyond universities. If you have a culture in which engineering is seen as a solely male discipline, it's very hard to fix the problem at this stage. It needs to be addressed at the level of primary and early secondary education – engineering should be promoted among girls in schools.

### Do you think that Brexit will spur UK-based academics to consider following your lead and relocating?

We're already seeing signs of that. It's not good for academia to have any sort of restrictions on movement. In academia, it doesn't matter where you were born.

### What impact might Brexit have on academic collaboration?

As soon as nationalism rises to prominence, it hurts research and development. I left my country because of that. Yugoslavia had the pinnacle of that craziness; we had a war, which hopefully you won't get. But when that stuff starts to rule a country, academia as well as R&D suffers big time. History [shows] that as soon as you start closing borders and playing this nationalistic tune, advancement of technology, science and the arts suffers. It's been like this always: the most closed country is the worst for innovation and development.

### What is the best thing about being an academic?

The freedom to do what you want. You officially have a boss; but at the end of the day, no one can really tell you what to do. You have to deliver lectures; but that's a small part of what you do. When it comes to research, you create your own research agenda. Someone's paying you to play – you go and play in your lab, and you get paid for that. It's the most fun job on earth.

This is an extract from an interview originally published in *The Times Higher Education Supplement*.



Professor Ana Deletic

## HIGH HOPES FOR BIG CHALLENGES

Professor Megan Davis started her role as the inaugural Pro-Vice-Chancellor (Indigenous) in June, after fulfilling her obligations in leading the Referendum Council Aboriginal Constitutional Dialogue.

Professor Davis said she was honoured to take on this new role. "I've worked at UNSW since 2001, when I was Professor George Williams' first employee at the Gilbert + Tobin Centre of Public Law. It's an honour to now be the first PVC Indigenous".

"I'm excited about showcasing and developing UNSW research excellence across many important areas of Indigenous policy that impact communities on the ground and, in particular, nurturing Aboriginal and Torres Strait Islander scholars."

Professor Davis, a Cobble Cobble Aboriginal woman from the Barrungam nation in south-west Queensland, is one of Australia's most highly regarded lawyers specialising in public law and public international law. Her research work is targeted at law reform in constitutional law and violence against Aboriginal women.

Professor Davis has also served as a member of the Prime Minister's Expert Panel on the Recognition of Aboriginal and Torres Strait Islander Peoples in the Constitution.



Laurie Pearcey



Professor Megan Davis

Laurie Pearcey, the Executive Director of UNSW's International Office, has been appointed Pro-Vice-Chancellor (International). At 33, he is one of the youngest PVCs to be appointed at the University.

A graduate from UNSW's International Studies program, Pearcey joined the Australia China Business Council in 2007, becoming its Chief Executive Officer two years later. He returned to UNSW in 2012 to take up the role of director of the University's Confucius Institute.

Mr Pearcey's leadership soon expanded into a strategic role, which saw him develop UNSW's first pan-University plan for China and later India.

His responsibilities as PVC will include implementing UNSW's global impact strategy and supporting global partnerships, as well as strengthening the University's international profile.

A wooden skyscraper? It sounds like something from Middle Earth. Wood is what you use to build log cabins, tree-houses, saunas. But high-rise? It's happening all over the world, including Australia, where International House Sydney at Barangaroo has set the example for others to follow. Aided by breakthroughs in the manufacture of materials, and a push for sustainable urban living, wooden towers have emerged at the cutting edge of community-friendly architecture.

"Australian builders have been fairly slow in the uptake but as soon as there are precedents, more and more people will be on board," says Dr Philip Oldfield, a senior lecturer in the Faculty of the Built Environment at UNSW.

"We are right at the tipping point of a revolution in high-density living." The UK architect, who moved to Australia 18 months ago with his young family, became fascinated with skyscrapers as a boy growing up in Nottingham. "I was always interested in tall buildings because they always left me cold. All I saw was monotony, banality, big, glass boxes. They always seemed to be more about economics than good design," he says.

As he studied architecture, and grew increasingly aware of the challenges of climate change and population growth, Oldfield became part of a group spearheading a movement aimed at designing tall buildings that are sustainable, green and welcoming to live in. This "high-performance architecture",

as he calls it, is a crucial aspect of UNSW's Masters of Architecture program.

One thing is certain, Oldfield says, the world's exponential population growth and a rise in urban living mean more and more of us will be living in high-rises as well as working in them. "So we might as well try to get it as right as we can."

Oldfield's upcoming book, *The Sustainable Tall Building*, highlights the possibilities. There's a timber-clad, family apartment in a Norway high-rise, a soaring, sun-splashed, vertical school in a New York skyscraper, and a seven-tower residential block in Singapore linked with green walkways, that includes a sky-high running track, a children's playground and lush hanging gardens.

The use of timber has been embraced to

Philip Oldfield with models of towers.



The development of wood as strong as steel has spawned a new breed of timber towers to revolutionise the way we live in cities. *Ali Gripper* reports.

# TIMBER TOWERS

Photo: Quentin Jones

build commercial buildings, which have a much lower level of "embodied carbon" than conventional buildings, making them far more environmentally friendly. This happens because trees absorb carbon dioxide from the air through photosynthesis, and so timber has the ability to store carbon and remove it from the atmosphere.

"My research is showing that materials typically equate to 33% of all the carbon emissions of a tall building. So if we build them out of timber, we can dramatically reduce their carbon footprint, creating sustainable powerhouses," Oldfield says.

The trend has been enabled through a breakthrough in the manufacture of extremely strong wood known as mass timber. This involves laminated timbers being glued together at right angles under extreme pressure to form giant pieces of wood. These can be as equally strong as conventional building materials such as steel.

The timber pieces are typically up to 40cm thick, but have been proposed to be made up to 2.5m thick, and 2.5m wide. Builders have increasingly begun considering using this heavy-duty engineered timber, prompting the moniker 'plyscrapers'.

The safety of high-rise buildings has always been an issue, highlighted by the tragic Grenfell apartments fire in London. Yet as counterintuitive as it sounds, this engineered wood can be

just as safe – if not safer – than steel, in a fire. "Steel starts to lose its strength at 550 degrees Celsius, after which it will just buckle and collapse. By contrast, engineered timber has been manufactured in a way so that the exterior chars, leaving the core of beams and columns intact, and people inside the building have time to get out."

The good news is Australia is leading the way when it comes to rethinking our skylines.

Oldfield shows images of the recently opened International House Sydney in Barangaroo South, Australia's tallest timber commercial building.

Designed by Alec Tzannes, former Dean of the UNSW Faculty of the Built Environment and one of Australia's most respected architects, and Jonathan Evans, the soaring, light-filled space with its colonnade of recycled iron bark timber, is a hymn of praise to wood. And it has impressive green credentials. By not using concrete, thousands of tonnes of greenhouse gases were avoided.

It's a "new form of beauty" according to Tzannes. "Normally, building sites are full of dust that gets in your eyes. But when you walk out into this building, it smells like a pine forest," he says. "It's like entering another world. When you look out to the more conventional buildings all around, it's all the more beautiful. It recreates the beauty of historic buildings in the past."



Exterior and interiors of International House Sydney at Barangaroo.



The mass timber panels, grown in sustainable forests in Austria, were prefabricated, craned on to the site, then slotted and screwed into place by a small construction team.

Having been recently tenanted by Lendlease, Tzannes regards the building as a commercial trailblazer. “It is proving to the commercial real estate market that mass timber construction is a viable alternative to conventional concrete construction.”

Buildings like International House Sydney, Forte Apartments in Melbourne, and the upcoming King Street project in Brisbane, which are also built out of timber, are a blueprint for what is possible.

“The place we work in can have a huge impact on our lives, as well as our wellbeing,” Oldfield says. Natural materials provide a warmth that concrete and steel struggle to achieve.

“These new high-rises are going to totally transform buildings that have traditionally been seen as gas guzzlers. Instead of air-conditioned boxes, we will be seeing much friendlier buildings that are more generous to the environment.”

And more generous to the community as well. “High-rise buildings should be more than just machines for living in. Ideally they should form part of the fabric of the city, and be able to make a difference socially and civically,” Oldfield adds.

A classic example is 1 Bligh Street in Sydney, a modern office overlooking Circular Quay. Its wide, north-facing steps provide a sunny public space where office workers can sit and enjoy lunch. Pedestrians can cut right through the 40-storey atrium, using it as a public thoroughfare.

“Part of the problem in Australia is that, up until now, we have designed tall buildings for the economy – simply as income generators – rather than thinking about communities or sustainability,” Oldfield says.

Yet the new tall towers are actually a lot more economically viable than their predecessors, as well as being good for the environment, he says.

“The Australian building industry is increasingly seeing the financial benefits of timber buildings. They are pre-fabricated in a factory, craned on to the site, and put together like a giant piece of IKEA furniture. The workforce needed is smaller, and the process is a lot safer.”

Already, several 20-storey buildings made out of timber are being built in Scandinavia and Canada. A timber tower up to 85 storeys high is also being planned for London.

“It’s a matter of helping people to think differently. We need to think about the big picture.”

*The Sustainable Tall Building: A Design Primer*, by Philip Oldfield, will be published in 2018 by Routledge.

## Dingoes reshape the landscape

Photo: Barry Eggleton

A comparison of conditions in the outback on either side of Australia’s dingo fence has revealed that extermination of predators affects not only the abundance of other animals and plants, but also reduces the quality of the soil.

The UNSW study indicates greater control of kangaroo numbers is needed across a third of the Australian continent where dingoes are rare, to reduce damage on ecosystems.

“We have shown the presence of dingoes is linked to healthier soils, because they suppress the numbers of kangaroos that graze on the vegetation,” says senior author of the study, UNSW Associate Professor Mike Letnic.

The research by Letnic and his honours research student Timothy Morris has been published in the journal *Proceedings of the Royal Society B*.

The dingo fence, erected to keep dingoes out of eastern Australia, extends approximately 5,600km across South Australia, New South Wales and Queensland.

Dingoes are common on the western side of the fence, but rare on the other side, due to intensive control measures including poisoning, trapping and shooting. This latter area includes most of New South Wales and Victoria, and southern Queensland and southern South Australia.

The researchers studied four sites – a national

park site and a pastoral site on each side of the fence in the Strzelecki Desert. They drove along outback dirt tracks at night for four years to count dingoes and kangaroos. They also collected dingo scats to determine what they ate, and measured levels of phosphorus, nitrogen and carbon in the soil.

Kangaroo numbers were high at the two study sites on the “inside” of the fence where dingoes were rare, with just one dingo and 3,245 kangaroos spotted, compared with 85 dingoes and only eight kangaroos at the two study sites “outside” the fence.

The researchers also found that where dingoes were rare, large numbers of kangaroos overgrazed vegetation cover, leading to lower levels of phosphorus, nitrogen and carbon in the soil.

“Our novel finding goes against the conventional wisdom that apex predators like dingoes have little impact on soil,” says Letnic. “We show that allowing dingo populations to increase could enhance the productivity of ecosystems across vast areas of the country by reducing herbivore numbers.

“We need to rethink the idea that kangaroos have benign impacts on ecosystems. Kangaroo numbers are very high across the approximately one-third of the continent where dingoes are rare, and are having damaging impacts on soils and vegetation,” he says.

– Deborah Smith

## The world’s most interesting genome

A wild-born, pure Australian desert dingo called Sandy Maliki has taken out first place in the World’s Most Interesting Genome competition.

The UNSW-led proposal to have Sandy’s DNA decoded was one of five finalists for the Pacific Biosciences SMRT Grant, which provides cutting-edge sequencing of the complete genome of a fascinating plant or animal. The project won after receiving the most votes in an international online ballot.

“Sandy is truly a gift to science,” says project leader, Professor Bill Ballard of the UNSW School of Biotechnology and Biomolecular Sciences.

“Pure dingoes are intermediate between wild wolves and domestic dogs, with a range of non-domesticated traits. So sequencing Sandy’s genome will help pinpoint some of the genes for temperament and behaviour that underlie the transition from wild animals to perfect pets.”

Sandy and her sister and brother were discovered as three-week-old pups in the harsh Australian desert near the Strzelecki Track in 2014 by NSW animal lovers, Barry and Lyn Eggleton, who have hand-reared them since.

The dingo sequencing project will be the first to test Charles Darwin’s 1868 theory that domestication can be divided into two steps: unconscious selection due to non-intentional human influences; and artificial selection due to breeding by humans for desired traits.

“The project will reveal the DNA changes between wolves and dingoes (unconscious selection) and dingoes and dogs (artificial selection),” says Ballard.

– Deborah Smith

# A FRESH LENS ON ANXIETY

Professor Jill Bennett at the EPICentre.

Photo: Nick Cubbin

Australia's first high-tech festival to explore the experience of anxiety will fuse art, science and technology to shake up approaches to mental health, writes *Fran Strachan*.

Sometimes described as the 'modern plague', anxiety affects more than two million Australians each year. Now an innovative Sydney-wide festival is set to reframe conversations around the all-too-common condition.

A unique collaboration led by UNSW, the Black Dog Institute, and numerous partners in the cultural sector, The Big Anxiety: Festival of Arts + Science + People is an event of unprecedented scale in the field of mental health research, supported by a major grant from the federal government's Catalyst—Australian Arts and Culture Fund.

Spanning more than 60 events over seven weeks and numerous cultural hubs in greater Sydney, the festival will include state-of-the-art immersive environments, international art exhibitions, theatre and performance, interactive media events and public forums designed by some of the world's most progressive creative innovators.

Festival director, Professor Jill Bennett from UNSW Art & Design, says the event will showcase the combined strengths of art, science and technology and the ways they can make a difference to people's lives.

"Around 65% of Australians with mental health issues don't seek or access help. Our aim is to develop the rich communications and engagement strategies we need to connect with people experiencing mental health issues," she says.

Bennett was recently awarded a prestigious Australian Laureate Fellowship by the Australian Research Council to pioneer the use of immersive visualisation technology in the understanding of stigmatised conditions, particularly mental decline in the ageing population.

"We are opening up a new area of visualisation, using immersive media to

create the possibility of seeing through the eyes of another," she says.

Located at multiple venues across greater Sydney, including UNSW, Customs House, the MCA, the Art Gallery of NSW and Parramatta's Riverside Theatre, the festival will help visitors understand the lived experience of anxiety through state-of-the-art technology including UNSW Art & Design's Expanded Perception and Interaction Centre (EPICentre).

At EPICentre, festival visitors can experience the 3D, 360-degree multimedia project *A Woman's Place*, an exploration of the traumatic memories of former Parramatta Girls' Home residents. In the nearby National Facility for Human Robot Interaction, visitors can play a game that tests their stress responses in a responsive environment, created by UNSW's Creative Robotics Lab, the Black Dog Institute and Supermanoeuvre architects.

"The Big Anxiety Festival promises to connect with diverse audiences in ways that direct mental health messaging can't do," says festival supporter and NSW Mental Health Commissioner John Feneley.

The festival's mental health lead Professor Katherine Boydell, from the Black Dog Institute, agrees. She says art and technology

have the power to promote empathy and decrease stigma around mental health issues.

"Art provides a great entry point for communication about mental health – when people experience something and it is visual, conversations are generated and people find multiple ways of engaging with each other," Boydell says.

"The festival will visually capture the pervasiveness of anxiety and provide multiple places for people to connect and communicate about it."

The *NeurodiverseCity* exhibition at Customs House aims to start a conversation about urban design, by exhibiting the work of autistic artists such as UNSW PhD

graduate, Dawn-joy Leong, that improve the sensorial experience of our cities.

Travelling straight to the public is the festival's Mobile Mood Lab. The repurposed ambulance features interactive artworks by UNSW's Dr George Khut, whose compelling visualisations are created from wearable sensor technologies. Visitors to the Mood Lab will receive visual feedback on their stress and anxiety levels as their heart rate, skin temperature and brainwaves literally transform into works of art.

Far from focusing on the negative aspects of anxiety, Bennett explains the festival will celebrate stories of individual and community resilience.

The World's Largest Mental Health Lesson at Sydney Town Hall will teach high-school students about resilience and how to manage anxiety and depression. Led by Professor of Clinical Psychology and Rehabilitation at King's College London,

Dame Til Wykes, the event is a bid to break the Guinness World Record for the biggest lesson in mental health.

UNSW Vice-Chancellor Professor Ian Jacobs says the festival embraces social engagement – a critical element of the University's 2025 Strategy.

"We know that every year, around 4% of Australians will experience a major depressive episode and 14% will experience an anxiety disorder. I can think of no better use of UNSW technology research and innovation than developing new and imaginative ways to communicate the experiences of mental illness, recovery and resilience."

The Big Anxiety Festival sponsors include the Australian Government, City of Sydney, Bridging Hope Charity Foundation, Neilson Foundation and the Mental Health Commission of NSW.

The Big Anxiety Festival runs from 20 September to 11 November.

*"Art provides a great entry point for communication about mental health."*

Black Dog Institute chief Helen Christensen believes digital technology holds the key to lowering Australia's unacceptable suicide rate. Steve Meacham reports.

# A trend we must reverse

Helen Christensen took up skydiving while in her 20s – leaping out of aeroplanes above Sydney. She vividly recalls her first solo jump: “I remember how powerless and fearful I felt.”

As she jumped into the void that first time without the back-up of a static-line safety mechanism, Christensen realised no one was there to help her pull the rip cord. Without the back up, she would have to rely on her mental fortitude and composure if she was to reach the ground in one piece. “All of a sudden, I felt incredibly unsafe,” she says.

Today, as a UNSW Scientia Professor of mental health and director of the Black Dog Institute, Christensen is one of the country's

leading mental health experts. And today the rush of powerlessness and fear she felt on that first solo jump remains a visceral insight into how the 3,000 Australians who take their lives each year must feel.

“If we are ever going to reduce the disturbing levels of suicide in Australia, we need evidence-based interventions – we need to provide the mental health equivalent of that static line,” Christensen says.

Under Christensen's guidance, since 2012 the Black Dog Institute (‘black dog’ was the term former UK prime minister Winston Churchill used to describe his own depression) has earned a world-class reputation for its pioneering work on

‘e-health’, embracing digital and social media technology to help reach the one in five Australians who are, at any one time, experiencing anxiety, depression or other mental illnesses.

Using apps, Facebook, Twitter and the internet, Christensen and her teams are identifying people who are showing telltale signs of mental ill health, then offering appropriate self-help digital treatments that have been proven to work.

It's a community-wide, safety mechanism in action and it is attracting attention around the world. “I wish we had a Black Dog Institute in the US,” Dr Tom Insel, a former director of the US National Institutes of Health,

*“Australia is a winner in terms of sporting prowess and living standards, but when it comes to suicide rates we are big losers.”*

while growing up on Sydney's northern beaches, enmeshed in its surfing culture of parties and drugs.

She has often hinted at a personal reason for her interest in suicide prevention. “Like most of us, I know people – young and old – who have died by their own hand,” she says.

“Even this morning I got a message from a friend saying her husband had died by suicide.”

But the motivation is even more personal still. Christensen reveals something she rarely discusses: she, too, has suffered from mental health problems – and has herself contemplated ending her life.

“It was in 2011,” she says. “I was going through a very hard time. I got to the point where I genuinely believed everyone would be better off if I was dead. It's hard to explain, but I was convinced it was true.”

But, she says, the feeling was transient. “The next day, I remember thinking: ‘How could I have possibly thought that? And how could I have really believed it?’”

Christensen did not act on her suicidal thoughts. “I never got that far. But I certainly felt the hopelessness – that lack of belonging – that people who attempt suicide talk about. And I felt that sense of social isolation, unworthiness and burdensomeness.

“That was a very big learning experience for me. It convinced me that everybody is capable of contemplating suicide under extreme circumstances.”

Did she follow her own advice when she found herself in that position?

Christensen issues one of her frequent and cheerful laughs. “No. I felt I could deal with it myself. Ironic, isn't it? Here I was – the mental health expert and I couldn't even see what was happening to me.

“I don't think I even thought I was depressed. I was working. I was looking after my kids. I thought I was ‘functioning’ ... I felt ‘on duty.’” Fortunately, Christensen's friends weren't hoodwinked. “They were saying, ‘Don't you think it's time you sought help?’”

## INTERNET A GAME-CHANGER

Born in Hay in New South Wales to a banker father and a mother who was a teacher, Christensen and her six siblings moved

frequently around the state. After high school at Narrabeen Girls' High, she went to the University of Sydney, leaving with an honours degree in psychology.

Her first jobs after university were working in TAFE colleges as a counsellor (mainly working in youth depression) and the hospital system, before returning to university to complete her PhD.

In the 1980s, dementia was considered a normal process of ageing but Christensen was interested in why some people lost their memory while others retained it. This remained her primary research interest until the mid-1990s.

By then, Christensen was working at what is now the Centre for Mental Health Research at the Australian National University.

By happy coincidence, the centre was awarded the federal government contract to write the guidelines for diagnosing mental health issues in young people at the same time the internet was being introduced.

“Before the advent of antidepressants, one of the only treatments for depression was cognitive behaviour therapy or CBT,” Christensen says.

“What's great about CBT is that it doesn't require a trained psychologist or psychiatrist. There were already self-help books using CBT that had proven to be effective in clinical trials, but the problem was getting the techniques out to the people who needed them.

“Suddenly there was this perfect dissemination tool that could spread information widely and for no or little cost.”

While the internet allowed people easy access to CBT, the “game-changer”, Christensen says, was Apple's launch of its iPhone in 2007. The age of the smartphone had begun, and with it the proliferation of apps.

“Apps marked a major change in how we thought about reaching the people who most needed help,” says Christensen. “Smartphones and their apps meant anyone could carry their own personalised mental health therapies around with them in their pocket.”

The first standalone Black Dog Institute app, Snapshot, was launched in 2015. Among the suite of apps in progress since then,

Photo: Quentin Jones

## Centre of excellence to drive world-class mental health research

The Black Dog Institute and the Hunter Institute of Mental Health received \$5 million in the federal budget to establish a Centre of Research Excellence in the Prevention of Anxiety and Depression.

“The delivery of evidence-based interventions through schools, workplaces and primary health care has the potential to reduce incidence of these disorders by around 20%,” says UNSW Scientia Professor Helen Christensen, Black Dog Institute Director and Chief Scientist.

“This exciting new initiative will help us to develop new prevention strategies and programs, and facilitate the delivery of these strategies to Australians of all ages and backgrounds.”

The NSW-based centre, jointly led by The Black Dog and the Hunter Institute of Mental Health, will support innovative translational research to improve and accelerate the uptake and impact of programs across settings and across communities.

The Hunter Institute of Mental Health Director, Jaelea Skehan says the centre will consolidate and drive world-class activities in prevention.

“The centre includes a multi-agency team of experienced and internationally regarded researchers, educators, communicators and clinicians. This funding will enable us to combine our skills, leverage relationships and build effective and streamlined programs for addressing the risk factors associated with anxiety and depression.

“The centre will place focus on developing accessible and effective programs for those in particular need, including children and young people, targeted workforces and workplaces, families and carers and those living in regional and rural areas.

Funding is expected to commence in late 2017.

– Emily Cook

Black Dog Institute is developing iBobbly – a name derived from a traditional Aboriginal greeting in the Kimberley region of Western Australia. A pilot program of the app in 2013 targeted suicide prevention among Indigenous Australians in the Kimberley, recognising that suicide rates in Aboriginal and Torres Strait Islander communities are among the highest in the world – and that fewer Indigenous people seek help.

“Rates of suicide among Indigenous children are around three to four times higher than they are among non-Indigenous Australian children,” Christensen says. “That’s shameful.”

The Kimberley pilot proved successful and now further programs are being tested in various Indigenous communities around Australia, funded by the National Health and Medical Research Council.

The boom in digital engagement also allows research institutes like Black Dog to monitor social websites such as Facebook and Twitter to identify people experiencing mood changes through their altered social interactions. This is done through ‘machine learning’ – mathematical algorithms that decipher mental health signals that would seem meaningless to humans.

“This is an evolving area,” Christensen says. “There are a lot of technologies out there but the material they gather is not transparent; they have never been demonstrated in clinical groups. That’s our niche.”

These early positive results fly in the face of a common perception that the digital revolution has added to, not reduced, the incidence of mental health problems by introducing cyberbullying and a withdrawal from face-to-face contact. It’s a notion Christensen rejects.

“If you look at all the population surveys, you’ll find that young people are no more – and no less – anxious than they used to be.”

In fact, Christensen says, digital technology has delivered us e-health, offering not only new therapies for age-old problems but new ways to research mental health.

One online program involving Britain’s National Health Service in 2013 was aimed at people who were browsing the web looking for mental health help. When they typed

in key search terms, they were randomised to the opportunity to either receive or not receive a web-based mental health program.

“We had 17,000 British people sign up in the first three months,” she says. “We did a similar thing in Australian schools, in GP practices and in Lifeline centres. We were able to use digital technology to conduct research on a huge scale that would previously have been unthinkable.”

### TARGETING SUICIDE

Black Dog Institute chairman Peter Joseph has previously gone on the record to say Australia’s suicide rate could be cut “by a third, if not a half” if these new digital suicide prevention tools received more funding. In 2015, the Paul Ramsay Foundation donated \$14.7 million towards LifeSpan, an evidence-based ‘systems approach’ led by the Black Dog Institute that involves the simultaneous implementation of nine proven strategies.

“Peter’s an optimist,” Christensen says. “But the LifeSpan program is now in trial and I’m confident we’ll see a 20% reduction in suicides and a 30% reduction in suicide attempts, based on the results of similar large-scale suicide prevention programs overseas and modelling of the impact of each of the separate strategies that comprise LifeSpan.”

It’s a target that we, as a society, desperately need to reach, Christensen says, not just for the personal but also economic cost.

The World Health Organization estimates a quarter of all sick days taken every year are related to mental health issues.

Yet many people are still unconvinced we should be doing more, something that frustrates Christensen. The former skydiver reverts to a language most Australians understand – sport. “Australia is a winner in terms of sporting prowess and living standards, but when it comes to suicide rates we are big losers,” she says.

“Compared to the countries we play professional sport against – like the UK, the Netherlands, Brazil, Germany and Spain – our rates of suicide are worse.

“It is time we turned those statistics around.”

## The man behind the mask

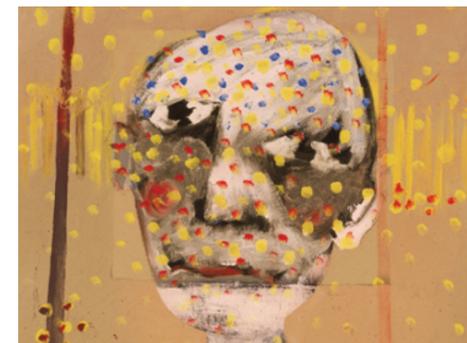
Art lovers have long pondered the identity of the mystery face behind the Ned Kelly mask in Sidney Nolan’s most iconic painting. Now science and art have merged to reveal an upside-down portrait of Nolan buried under layers of paint in his 1945 work, *Ned Kelly*, “*Nobody knows anything about my case but myself*”.

Dr Andrew Yip, from the Laboratory for Innovation in Galleries, Libraries, Archives and Museums (iGLAM) at UNSW Art & Design, is part of a team of experts who worked collaboratively with the Australian Synchrotron to visualise the artist’s hidden face.

Yip worked with Paula Dredge, Head of Paintings Conservation at the Art Gallery of New South Wales (AGNSW) and Kendrah Morgan, curator at Heide Museum of Modern Art, in Melbourne, who worked with Synchrotron scientist Daryl Howard to identify the painting’s elements down to the finest brush stroke.

With powerful x-ray imaging, previously invisible layers of colour were revealed to show a face beneath the now-famous Ned Kelly helmet.

“The scans revealed a face behind the mask covered in red, yellow and blue dots that raises questions about the meanings of Nolan’s Kelly series,” says Yip. “We were able



to recolour the scans to reconstruct how the portrait originally appeared before the mask was painted over it, by directly referencing Nolan’s own pigments, which are preserved in the conservation labs of the AGNSW.”

The newly discovered portrait has similarities with a self-portrait Nolan painted in 1943, while he was in the Australian Army. In *Self portrait*, now in the AGNSW collection, he wears strips of blue, yellow and red across his forehead, suggesting war paint. By 1945 he had absconded from the army and was hiding from the authorities. Nolan’s identification with Australia’s best-known outlaw is suggested by the title of the work, in Kelly’s own words, and the portrait under the mask. Oddly, the artist turned the portrait upside-down and started again, leaving just the eyes pointing out from behind the helmet.

The original Ned Kelly painting and a virtual-reality reconstruction of the images underneath the surface developed by Yip, Dredge and Matt Nix, the digital designer at AGNSW, were exhibited at Heide this year.

Displayed in the former home of Melbourne art benefactors John and Sunday Reed, where Nolan lived in the early 1940s, the virtual-reality work allowed visitors to step into the library, a room where Nolan spent time researching his paintings.

**Above:** Sidney Nolan, *Ned Kelly*: “*Nobody knows anything about my case but myself*” 1945, Heide Museum of Modern Art, Melbourne.  
**Below:** Digital colour recreation of the first stage of the painting based on x-ray fluorescence.

“Viewers stood in the house where the original painting was made, and used the VR headset to peer through the painting, peel back the layers of Kelly’s mask and reveal the portrait underneath,” Yip says.

Visitors were also able to view intimate photos of Nolan’s circle of friends, sourced from Heide’s collection, while exploring more recoloured Synchrotron scans through a virtual archive.

“The library is a really significant, ghostly space that’s pregnant with meaning – Nolan painted the Kelly series in the adjacent room”.

“I think VR is a really valuable way to bring art history to life and tell important stories, as long as it is done sensitively. This is also an example of how science can be used to convey the significance of art to a wider audience.”

The team is planning to develop the virtual-reality aspect of the exhibition further to include the literary history of Heide and its artists.

– Fran Strachan

The exhibition was presented with support from UNSW iGLAM, Australian Synchrotron and the Art Gallery of New South Wales.



Professor Buckland with budding hackers.

## The knack of the hack

**Australia's hottest cyber hackers come from one UNSW lab, led by a professor on a mission to fight global cybercrime, writes Ben Skuse.**

In 2012, the Prime Minister's Office – together with Cisco, Microsoft and Facebook – established an annual hacking competition to find the next generation of cybersecurity talent. Student teams from across Australia compete in the 24-hour hackathon. And each year Professor Richard Buckland's students blow away the competition – taking out first, second and third place.

"Every year, we blitz it," says Buckland, head of the Security Engineering Lab and a professor of cybersecurity at UNSW's School

of Computer Science and Engineering. "So I think we're doing something right."

What Buckland does is organise courses that teach cybersecurity through a series of hands-on exercises, using cloak-and-dagger collaborative games that ignite his students' enthusiasm. This approach flips the standard teaching model, so that students are taught offence as a way to develop defence; and, in the process, come to understand the mindset of the hacker.

"In addition, we partner with experts to bring in real-world scenarios to the classroom," Buckland says. Sometimes, these are industry gurus in banking and telecommunications. Sometimes they are [just plain] hackers.

"I can give the students an overview and tell them the theoretical aspects, but then we have cyber community leaders show them

how to actually do it," he says. "The role of teachers is to lift our students up above us."

The program's alumni have brought this collaborative ethos into the corporate world. "I've seen the emergence of a community of security professionals who work together, not just for the interests of their own company, but for security in general," says Buckland.

There is a huge supply and demand problem for cybersecurity professionals. A recent report by US-based market research company Cybersecurity Ventures estimates cybercrime cost companies US\$4 trillion in 2015, and is set to rise to US\$8 trillion annually by 2021.

It's a criminal epidemic that can only be fought by cybersecurity experts, a profession now growing at a rate of 18% annually, according to the US Bureau of Labor Statistics.

Cisco estimates there are more than a million unfilled security jobs worldwide. "In the early days, companies just repurposed rebels and old-style malcontent hackers, dressing them in suits and paying them lots of money," says Buckland. "That was a really great solution – until the pool ran dry."

Now that cybersecurity experts need to be mass produced, the burden is falling to universities. "But no one really knows how to do it – there isn't yet expertise on training up the rebels and breakers you want."

To quench demand, Buckland is developing a series of massive open online

*"Now that cybersecurity experts need to be mass produced, the burden is falling to universities."*

courses (MOOCs) as part of a partnership with the Commonwealth Bank of Australia to expand UNSW's cybersecurity teaching resources and curriculum.

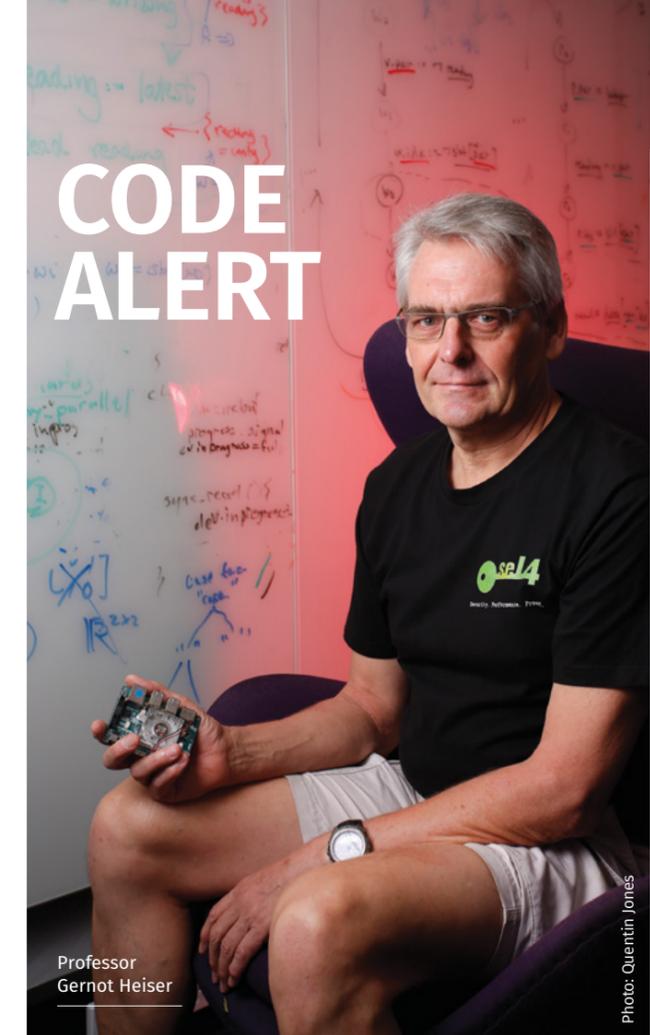
Already, almost 20,000 budding cyber defenders have signed up to the introductory course, 60% of them from Australia, ranging from information technology professionals wanting to brush up on the latest technical know-how, to schoolchildren – even miners and taxi drivers who want to re-skill.

Perhaps most crucial are the many teachers and lecturers taking the course. "For university academics who have been brought up in a traditional non-hacker way, cyber is a little bit scary to teach," he says. "Academics can borrow our lecture notes and course materials, or just be influenced to become believers in the way we teach cyber."

Buckland is not just focusing on young adults and professionals. He also goes into primary schools to teach kids the mindset of a hacker and how to protect against cybercrime. "I'm trying to get the kids to scam each other in a controlled way, because then they get to understand how scams work and how to be defensive against them."

A version of these stories first appeared in *Ingenuity*, the research magazine of the Faculty of Engineering.

## CODE ALERT



Professor Gernot Heiser

mathematically correct. This may not sound like much, but this is incredibly difficult to achieve.

"It is hard to comment on this achievement without resorting to clichés," quips Lawrence Paulson, a noted leader in theorem proving and a professor of computational logic at the University of Cambridge.

June Andronick, a principal research scientist at Data61, who specialises in the verifiability of software systems, adds: "What Heiser and his team have done, is to strengthen the guarantees that can be provided about software by orders of magnitude, while maintaining very good performance for real-world use."

A big test of Heiser's seL4 microkernel came in 2015, when the US Defense Advanced Research Projects Agency gave hackers unfettered access to the onboard computer of an autonomous Boeing AH-6 helicopter gunship.

Their task was to hijack the microkernel and take control. While hackers easily commandeered the helicopter when it hosted other software, they could not crack the on-board computer when it ran on Heiser's microkernel.

The development cost of the seL4 microkernel was about three times that of comparable unverified, vulnerable software. But Heiser thinks he can make the software affordable for everyone. "If we manage to eliminate this factor-three cost gap to standard software, we're totally changing the world of software systems."

– Ben Skuse

We trust computer systems every day – but trusted systems are rarely entirely trustworthy. Laptops can crash, servers can freeze, and personal details can be stolen. Even pacemakers can be hacked.

"The complexity of the systems we're building has grown much faster than our ability to deal with it," says Gernot Heiser, a professor of operating systems at UNSW and chief research scientist at Australia's digital research network, Data61, a division of CSIRO.

"The result is an appalling lack of dependability. As tasks like controlling medical devices, mobile phones, industrial plants and aeroplanes become more

technology-dependent, trust should not be taken for granted."

Is it even possible to write truly trustworthy code? Heiser thinks so – which is why he has spent the past decade developing secure microkernels, the core on which dependable operating systems can be built. By itself, a microkernel does not provide useful services, but contains the core mechanisms on which to build them.

Working with UNSW colleagues Gerwin Klein and Kevin Elphinstone, Heiser sparked excitement among experts when the team proved that all 7,500 lines of C code in his seL4 microkernel were

Our concrete jungles are getting so hot they could eventually become uninhabitable. *Fran Strachan* spoke to a researcher trying to cool them down.

In the middle of winter, Australians enjoy a brief respite from the crushing heat, and silently vow to better protect their homes next time summer comes around. But as more of us live in cities, there is another hurdle to overcome – the concrete jungles of our urban environment.

Nowhere is this more pronounced than in western Sydney. Deprived of the cool ocean breezes that soothe Sydney's coastal areas, the city's western sprawl suffers from the urban heat island effect, where dense building materials absorb more of the sun's energy, where fewer trees provide shade, and waste heat from car engines and air conditioners intensify air temperatures.

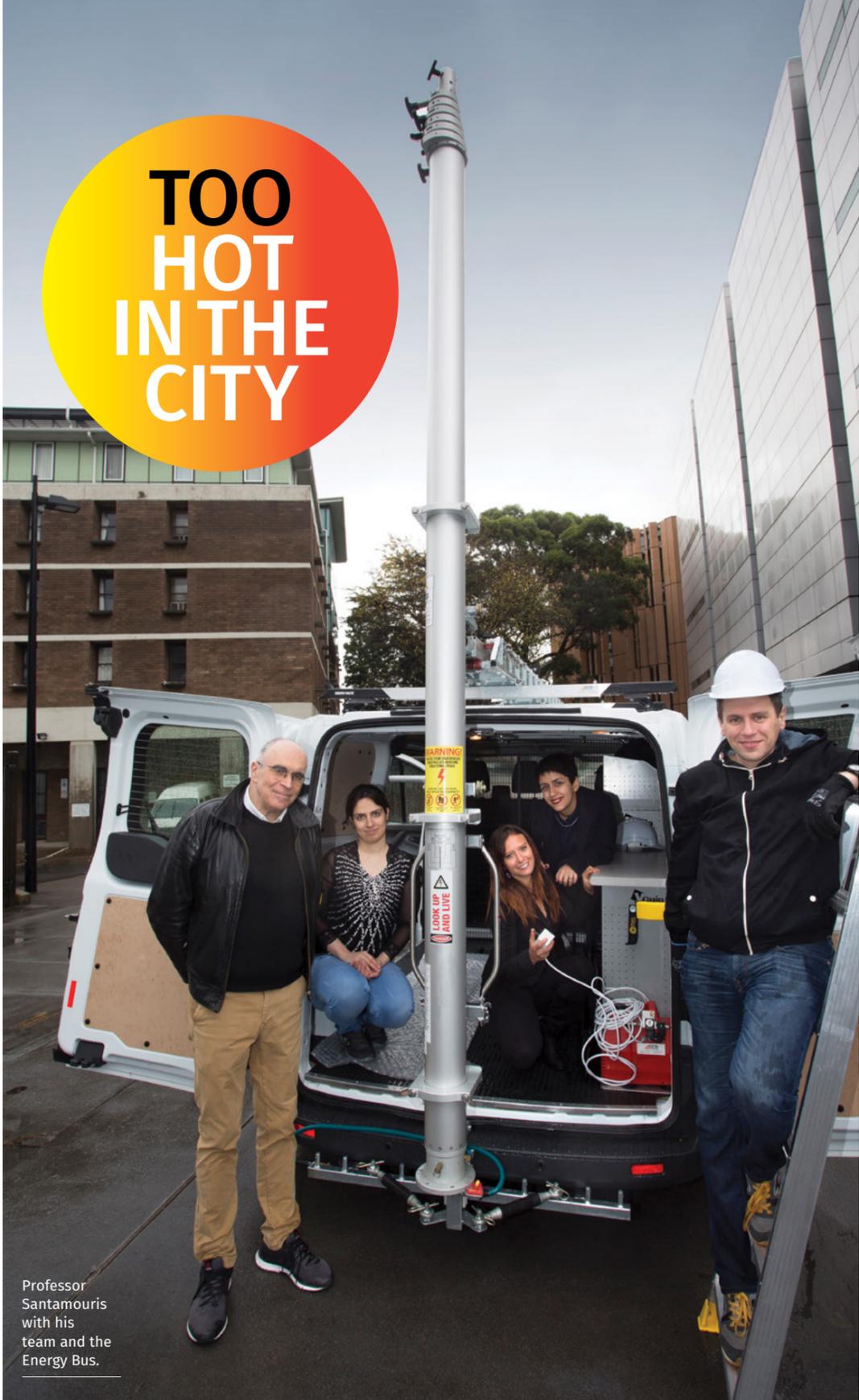
More than 500 cities worldwide are currently dealing with this perfect storm of conditions, which has resulted in increased electricity demand, surging energy consumption in buildings, and higher mortality rates, particularly among the elderly.

It's predicted the number of summer heatwave days experienced in some Australian cities could triple by 2050.

"Urban heat islands are the most documented phenomenon of climate change," says UNSW Built Environment's Professor of High Performance Architecture, Mat Santamouris, who has spent the past 15 years mapping urban heat islands in 200 cities, including a collaboration with the European Union that led to the first complete study of urban heat islands in European cities.

"The focus is often on the global impact of climate change but we also need to understand what is happening at a local level, in our own cities," says Santamouris. "If we can't find a way to make our cities cooler, they will eventually become uninhabitable."

Formerly the Director of the Laboratory of Building Energy Research at the University of Athens, Santamouris has brought his expertise to major heat-mapping projects in Australia as



Professor Santamouris with his team and the Energy Bus.

Photo: Quentin Jones

UNSW's inaugural Anita Lawrence Chair in High Performance Architecture.

After analysing data from six weather stations across a 10-year period in the Greater Sydney Area, he describes western Sydney as "a catastrophic scenario waiting to happen".

"It's hard to remember that kind of heat when we're in the middle of winter, but last summer the temperature in Penrith was above 40 degrees Celsius for about 20 days, reaching even 46 degrees Celsius. It was unbelievable.

"That is on average, eight to nine degrees Celsius higher than the medical risk threshold. People were really suffering, and most people in these areas can't afford air conditioning."

He recalls the 2003 heatwave in Europe that resulted in more than 50,000 deaths and the power failure during Adelaide's heatwave this year, saying electricity demand in our already over-heated cities could cause these situations to happen more frequently.

However, Santamouris prefers to focus on the solution rather than the problem. As the former president of Greece's national body for the promotion of renewable energy sources and conservation, he has plenty of experience.

"It is critical that we turn the urban heat island challenge into an opportunity, by working out how it can benefit the economy. Focusing on the negative impacts doesn't help, we need to find a better solution."

Much of his research involves developing heat-mitigation technologies to help cool our cities in the future. "Reflective materials on buildings can help reduce the urban heat island effect, as can cooling pavement technologies, street shading, greenery and installing fountains, ponds and sprinklers," he says.

"But there's no one-size-fits-all approach. Every city has its own set of issues so we often need to use a cocktail of different solutions."

Santamouris and his team use a mobile lab called the Energy Bus to record the scientific data they collate when mapping urban heat islands. The bus, combined with the thermal imaging provided by an accompanying drone, allows data to be visualised and transmitted in real time via a 20m extendable aerial.

The Energy Bus, the first of its kind in Australia, was used in Santamouris's latest project which aims to reduce the temperature in Darwin's CBD by three degrees.

Funded with \$100 million by the Northern Territory government, and an equal budget by the Commonwealth Government, Santamouris says the Darwin project is the largest heat-mitigation study in the world. Using thermal imaging and drone aerial monitoring to map the city's hotspots, the team has recommended ways to retrofit the entire CBD to achieve the maximum cooling effect.

Shading, cool roofs and new-generation, cool pavements that absorb less solar radiation, green roofs (where vegetation is planted on rooftops to absorb carbon dioxide and pollutants) and water sprinkling (where a light mist is sprayed directly into the air and then descends) have all been recommended.

But Santamouris is acutely aware that new heat-mitigation technologies need to be developed quickly.

*"The goal now is to develop heat-mitigation materials and solutions capable of reducing urban temperatures by five degrees."*

"When I started my research 15 years ago the aim was to reduce urban temperatures by 2.5 degrees Celsius but now we're running to catch up. The goal now is to develop heat-mitigation solutions capable of reducing urban temperatures by five degrees, and in the case of western Sydney it needs to be by seven degrees."

Santamouris isn't just racing against the global warming clock, he's also committed to educating the local community about the impacts of climate change while there's still time to make a change. "We need to initiate people into the problem of climate change, and get them involved," he says. "That has far more influence than an expert telling them."

As part of a university collaboration with RMIT, Santamouris and his team have been successful in the Citizen Science Grants

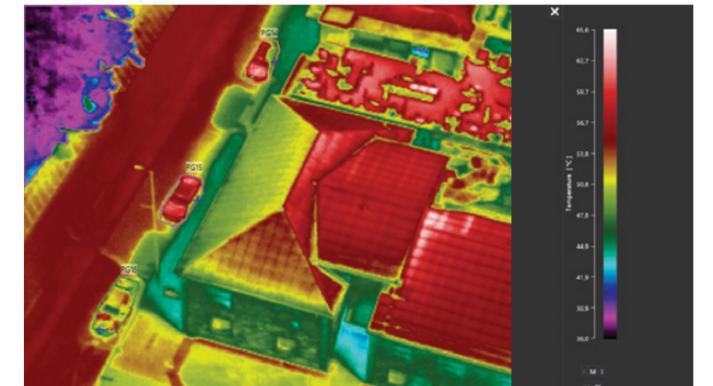
scheme run by the Department of Industry, Innovation and Science as part of the National Innovation and Science Agenda.

The project, which is worth \$670,000, will allow Santamouris and his team to work with 12,200 residents from 22 local councils across Australia, by providing them with the technology to measure the thermal performance of their neighbourhoods.

"This is the first large-scale project in the world to involve people in the understanding of heat mitigation," Santamouris says.

As part of the two-year study, citizen scientists will use portable wireless sensors to measure temperature, humidity, wind and solar radiation in 2,200 areas across 22 councils in Sydney, Melbourne, Adelaide, Brisbane, the Gold Coast, Canberra, Darwin and Perth.

"People understand climate change in that

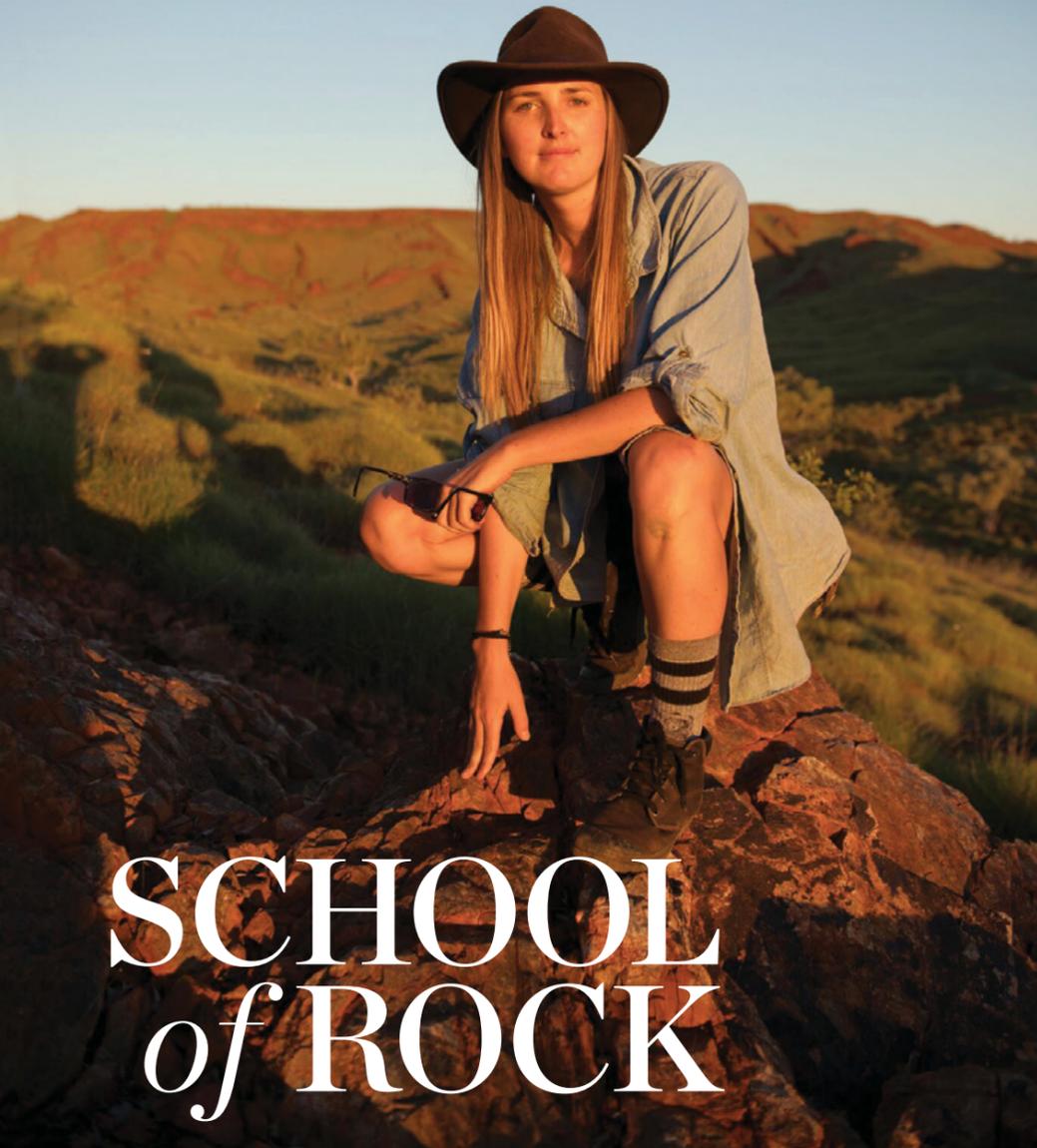


it's an increase in temperature, but they don't know how it personally affects their neighbourhood, their home and their life. For example, if they plant a tree how does that lower the temperature of their house?" he says.

In the final stage of the project, participants will be taught how to design heat-mitigation techniques to cool their homes.

Santamouris says UNSW is at the forefront of developing heat-mitigation techniques that will make our cities more livable, protect vulnerable populations and save lives.

"Urban overheating is perhaps among the more severe climatic phenomena that humanity faces, but I'm confident that in a three- to five-year period, we will be able to decrease peak ambient temperatures by up to four or five degrees Celsius."



# SCHOOL of ROCK

**The discovery in the Pilbara of the oldest evidence of land-based life could help in the search for life on Mars, writes Deborah Smith.**

Evening was drawing in and UNSW research student Tara Djokic was ready to call it quits on a long day in the field. For hours she had trekked up and down the 3.5-billion-year-old red rocks of the Pilbara in Western Australia, painstakingly identifying signs of early life on Earth and geological clues about the environment in which these ancient microbes once existed.

“It was in 2013, and I came across a steep little valley that led up to the crest of a ridge, and thought it would be a great short cut home,” she recalls. “Then I saw an interesting-

looking mound of rock and curiosity got the better of me. So, I decided to take some notes and a few samples. It was a little serendipitous.”

One of those samples, a rather small piece of rock, had a texture she had never seen before – a series of swirling, extremely thin black and white layers. “And the really cool thing was that it was exceptionally well preserved,” she says.

Back in Sydney, she showed the unusual sample to UNSW Professor Malcolm Walter, who examined a slice under a microscope and came to a game-changing conclusion: the rock could be geyserite – a mineral deposit formed by the near boiling, silica-rich fluids only found in terrestrial hot springs.

“That was very exciting,” says Djokic, who is now a PhD candidate. “We’d known for decades that microbial life existed 3.5 billion years ago in the Dresser Formation in the Pilbara, but the geyserite suggested some of these ancient microbes lived in freshwater hot springs on land, completely restricted from the sea.”

In May this year, four years after Djokic wandered through that little valley, her discovery made big news around the globe. In a paper in *Nature Communications*, the UNSW Science team of Djokic, Walter, Professor Martin Van Kranendonk and Professor Colin Ward, along with Professor Kathleen Campbell from the University of Auckland, presented their case that the Dresser Formation contains the oldest evidence of land-based life on Earth.

If correct, the find pushes back the record by about 580 million years. Their find also pushed back evidence of geyserite and hot springs by a whopping three billion years. And it lends weight to Darwin’s theory that life originated on land in a “warm little pond”, rather than in the salty sea.

It also has important implications for the search for fossil life on Mars when NASA’s rover touches down in 2020. “The Pilbara deposits are the same age as much of the crust of Mars, which makes hot spring deposits [there] an exciting target for our quest to find fossilised life,” says Van Kranendonk, whose geological advice has helped NASA whittle down potential landing sites for the

upcoming rover mission.

The Mars rover will endeavour to search for signs of past life in a region of Mars thought to have had conditions long ago favourable for microbial life. It will also collect samples for potential return to Earth for analysis.

As a pioneering step towards how humans could use Mars’ natural resources, the rover will conduct an experiment to extract oxygen from its atmosphere.

Back in Australia’s Pilbara, the new understanding of fossil deposits is the culmination of decades of study by different researchers. Fossilised, cone-shaped, layered structures called stromatolites were first discovered there in the 1970s.

It was initially thought the microbes that built these stromatolites lived in a quiet,

*“If correct, the find pushes back the record by about 580 million years.”*

shallow sea, much like we see today at Shark Bay on the Western Australian coast.

It was Van Kranendonk, the head of the UNSW School of Biological, Earth and Environmental Sciences and Director of the Australian Centre for Astrobiology, who in the early 2000s showed these fossil-bearing rocks were in fact part of an ancient volcano that had a huge amount of hot water circulating beneath the ground. Djokic’s small piece of geyserite has confirmed that some of this hot water ejected on to a land surface, rather than the ocean, and manifested as hot springs.

The Pilbara research will feature at two events during National Science Week and the Sydney Science Festival in August. UNSW’s Big Questions Institute and the Sydney Opera House will present an event on 17 August called *Life on Mars: How Australian Scientists are Shaping NASA’s 2020 Mission to the Red Planet*, featuring NASA’s Dr Abigail Allwood and Dr Mitchell Shulte, Van Kranendonk, and physicist Professor Paul Davies.

On 18 August, UNSW Science will also hold a *Women on Mars* event for female high-school students with speakers including Djokic and UNSW Dean of Science, Professor Emma Johnston.

## MISSION TO MARS

As the first female commander of a NASA-funded Mars mission simulation, former UNSW academic Martha Lenio has gained a deep understanding of what it might be like to travel to Mars.

In 2014, Lenio, who completed her PhD in photovoltaics, and five others entered the Hawaii Space Exploration Analog and Simulation dome for eight months of simulated space travel.

**How did you enjoy the mission?**

I really enjoyed it and my team and I are still good friends, so for me that means it was a really successful mission. As commander, I was often the mediator. What I found is that I took my “mothering ability”, to another level. I’m the oldest of five, so taking care of the people around me comes naturally.

**What was it about your mission that made it so successful?**

Even when times were tough, our crew was diligent about ensuring NASA got 100% of the results that they wanted to get. There is the technological and physical survival side of the mission, but with humans there’s the whole social aspect, too.

Often they’ve found that when the social structure starts to break apart, your task and goal structure starts to break apart as well.



But with us that didn’t happen. When our social structure degraded a bit, we were still able to meet NASA’s needs and goals. One of the researchers remarked to me at the end that we turned socialising into a task that everyone was committed to doing rather than something we did for fun. Maybe that was an important thing they learned.

**As gardener-in-chief, how did your garden grow?**

I tried growing so many different things. I grew lettuce, tomatoes, carrots, mushrooms, onions and just about all the herbs. We grew wheatgrass and flowers, too, just for the fun of it. The crew got the most enjoyment out of the herbs because we could harvest them continuously and it just added so much to a meal.

**How did you make life fun in such close quarters?**

We marked and celebrated time. You don’t think of the passage of time as that important when you’re in the outside world, but in the dome it was a really big deal. Days merge and you’ve got no sense of time. We were the first crew to be in there for every major holiday. If we felt we hadn’t

had a celebration in a while we’d look to our “space calendar” and say, “Ah, this was the day the first female astronaut went to space, let’s celebrate that.”

**When did you first dream of becoming an astronaut?**

I think I seriously started thinking about it back in grade eight or nine. I’m really interested in exploring and I like travel. I’m really into sustainability, too, so this would be the ultimate travel, sustainability dream.

**What’s the connection with sustainability?**

The more sustainable you can make space travel, the further you can go. In space, you’re living off renewable energy. You have to recycle all of your air and water, and ideally all of your organic waste back into food.

**You got down to the last 70 applicants (out of more than 3,000) who applied for the two Canadian positions for NASA. Will you apply again?**

I was actually a lot more disappointed than I thought I would be when I didn’t make it out of the final 70. I will definitely be applying again.

This Q&A first appeared on the UNSW Engineering website.

# Books



## What I'm reading

### Greg Austin

Professor in the Australian Centre for Cyber Security at the University of New South Wales (Canberra)

I am reading an American military study from 2015 on how to win the country's information wars with Russia, Al Qaeda and Islamic State. It's called *Influencing Tomorrow: A Study of Emerging Influence Techniques and Their Relevance to United States Information Operations*. As a professor of cybersecurity, strategy and diplomacy, I want to understand why, in the words of Malcolm Turnbull in January 2016 in Washington DC, the coalition's war against Islamic State still "needs considerable improvement" in cyberspace operations.

"The cybersphere demands reactions as rapid as the kinetic battlefield," Turnbull said.

Almost 18 months later, we seem to be losing that cyber battle still, as terrorist attacks across the world increase in intensity, as extremists gain new political influence in Indonesia, and as the Philippines Armed Forces have been in open combat for three weeks to recapture the town of Marawi from armed groups claiming affiliation with Islamic State.



### A Charter of Rights for Australia

George Williams and Daniel Reynolds  
UNSW Press/NewSouth

• Australia does not have a bill or charter of rights. What does this mean for the rights of Australian citizens? In this fully revised fourth edition, the authors show that human rights are not adequately protected in Australia and demonstrate how the rights of people at the margins of our society are violated in often shocking ways. This book's argument that the time has come for a federal charter is more urgent than ever.



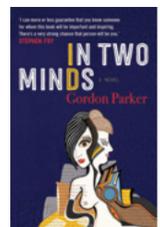
**Postvention in Action:** International handbook of suicide bereavement support  
Karl Andriessen (UNSW), Karolina Kryszynska (UNSW), Onja Grad (University of Ljubljana) – Editors  
Hogrefe

• Almost 100 experts, including Australians, have contributed to this unique resource. Suicide can increase the risk of the same happening in the bereaved. The WHO and others have recognised postvention as an important strategy for suicide prevention. The book begins with key concepts experienced by people bereaved by suicide, and concludes by exploring support in 23 countries.



**Running the City:** Why Public Art Matters  
Felicity Fenner  
UNSW Press/NewSouth

• Leading Australian curator Felicity Fenner profiles activity-based and pop-up contemporary public art projects from Australia and around the globe. *Running the City* explores art projects that bring together diverse disciplines and cultures – including running, cycling, architecture and guerilla gardening. Participatory, temporary and permanent community-driven art projects reveal how public space can be activated in ways that are original, subversive, fun and unexpected.



**In Two Minds: A Novel**  
By Gordon Parker  
Ventura Press

• UNSW Scientia Professor Gordon Parker draws on his distinguished career in psychiatry for some of the richest passages of his second novel. Beloved by his patients and his wife, Dr Martin Homer is an amiable Sydney GP who begins to self-medicate after the death of his mother triggers a debilitating depression. On a bipolar high, Martin meets Bella, a young woman with borderline personality disorder, leaving a toll of broken relationships in her wake. The book explores both conditions with humour and warmth.

# NewSouth

*named the 2017 Small Publisher of the Year*

The division of UNSW Press received the honours at the 2017 Australian Book Industry Awards.



Left to right: Jane Kembrey, Sales Manager NewSouth Books; Elspeth Menzies, Publisher NewSouth Publishing; Phillipa McGuinness, Executive Publisher NewSouth Publishing; Nella Soeterboek, Director NewSouth Books; Kathy Bail, CEO UNSW Press

UNSW Press CEO Kathy Bail: "We may be relatively small in scale, but we think big all the same. Our books create debate and spark conversation. And they look beautiful."

Books published by the university press are available at UNSW Bookshop [bookshop.unsw.edu.au](http://bookshop.unsw.edu.au)

17 AUGUST

## SPECIAL EVENT

# Life on the red planet

UNSW's Big Questions Institute and the Sydney Opera House present a special event, *Life on Mars: How Australian Scientists are Shaping NASA's 2020 Mission to the Red Planet*.

Expert panellists include:

**Physicist Professor Paul Davies**, who will address whether we are alone in the universe and what will happen if we find life on Mars

**Geologist Dr Abigail Allwood**, one of seven principal science investigators on NASA's 2020 Mars rover mission

**Geochemist Dr Mitchell Schulte**, a scientist with the Mars Exploration Program at NASA Headquarters in Washington DC

**Astrobiologist Professor Martin Van Kranendonk**, whose research uncovers possible links between early organic life on Earth and Mars