

➤ **A NEW LEAF OF LIFE**
How to change a koala's diet

➤ **HOME ADVANTAGE**
Making a difference to maternal health

➤ **DREAM WEAVER**
Smart T-shirt detects sleep apnoea

FUTURE-MAKERS



AN EYE ON SPACE

The space junk tracker
inspired by nature

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36351661

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WESTERN SYDNEY
UNIVERSITY

ON THE COVER



➤ A camera that works in a similar manner to the human eye can detect fast-moving space debris.

Cover image:
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Science Photo Library

BRINGING WORLD-CLASS RESEARCH TO WESTERN SYDNEY

New knowledge empowers people, it encourages the open inquiry and debate crucial for addressing the world's most pressing issues. At Western Sydney University our researchers are delivering research that informs and leads this debate. Western's rigorous research, and our outstanding collaborations with industry and end users, confronts real world challenges. The research produced at Western is robust, transparent and, importantly, reproducible.

In the second edition of *Future-Makers* we showcase some of Western's incisive and innovative research. It is a glimpse of our work that is empowering communities and improving lives, locally, regionally and globally. Genuine research impact is not achieved in isolation. Western's research is inclusive and co-designed with those beyond the University's gates, those who know the issues through lived experience.

Western Sydney University is ranked among the top two per cent of universities worldwide with a growing international reputation as an impact driven, research led institution. Western's world-leading research teams continue to attract outstanding researchers from across the globe to add to our intellectual excellence and cutting-edge research facilities. We are continuing this strategy by launching new research centres that bring together and support our cohorts of research excellence and our partnerships with industry. This strategy, coupled with our prestigious scholarship

schemes, is helping to realise Australia's next generation of research leaders.

The stories of discovery and research translation delivered in *Future-Makers* are exciting and intriguing but, perhaps most importantly, they are relevant to peoples' lives. This issue reflects the often unique cross-disciplinary and collaborative lens through which problems are viewed and research is driven at Western. The research projects discussed in this publication are wide-ranging and include: a complementary medicine-based education program that can significantly reduce medical interventions during childbirth; the use of biologically inspired cameras to make space safer; the development of non-intrusive methods to monitor both cardiac and respiratory functions; professional and volunteer home visiting support programs for families living with adversity; and the documentation and analysis of the transformation of Sydney's Chinatown into a transnational, hybrid economic and cultural space in the context of the rise of China.

We are delighted and proud to share these and other stories arising from the excellent work by Western Sydney University's researchers. ♥

Professor Barney Glover AO
Vice-Chancellor and President

Professor Deborah Sweeney
Deputy Vice-Chancellor and Vice-President
(Research and Innovation)

FUTURE-MAKERS

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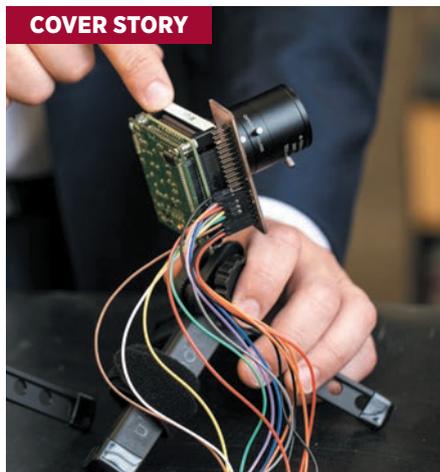
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WESTERN SYDNEY UNIVERSITY IN NUMBERS

Located in Greater Western Sydney, one of the fastest growing regions in Australia, Western Sydney University is home to a vibrant and diverse community of staff and students.

GLOBAL RANKINGS

2018 EXCELLENCE IN RESEARCH FOR AUSTRALIA (ERA) NATIONAL REPORT WSU DISCIPLINES ABOVE WORLD STANDARD



- Agricultural and Veterinary Sciences
- Biological Sciences
- Complementary and Alternative Medicine
- Cultural Studies
- Ecological Applications
- Ecology
- Electrical and Electronic Engineering
- Environmental Sciences
- Evolutionary Biology
- Forestry Sciences
- Microbiology
- Nursing
- Oncology and Carcinogenesis
- Pharmacology and Pharmaceutical Sciences
- Plant Biology
- Soil Sciences
- Zoology



- Applied Mathematics
- Biochemistry and Cell Biology
- Communication and Media Studies
- Environmental Science and Management
- Human Geography
- Human Movement and Sports Science
- Language, Communication and Culture
- Linguistics
- Macromolecular and Materials Chemistry
- Materials Engineering
- Mathematical Sciences
- Medical and Health Sciences
- Performing Arts and Creative Writing
- Psychology
- Psychology and Cognitive Sciences
- Pure Mathematics
- Sociology
- Statistics

2018/2019 SUBJECT RANKINGS

ARWU: Academic Ranking of World Universities
QS: QS World University Rankings

 **ECOLOGY**
39th in the World
in ARWU rankings

 **NURSING**
49TH (ARWU)

 **CIVIL ENGINEERING**
TOP 75 (ARWU)

 **AGRICULTURAL SCIENCES**
TOP 75 (ARWU)

 **EDUCATION**
TOP 75 (ARWU)

 **COMMUNICATION & MEDIA STUDIES**
TOP 100 (QS)

 **SOCIOLOGY**
TOP 100 (QS)

2018 LEIDEN RANKINGS

Western Sydney University is ranked 2nd in Australia and 109th in the world for research collaboration

TOP 2

2018 TIMES HIGHER EDUCATION WORLD UNIVERSITY RANKINGS

TOP 2%

STUDENTS

EDUCATIONAL ATTAINMENT IN FAMILY



63%
FIRST IN FAMILY
TO OBTAIN
UNIVERSITY
DEGREE

48,537
TOTAL
STUDENTS

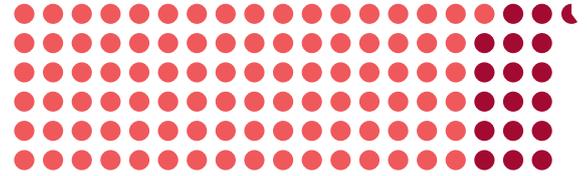
STAFF

GLOBAL PERSPECTIVE

60% WSU ACADEMICS
FROM INTERNATIONAL
BACKGROUNDS

ACADEMIC STAFF COMPOSITION

1,146 TOTAL
STAFF
970 RESEARCH
ENGAGED STAFF



● = 10 people

ALUMNI



190,000+
GRADUATES



20,000+
WORKING OVERSEAS
IN 128 COUNTRIES

RESEARCH

TOP 5 INTERNATIONAL COLLABORATORS

COLLABORATION SCORE

- ① 13.3 University of Minnesota, USA
- ② 4.9 Chinese Academy of Sciences, China
- ③ 3.7 U.S. Department of Agriculture, USA
- ④ 3.7 King Juan Carlos University, Spain
- ⑤ 2.4 Max Planck Society, Germany

based on collaboration score in the Nature Index
between January 2014 – October 2018
* see www.natureindex.com for more info



HIGHER DEGREES BY RESEARCH COMPLETED IN LAST 5 YEARS



792
COMPLETED
DEGREES
(2014-2018)

RESEARCH WITH IMPACT

A global atlas of
the dominant bacteria
found in soil

Journal: Science
Published: 2018

* More details at:
www.altmetric.com/details/31912411
(as of 15 March 2019)

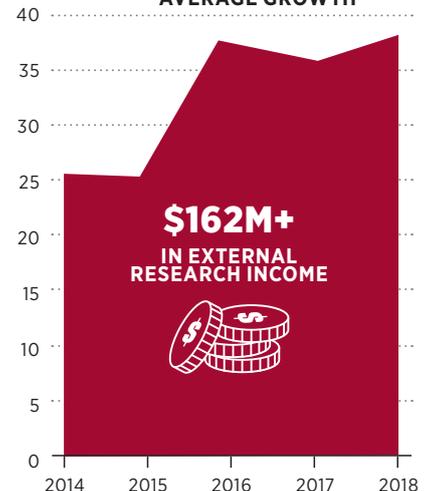


720

RESEARCH INCOME

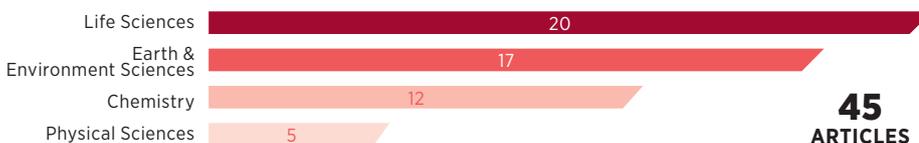
Million\$

9% YEAR ON YEAR
AVERAGE GROWTH



RESEARCH OUTPUT BY SUBJECT

In the Nature Index (1 Nov 2017 – 31 Oct 2018)



Articles in the Nature Index may appear in more than one subject category

DELIVERING BETTER BIRTHING STRATEGIES

Educating pregnant women about complementary therapies could save millions of dollars every year.

When Kate Levett was told, during her third pregnancy, that complications during her previous delivery meant she wouldn't be able to have an epidural during labour, she was flummoxed: "My first reaction was, 'what do you mean? I'm already pregnant; how am I going to get this baby out?'" she recalls.

After giving birth to her baby without any pharmaceutical pain relief and using natural methods, Dr Levett, a

public health researcher at Western Sydney University's NICM Health Research Institute, decided to test whether educating women about complementary therapies might reduce the rates of medical intervention during childbirth.

Thus, the Complementary Therapies for Labour and Birth (CTLB) study, which included 176 women with low-risk and first-time pregnancies, was launched.

NEED TO KNOW

- More than 50% of pregnant Australian women choose to have an epidural
- Around a third of Australian women have a caesarean section — one of the highest rates in the OECD
- Educating expectant mothers about complementary therapies could save the health system \$97M each year

The study compared women's birth experiences after a standard hospital antenatal course only, with the experience

of those who also attended a two-day information session about acupressure, upright birthing positions, breathing, relaxation techniques, massage and how partners could support the birthing process.

"The aspects of Kate's course I found most helpful were the breathing techniques for labour, and acupressure," says Joanna Allton. "I used acupressure prior to birth to relieve swelling in my ankles, and during birth to help contractions ramp up."

Levett found that women attending the CTLB course experienced 45% fewer epidurals compared to women who only attended the standard course; they also had significantly lower rates of caesarian sections (18% vs 32%) and minor trauma to the perineal area; a significantly shorter 'pushing' stage of labour



© Insung Jeon/Getty Images

(1hr vs 1 hr 32 minutes); and their babies were less likely to need resuscitation after birth (14% vs 29%).

Around one third of Australian women give birth by caesarean section, and more than 50% opt for epidural pain relief. Levett stresses that there's nothing inherently wrong with epidurals, but like any medical procedure, there's a risk of side-effects: "If you have an epidural, your brain stops registering that you're in labour, and the whole process can slow down," says Levett. If this happens, the chances of needing additional medical interventions, such as synthetic oxytocin or the use of forceps, increases.

A follow-up study suggested that education about complementary therapies could also save money. The course itself costs approximately \$149 per participant, but the net saving to the healthcare system or insurers was between \$659 to \$808 per woman — mostly due to a decrease in the rate of uncomplicated caesarean sections.

Levett has recently secured funding through the National Health and Medical Research Council to trial a refined version of the course, now called 'Birth Course', in a more generalised population. The government funded project, which seeks to reduce medical interventions in labour and birth, will include researchers from the University of Notre Dame in collaboration with Western Sydney University's School of Medicine, School of Nursing and Midwifery and NICM Health Research Institute. ■

GRASSROOTS SUPPORT FOR A THREATENED HABITAT

Ecologists go underground to investigate how grass roots bear up against bugs.

Pests that feast on plant roots are a significant threat to Australia's vulnerable grassland habitats. Researchers have been investigating the ways grasses defend themselves against these insidious attacks.

Root-eating herbivores, including beetles, can reduce plant productivity by up to 25%, slashing crop yields and threatening food production. Roots suck up nutrients and moisture from the soil to ensure plant re-growth and stability, so the whole plant suffers when its roots are ravaged. Remarkably, the combined mass of root herbivores can exceed that of sheep grazing on Australian pastures, yet as most research focuses on above-ground defences, little was known about how roots protect themselves.

Scott Johnson, a professor at Western Sydney University, leads a multi-pronged project that adopts an innovative and holistic approach to investigate plant self-defence. "Beetle larvae have a below-ground phase that can last up to two years" explains Johnson. "They chew away at plant roots until the root loses all anchorage. This is a big problem during droughts".

In 2014, Johnson and fellow ecologist, Dr Ben Moore, tested the way in which grasses responded to attacks from

NEED TO KNOW

- The combined weight of root-eating insects exceeds that of sheep on some pastures
- Root-munching herbivores can reduce plant productivity by up to 25%
- Research shows plants take strength from silicon to brace themselves against attacks



A scarab beetle larva. The majority of scarabs eat grass roots in their larval stage.

root herbivores, including the greyback cane grub, a member of the scarab family. "Our early studies revealed how much silicon was in the roots. Silicon strengthens plants and helps them retain water, and we found that plants under attack took up extra silicon from the soil to defend themselves."

Johnson and his team of postdoctoral scientists and PhD students at the Hawkesbury Institute for the Environment are now investigating how they can exploit silicon to protect plants. One way is to increase silicon

in the soil, as it can be rapidly depleted by nutrient-hungry crops. "We are working with Australian Steel Mill Services to see if we can reuse the by-product of steel production, calcium silicate, by adding it to soils. But first we have to test how ecosystems respond to such an intervention."

Climate change is at the forefront of this work. "We may see more pest outbreaks as the climate warms" said Johnson, "and droughts have highlighted the need for resilient crops". Recent studies from Johnson's team suggested that higher levels of carbon dioxide in the air reduces silicon uptake by plants, further weakening their defences. One solution may be to breed grasses to absorb more silicon.

The future of staple food crops could depend upon such research. "Root feeding grubs are the biggest threat to the sugarcane industry" says Kevin Powell from Sugar Research Australia. "They

affect nearly every grower. If we don't find a way to protect plants against pests — and there will be more of them as the climate warms — farmers will lose crops and money."

The direction of Johnson's research continues to respond to developments in the field of ecology. "We are now starting to look at the soil microbiome," he says, "and how symbiotic microbes affect nutrient uptake."

Harnessing natural processes to help crops defend themselves could help sustainably safeguard the future of food. ■

TINY TONGUES TALKING

Taking a community-based approach to early childhood language promotes children’s communication and identifies hearing problems.

In remote communities east of Katherine, in Australia’s Northern Territory, Sunrise Health Service provides healthcare to Aboriginal families. Many of the children experience early, chronic otitis media (middle ear infection) and resulting hearing loss.

In 2006, an innovative programme called ‘LiTTLe’ (Learning to Talk, Talking to Learn) was set up by husband and wife team Fred McConnel, a local GP, and Robin McConnel, a teacher of the deaf. LiTTLe provided a space for local Aboriginal parents and their babies and toddlers to hang out, chat, and play, while promoting the children’s hearing and early language development.

A recent evaluation conducted by Western Sydney University researchers found that the programme, staffed by local Aboriginal women, has brought significant value to the community and beyond. Associate Professor Caroline Jones from The MARCS Institute at Western Sydney University and her colleagues found the programme provided a way to identify children experiencing language difficulties caused by hearing problems, and connect the families with support.

Nationally, the situation is improving but Indigenous children with hearing loss still typically don’t receive a hearing aid until the age of six years, compared to 12 months of age for non-Indigenous children. Through

NEED TO KNOW

- LiTTLe programme encouraged children’s early language development and hearing abilities
- Based on research, the ERLI checklist, comprising 120 typical first words and gestures, was developed for children in remote NT
- ERLI can be used to help identify children who have language and/or hearing problems and facilitate support at an earlier age

LiTTLe, some children with hearing problems were identified earlier, and able to access treatment and hearing aids.

Jones and colleagues have published the lessons learned from LiTTLe in the international journal *BMC Pediatrics*, helping to inform services for families and infants.

LiTTLe was run by Sunrise Health Service — an Aboriginal controlled primary health service — and supported by Ian Thorpe’s Fountain for Youth, The Honda Foundation, and Communities for Children, with The Smith Family as Facilitating Partner. The programme was tuned to local languages and dialects, and for eight years, it provided a vital service to remote communities east of Katherine.

“It was really great that the programme worked across health and education sectors to improve outcomes for kids,” Jones says.

Jones, a language researcher who has worked with Aboriginal communities for more than 25 years, was invited by Sunrise Health to evaluate the LiTTLe programme through an ARC Linkage Grant with Macquarie University and the University of Otago. She and colleagues interviewed many of the parents and caregivers who had taken part in the programme over the years.

The goal was not to teach the children English, but to work with whatever language was used in their home and local environment, including Kriol, a creole language that is the first language of many Aboriginal adults and children in remote communities in the Katherine region.

“It supported parents to use home language with their kids,” Jones says.

Parents were encouraged to talk more to their children; for example, naming and talking about things they saw, and what they were doing. “The research around language development shows that the input matters a lot, so the more you talk to your kids, and the more caring responsive language that you use with kids, the quicker they learn,” Jones says.

For some, this had a significant positive impact. Jones describes one child who wasn’t talking much at all when they started attending the sessions, causing his parents concern. With encouragement from staff, the parents started talking more to the little boy, which led to a major improvement in his language skills.

Project Officer, Eugenie Collyer’s daughter, Heidi, has her hearing tested by Australian Hearing at Wurli-Wurlinjang Aboriginal Health Service.



This research was supported by the Australian Government through the Australian Research Council.



Researcher
Jaidine Fejo and
her daughter

For some parents, simply meeting up with other parents and giving their child the chance to play was enough. “It was good all the way,” says one mother interviewed by Jones’ team. “When I brought her along every morning, she loved playing, talking, and having fun.”

Other parents and caregivers were keen to get the children familiar with a school environment and processes. “It was good to bring kids to the school, to let them learn, so when they are four or five they can go to Transition [the first compulsory year of schooling, similar to Kindergarten],” another interviewee told the researchers.

Jones and her team, including project officer, Eugenie Collyer, and Aboriginal researchers,

**“WE WANT
TO WORK
WITH PARENTS
AND SEE IF
IT’S POSSIBLE
TO PROVIDE
SUPPORT AT
MUCH
EARLIER AGES.”**

Jaidine Fejo and Chantelle Khamchuang, have used what they learned during the LiTTle evaluation process to develop a practical tool, the ERLI (Early Remote Language Inventory), a checklist of 120 typical first words and gestures for children in that multi-lingual region.

“For instance, a child might know the word ‘dog’ in English, but they might also know it in Kriol or a traditional language, or even in a language from another part of the world, so the checklist allows parents to report on their progress in learning to talk,” Jones says. “The checklist respects the parent as the expert on their child, at age 0-3 years, when the parent knows most about the child’s language development”.

That checklist has attracted the attention of Australian Hearing and National Acoustic Laboratories (NAL), keen to validate their own hearing checklists against the ERLI language measure. Together, they have recently partnered with Wurlli-Wurlinjang Aboriginal Health Service and Tharawal

Aboriginal Corporation to trial the checklists as a package to identify children with language and hearing challenges. This project is funded by the ARC Centre of Excellence for the Dynamics of Language of which Western is a partner, and has recently received support to Australian Hearing, NAL from Prime Minister & Cabinet.

“We want to use the checklists to find the kids who have hearing and language problems earlier in life, work with the parents collaboratively, and see if it’s possible to provide support at much earlier ages,” explains Jones. “Our next step is providing and evaluating training for professionals in early childhood health and education to use the checklists themselves.” ♥

ACCIDENTAL TRIP REVEALS A HIDDEN PATHWAY

An unexpected discovery could lead to new predictive biomarkers of drug response for cancer patients.

An immunologist by training, Dr Tara Roberts wasn't planning to study cancer. In an effort to find out how genes affect cellular responses to DNA damage, she engineered mice to have only one working copy of a gene called *SMG1*, and was surprised to find a dramatic increase in the incidence of lung tumours and blood cancers. "It was one of those serendipitous discoveries," says Roberts, who published her findings in 2013 in the *Proceedings of the National Academy of Sciences of the United States of America*. A year later,

she landed a job at Western Sydney University with a dual appointment at the Ingham Institute for Applied Medical Research, where she created the Cancer and Inflammation research group that would apply immunological expertise to oncology.

Her team's first order of business: determining how exactly *SMG1* is implicated in tumour growth. As Roberts reported at major cancer meetings last year in Australia, Europe and the United States, her group showed that in cell lines, the loss of

NEED TO KNOW

- The enzyme encoded by *SMG1* regulates inflammatory responses
- The loss of *SMG1* could make cancers more susceptible to mTOR-targeted drugs now in clinical testing
- An interferon inducing pathway can affect whether cancer patients respond to immunotherapy drugs

SMG1 resulted in elevated levels of a critical protein complex called mTOR, one with known links to aberrant signaling pathways involved in cancer proliferation.

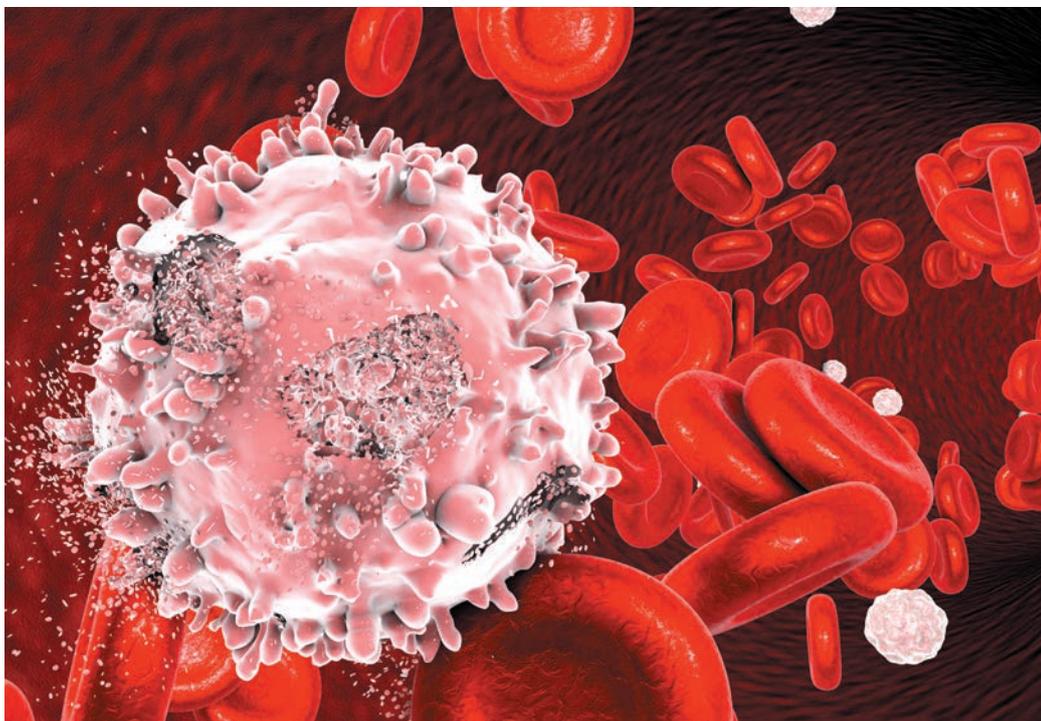
CLINICAL COLLABORATION

To examine the clinical relevance of *SMG1* activity, Roberts and her PhD student, Patricia Rebeiro, collaborated with haematologists from Liverpool Hospital, and biobank managers from the Cancer Institute NSW's Centre for Oncology Education and Research Translation (CONCERT) to collect blood samples from patients with chronic lymphocytic leukaemia, a slow-growing cancer that affects a type of white blood cell.

They found that around a third of these patients had no detectable levels of the protein encoded by the *SMG1* gene in their bloodstream. What's more, in these same patients, cancer cells showed signs of increased mTOR signaling. That suggested the loss of *SMG1* could make cancers more susceptible to mTOR-blocking agents, a premise supported by preliminary lab tests on patient samples.

Roberts and her colleagues exposed cancer cells to an experimental mTOR-targeted drug called sapanisertib, now in mid-stage clinical trials. They discovered that, among cells lacking *SMG1* activity, "there was more growth suppression and cancer cell death in response to mTOR inhibition," Roberts says.

This finding could have significant impact, notes study co-author, and CONCERT programme manager, Nicole Caixeiro, who credits Roberts' multi-disciplinary training and openness to collaboration for making the project possible. "Roberts is one of those basic scientists who appreciates the importance of research that is inclusive and calls upon all different health professionals," Caixeiro says. ■



© KATERYNA KON/SCIENCE PHOTO LIBRARY/ Getty Images; © puruan/ Getty Images

COMMON PATHWAYS

➤ Before coming to Western, Roberts had also been studying the role of inflammation in ataxia telangiectasia, a neurodegenerative brain disorder caused by mutations in a gene called *ATM*. In rat models, she and her colleagues from the University of Queensland showed that the loss of *ATM* leads to the activation of an immune signaling molecule, called interferon, that underpins neuroinflammation in the brain.

Bringing her research full circle, this same interferon inducing pathway was shown to determine a cancer patient’s response to the latest life-saving immunotherapy drugs. Roberts is now examining how this may be exploited to determine the best treatment for individual cancer patients.



The legacy of a mass die-off of mangroves in the Gulf of Carpentaria, Australia. In one of the worst instances of mangrove forest dieback recorded globally, more than 7,000 hectares of mangroves died suddenly after a period of extreme temperature and drought in the summer of 2015-16.

© Alice Gauthey

SURVIVING WHEN WATER GETS LOW

Scientists from Western Sydney University are helping policy-makers plan for climate change.

Recent droughts and heatwave conditions

in northern Australia have led to the death of more than 7,000 hectares of mangrove forests. Brendan Choat, an associate professor at Western Sydney University, is investigating the physiological underpinnings of this widespread die-off. Understanding this is essential for predicting forest mortality and better managing the risk to natural ecosystems posed by drought and extreme climate.

“Trees use an intricate plumbing system of hollow tissues, called xylem, to lift large volumes of water to their canopies from the soil,” explains

Choat. “Droughts cause a reduction in soil moisture and increased evaporation, causing blockages in the xylem and preventing the efficient transport of water to leaves, leading to a decline in the tree’s canopy cover.”

Supported by an Australian Research Council Discovery grant, Choat, along with colleagues from the University’s Hawkesbury Institute for the Environment are examining water and carbon uptake under drought conditions, and the ability of vascular tissues like xylem and stomata to withstand desiccation.

Dr Tony Auld from the Ecosystem Management

NEED TO KNOW

- Droughts prevent efficient transport of water to leaves
- Western researchers are trying to understand the physiological mechanisms behind drought tolerance
- This could lead to better forest management in the face of extreme climate

Science Division at the NSW Office of Environment and Heritage says: “Brendan’s work will help us to identify which tree species are at most risk from water scarcity, allowing us to predict where problems may arise and leading to better management of forests and woodlands.”

This research was supported by the Australian Government through the Australian Research Council, and the Australia Pacific Science Foundation.

This project was funded by the Cancer Institute New South Wales.



(Left-right) Lynn Kemp and Greg Cohen.

RECOGNISING EXCELLENCE

Western Sydney University research excellence awards are given to the best of a stellar spread of work.

From detecting fast-moving pieces of space junk, to helping children reach their full potential, two award-winning Western Sydney University researchers exemplify the diversity of study being undertaken at the University.

“Two years ago, it sounded crazy,” recalls Associate Professor Greg Cohen of his idea to use biologically-inspired cameras to track space debris as it travelled around the Earth (full story p17). But fortunately, Western didn’t think so.

In January 2017, Cohen began his postdoctoral fellowship in neuromorphic engineering — a field of electrical engineering inspired by the

way the brain processes signals — at the University’s MARCS Institute for Brain, Behaviour and Development.

“Western gave me the freedom to try things and to do things differently. Particularly in an area of research that I didn’t think would be easy to get support for,” explains Cohen.

That freedom paid off, and he has since received funding from both the Royal Australian Air Force, and the United States Air Force to continue exploring the application of these cameras for space traffic management and space situational awareness.

Cohen was thrilled to receive WSU’s 2018 Excellence as an

Early Career Researcher award. “It’s great to get an award for doing something different or difficult. It’s really nice to have that acknowledged.”

He attributes much of his success to the conditions at Western. “It’s a great working environment, from my colleagues working in the lab, right up to the people who make the decisions at the top. It’s been a fantastic experience. And I don’t think you get this anywhere else.”

This is a sentiment echoed by Distinguished Professor Lynn Kemp, from the School of Nursing and Midwifery. “Everyone at Western has a ‘can do’ attitude — they recognise that what we do in the world matters.”

A leader in the field of community-based early childhood interventions, Kemp’s work has made a difference to the lives of more than 20,000 families in New South Wales, and some as far away as Seoul, South Korea (full story p23).

Her Maternal Early Childhood Sustained Home visiting programme, or ‘MECSH’, involves family and child health nurses visiting pregnant women at home for eight weeks before birth, and for the first two years of their child’s life. As well as meeting their physical developmental milestones, children from the trial MECSH cohort consistently met or exceeded the national average in school performance, indicating the programme’s long-term impact.

Kemp joined the University in 2015 as the Director of the School of Nursing and Midwifery’s Translational Research and Social Innovation team. At Western her work has flourished, leading to her being named Researcher of the Year for 2018.

“It’s just so wonderful to be recognised by my colleagues and the University for the work we’re doing and the impact that we’re making for families and children across the world,” says Kemp. ♥

NEW ROADS TO SUSTAINABLE CONSTRUCTION

Polymers could reduce the environmental footprint of heavy industries, while improving health outcomes for workers.

It was fossil hunting

during his childhood in Iran that set Dr Bob Abtahi on the road to scientific research and discovery. “My father and his cousin would take me to river banks and mountain slopes, often carrying me on their backs,” recalls the Western Sydney University research fellow.

What caught young Abtahi’s attention was not the fossils themselves, but his cousin’s wish that a temporary plastic coating could be invented that could protect the day’s delicate finds during the trek home. The world of polymer materials the adults described, from hard plastic tools, to the rubbery soles of his shoes, had Abtahi hooked.

Today, Abtahi’s research on these highly versatile materials is focused on their potential to clean up heavy industry in applications such as polymers used in eco-

NEED TO KNOW

- Polymers are substances made up of repeating chemical units
- Polymers can be used to suppress dust in the mining industry
- Geopolymers based on fly ash could be used in eco-friendly concrete

friendly concretes, and polymer coatings that contain dangerous dust on mining sites.

The re-emergence of the incurable and often fatal ‘black lung’ disease, or coal workers’ pneumoconiosis, among Australian miners highlights the critical importance of dampening dust in mining. That’s currently

done by spraying water on dusty surfaces — but vast quantities of water, often delivered by truck, are required.

“Our alternative is a water-based, environmentally friendly polymer spray that forms a durable film that traps the dust,” Abtahi says. “You only have to spray it once.”

Another dust source at mines is that stirred up by heavy vehicles on the dirt roads. Abtahi has developed a polymer formulation for that too. “By using a polymer coating to hold the surface together, I can make a temporary road,” he says. The polymer’s makeup can be tailored so that the sun’s UV rays break it down after a predetermined time, and the road is reclaimed by the bush.

NOT JUST CARBON

When most people think of polymers, carbon-based materials come to mind. But Abtahi’s research at Western’s Centre for Infrastructure Engineering has begun to investigate the potential of other types of polymers for application in cement-free environmentally friendly concrete.

“To make 1 tonne of cement, almost 1 tonne of CO₂ emissions are created — so let’s

use other binders,” Abtahi says. He is developing concrete based on heavy industry waste materials such as fly ash, slag and clay, known collectively as ‘geopolymers’.

Whereas cement is calcium-based, these geopolymers are rich in aluminium and silicate. The key to making a geopolymer concrete is to mimic the chemical bonds that form when cement is mixed with water. Abtahi is tapping his expertise with regular polymers, which he is adding to the mix to improve the concrete’s final properties. “Not many people have tried using polymers to modify geopolymers,” he says.

The research forms part of a project Abtahi is working on with building materials company James Hardie. “Bob’s enthusiasm for the technologies he is involved with is infectious, and we have found the experience of working with him and WSU to be constructive and rewarding,” their spokesperson says.

Objects made from plastics and other polymers have become so ubiquitous in modern life, it is easy to forget what world-changing materials they are. Abtahi’s research is a reminder of their potential. ■



A GUT FEELING

Crucial work to understand the gut bacteria of koalas is raising the possibility of a new treatment for hospitalised koalas, which could enhance survival rates of this vulnerable species.

When koala, Bingara Liz was admitted to the Port Macquarie Koala Hospital, she was in a bad way. Suffering from a severe case of chlamydia, her eyes were red and almost swollen shut. She was put on a course of intravenous and topical antibiotics to treat the infection. Liz is just one of many koalas (*Phascolarctos cinereus*) treated in wildlife hospitals every year. The Australian Koala Foundation estimates perhaps 20,000 koalas have been treated in facilities like the Koala Hospital since the mid-1990s. As few as one fifth survive their treatment.

“They’ll be on the antibiotic and the chlamydia will be starting to clear up but then the animal crashes,” says Dr Michaela Blyton,

a research fellow at Western Sydney University’s Hawkesbury Institute for the Environment. “The assumption has always been that the antibiotic treatment has wiped out their useful gut bacteria and they’re not digesting appropriately, they stop eating, and they just go downhill.”

“IT’S IMPORTANT IN TERMS OF CONSERVATION BIOLOGY, NOT JUST HELPING A FEW LITTLE ANIMALS THAT ARE SICK ON THE SIDELINES”

Research from Blyton, and her colleague, Dr Ben Moore could lead to a new treatment for koalas to counter the harmful effects of the antibiotics, boosting their chance of survival.

With the animal listed as threatened or vulnerable in New

NEED TO KNOW

- Researchers have profiled the gut bacteria of koalas
- Research found that gut bacteria communities can be artificially altered
- Probiotic pills for sick koalas could be derived from this work

South Wales, Queensland and the Australian Capital Territory, the survival rate of koala hospital patients is critical to the species’ success in those states.

Moore and Blyton have been profiling the diversity, abundance and activity of koala intestinal bacteria revealing an astonishing, complex relationship between koalas, their food and their microbes. They found that the microbial community of a koala’s intestine can be artificially altered.

Moore started down the unusual path of examining koala faeces because he noticed that when koalas overbrowsed manna gum (*Eucalyptus viminalis*), their

preferred food tree, most individuals didn’t switch to feeding on the less preferred messmate (*E. obliqua*) trees nearby.

He realised that even though koalas can survive on both manna gum and messmate leaves, they seemed to be selective about the exact species of gum leaf they ate, creating a situation where koalas could be surrounded by edible gum leaves, yet starve to death. Moore wondered whether their microbiome played a role.

He and Blyton designed an experiment to test whether koala feeding had any relationship to their gut bacteria. Along with collaborators, they captured koalas from a manna gum forest and kept them for two months, collecting their faeces and running DNA sequencing on it to identify the resident bacterial species and their functions.

By night, the marsupials were given an abundance of messmate leaves; by day, they were offered manna gum to ensure they would still feed. For nine days, the animals were also administered two daily probiotic pills. Some were dosed with the bacteria extracted from the faeces of messmate-eating koalas living in the wild that had been



Koala faeces being analysed.

This research was supported by the Australian Government through the Australian Research Council.

previously caught and fitted with radio tracking collars, others were inoculated with their own manna-gum-conditioned bacterial community.

When Blyton looked at the results of the DNA sequencing she found that five out of six koalas' microbiomes were changed by their messmate diet and probiotic course. "Some shifted a lot, while others shifted a bit: their microbiomes became more similar to those of the messmate-eating donors," she says.

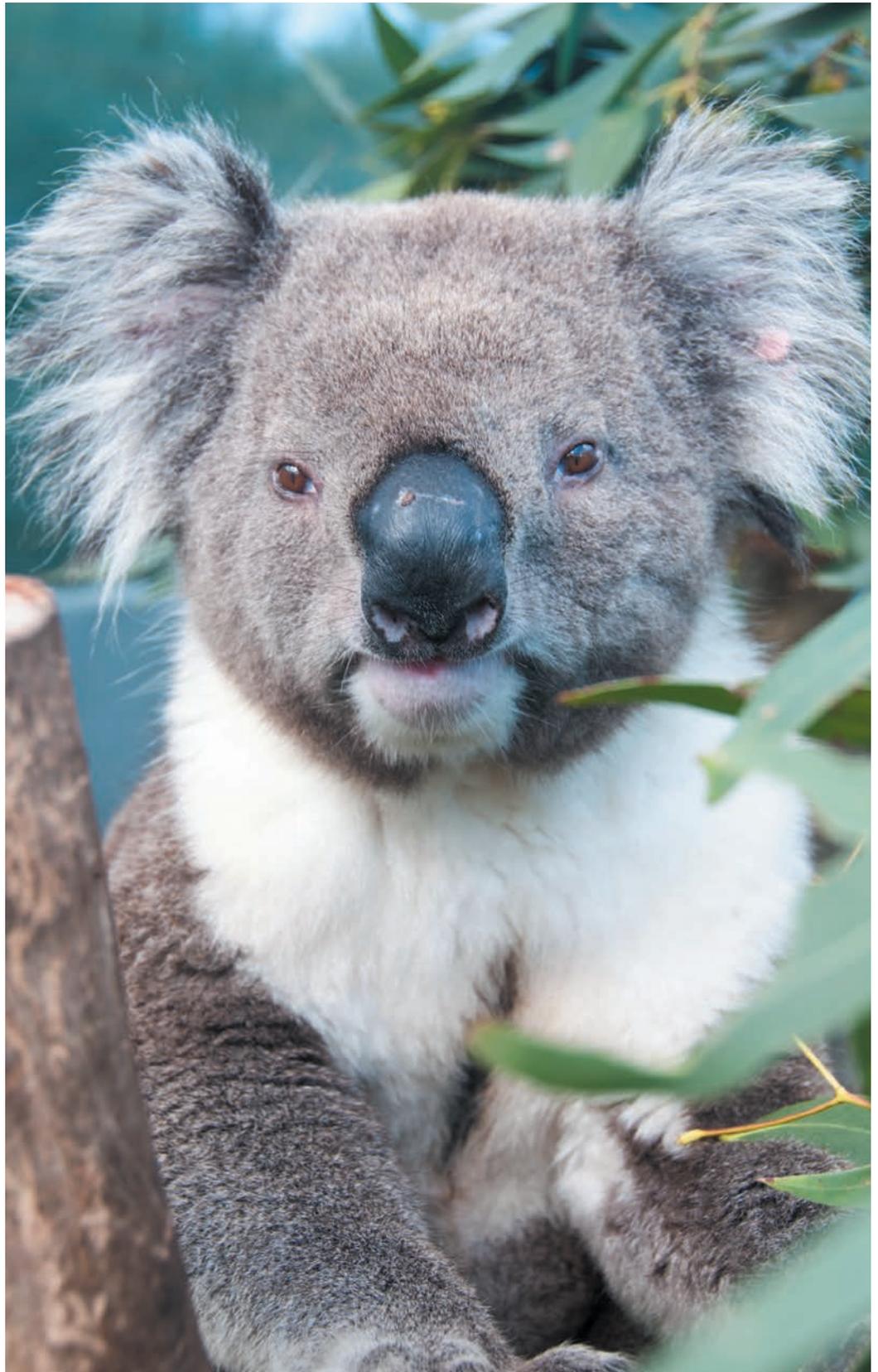
Curiously, the researchers also found that the degree of change in the microbiome determined how much messmate they ate.

"The more the microbiome shifted, the more messmate an animal was willing to eat," says Blyton.

The researchers are now exploring the possibilities for koala microbiome manipulation in more depth.

While Bingara Liz survived, many koalas don't. The researchers say their work could lead to a koala-specific probiotic pill to help maintain the delicate balance of intestinal flora during and after a course of antibiotics.

"It's important in terms of conservation biology, not just helping a few little animals that are sick on the sidelines," says Moore. "There's enough seriously threatened koala populations in New South Wales and Queensland where a substantial part of the population is coming into care. Losing those animals from the population is actually dooming the survival of those populations in the wild. We need to get them out of the hospital and back into those wild populations." ■



REALISING A DREAM TECHNOLOGY

Tackling the condition of sleep apnoea could be as simple as slipping on a T-shirt developed by Western Sydney University researchers.

Unbuttoning his shirt during a presentation

was not the way Dr Gaetano Gargiulo imagined he would launch a new medical device. But as the Western Sydney University biomedical engineer revealed the prototype he wore beneath — a seemingly simple T-shirt — he both captivated his audience and potentially brought relief for

people with sleep disorders around the world.

Gargiulo and fellow engineer, Associate Professor Paul Breen from Western Sydney University's MARCS Institute for Brain, Behaviour and Development, introduced their 'VitalCore' technology at the industry pitch evening of the 2014 NSW Medical Device Commercialisation Training Programme. Now funded by a Cooperative Research Centre project grant of \$10 million-plus, Gargiulo, Breen and the VitalCore team are set to transform how researchers understand sleep.

In Australia, more than a million people suffer from sleep apnoea, a disorder in which the throat briefly closes during sleep, forcing someone to gasp for air several times every hour. The condition disrupts regular sleeping patterns and, if not treated correctly, can lead to high blood pressure, irregular heartbeat, diabetes, and stroke.

Currently, doctors diagnose sleep apnoea and monitor treatments via a sleep study, an

invasive procedure that requires patients spending a night in a sleep laboratory with electrodes on their body and catheters run down their nose and throat. These single-night sleep studies give no indication of how behavioural factors, such as alcohol intake, or environmental factors, such as pollen count, might influence sleep apnoea from night to night.

“AS RESEARCHERS, WE WANT TO WORK ON STUFF THAT LOOKS LIKE THE FUTURE. VITALCORE LOOKS LIKE THE FUTURE.”

“The VitalCore alternative is so simple, we had a hard time explaining it to other engineers,” Gargiulo says. The researchers had been investigating a new method for monitoring blood flow when they discovered that the sensors strips they were

using — silicon rubber bands doped with silver or carbon — were sensitive enough to pick up minute volume changes in the limbs or chest due to the blood pulsing underneath the stretched sensors.

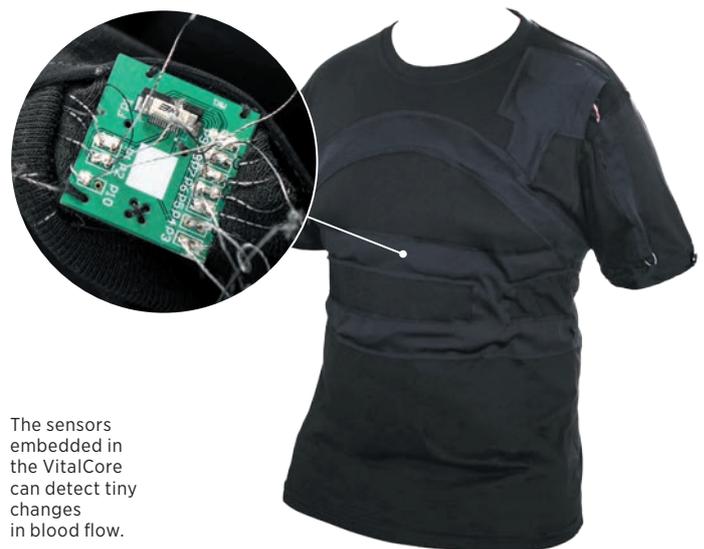
Place a hand on your chest and you'll notice it expand and contract with every breath, as well as the smaller fluctuations of your heartbeat. Sewn into the VitalCore T-shirt, Breen and Gargiulo's sensor strips wrap around the torso. A low current fed through the sensors by a battery produces a voltage, and as the wearer breathes or their heart beats, the sensors stretch and the voltage changes.

SLEEPING EASY

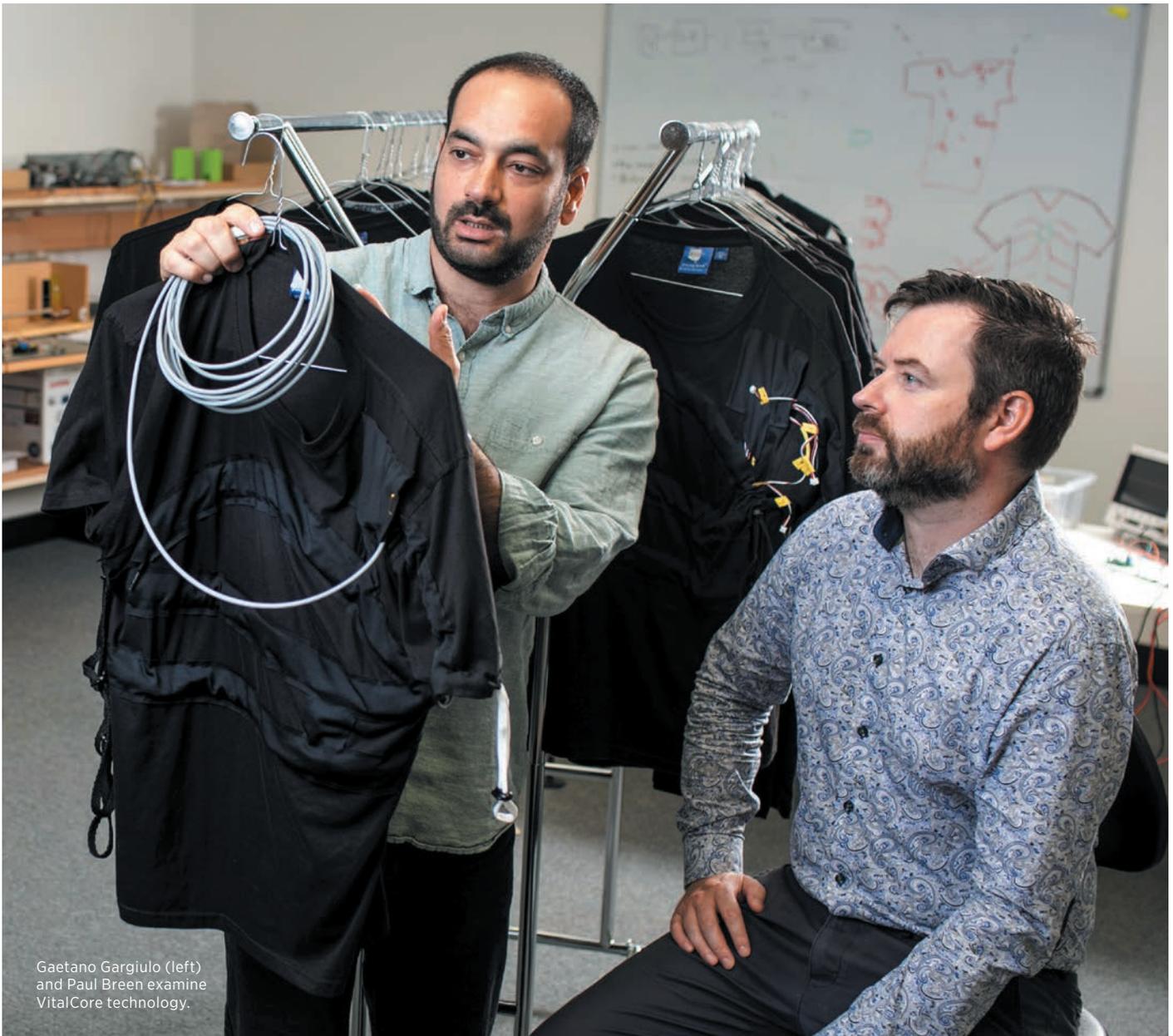
“It's like a second skin,” Breen explains. “The sensors move with the skin to capture the very smallest of fluctuations.” Next-generation Bluetooth technology then relays the sensor's voltage data to an app which analyses the signals to reveal how often the wearer breathes, the volume of their breaths and how often they swallow — providing a snapshot of disturbance during sleep.

NEED TO KNOW

- More than a million people suffer from sleep apnoea in Australia
- Sleep apnoea is typically diagnosed via a laboratory sleep study
- VitalCore is a T-shirt that can monitor a person's sleep in their own home continuously over multiple nights



The sensors embedded in the VitalCore can detect tiny changes in blood flow.



Gaetano Gargiulo (left) and Paul Breen examine VitalCore technology.

To begin an at-home sleep study, a patient simply slips on the VitalCore T-shirt, switches on an app and goes to sleep.

To commercialise VitalCore, Gargiulo and Breen licenced the technology to Medical Monitoring Solutions, led by Neil Anderson, the former CEO of medical devices company, Oventus Medical. The team work closely with this company and are

working with Oventus Medical, CSIRO and Neuroscience Research Australia (NeuRA) to refine the prototype and run clinical trials.

Danny Eckert is leading the VitalCore clinical trials at NeuRA. “I’m excited about rolling out studies that we typically do in the lab into the home to get some insights on how treatments are going over time,” he says.

Eckert, who has been studying sleep and respiration for more than 15 years, says that while VitalCore is still in its early days, initial results are promising. He sees the technology as “a really powerful research tool, given how easy it is to use and wear”.

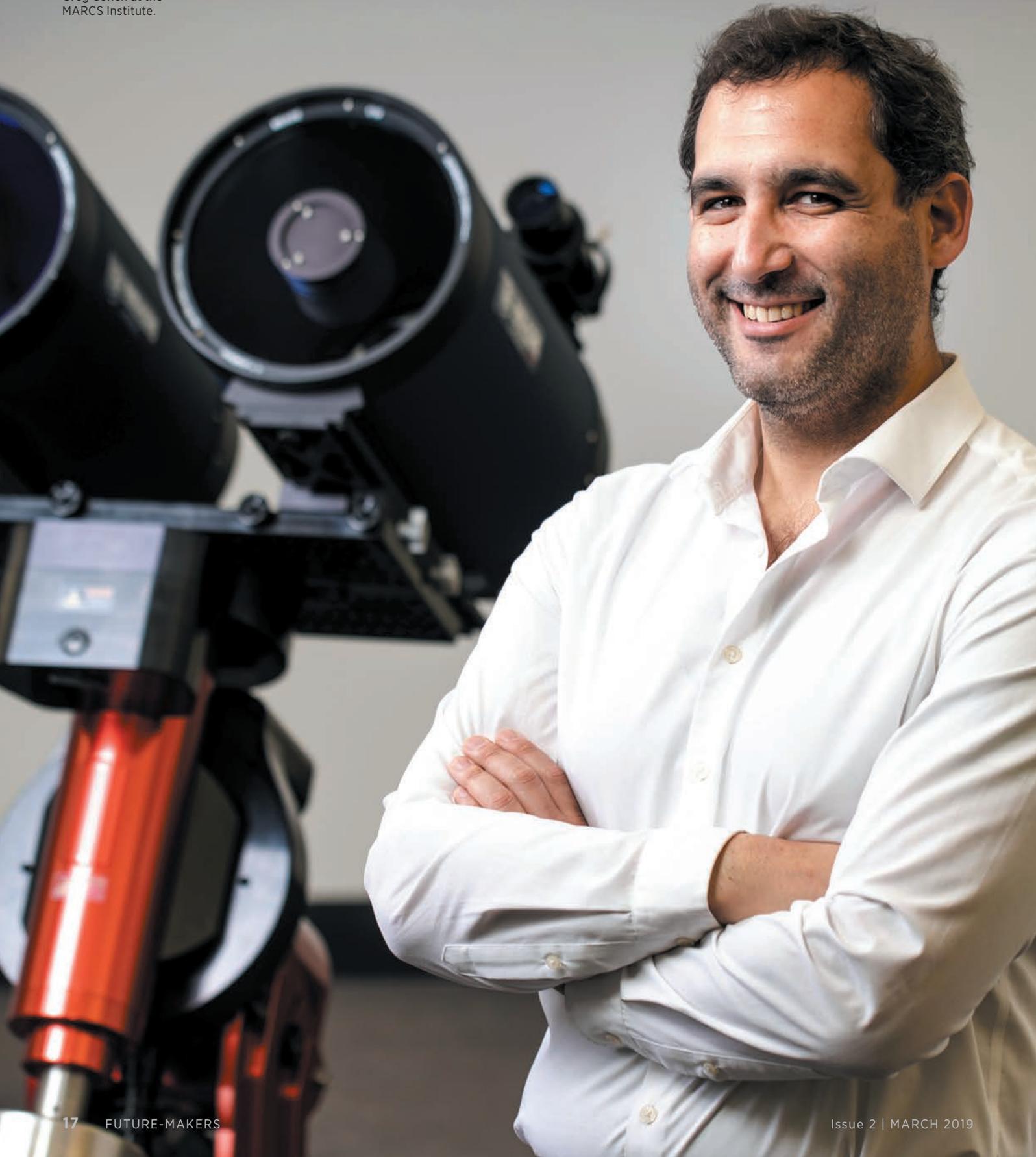
For now, Breen and Gargiulo are focusing on developing the VitalCore for monitoring sleep apnoea. But they say

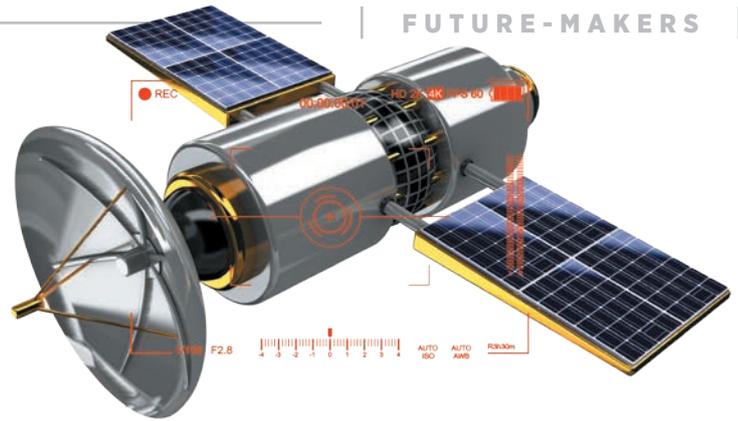
the revolutionary technology could have several other medical applications, and may even one day be used by elite athletes to track performance in real time.

“Our technology is really invisible – that’s where I think we have the edge,” says Breen. “As researchers, we want to work on stuff that looks like the future. VitalCore looks like the future.”



Associate Professor
Greg Cohen at the
MARCS Institute.





FOCUSING ON SPACE JUNK

Biologically-inspired cameras can track satellites that even the best optical telescope cannot, thanks to Western Sydney University's revolutionary, world-first approach to space imaging.

Greg Cohen vividly recalls the moment that changed the course of his career. He and his colleagues were star-gazing through a telescope rigged with a prototype camera that they were working on in his engineering lab at Western Sydney University's MARCS Institute for Brain, Behaviour and Development. Suddenly, the camera picked up a mysterious bright object streaking across the sky. "It was spectacular," says Cohen.

The team realised that Cohen's camera had captured a satellite speeding across the sky in real-time. Standard cameras — even the sophisticated models used by professional astronomers — can't perform this feat as satellites are simply too fast to register as they pass by. But rather than snapping images in the conventional way, Cohen's

camera was designed to mimic the way the eye works.

Now, Cohen in collaboration with one of his former PhD supervisors, Professor Andre van Schaik and the team at the newly formed International Centre for Neuromorphic Systems are developing their biologically-inspired imaging systems to track the space junk zooming around, in danger of crashing into Earth. The technology could also be used to spot asteroids on a collision course with our planet, and for navigation by spacecraft, drones, and submersibles.

Cohen concedes that his path into space-tracking was a bit unusual. Born in South Africa, he originally applied to the University of Cape Town to study medicine, but was instead accepted into an electrical engineering course.

After graduating, he worked for a while as an engineer, but, feeling restless, decided to study finance and tried working in share portfolio management for a while. "It was a disaster,"

laughs Cohen. Still dissatisfied, six years ago he embarked on a PhD, jointly at Western and at the University Pierre and Marie Curie in Paris, in the intriguingly-named field of neuromorphic engineering, which involves developing biologically-inspired electronics.

It was during his PhD that Cohen started working on cameras being designed by his lab-mates. Dubbed "silicon retinas", these cameras borrow the abilities of the human eye. Normal cameras, Cohen explains, can be relatively inefficient for tracking the motion of specific objects, for instance, because they are built to capture everything in a scene. The hope is that there will be enough visual information recorded in the photograph for our eyes to figure out what was going on. "Biological eyes don't

NEED TO KNOW

- Biologically-inspired cameras can track speeding satellites by mimicking how an eye works
- Tracking and managing debris in space is critical in ensuring both future space travel and communications on Earth

work like that — they don't see what they don't need to see," says Cohen. Rather, animal eyes are highly refined and have adapted to see only things pertinent to their survival and to the functions they need to perform. "Biology is much more careful about extracting only the information that it needs," says Cohen.

With that alternative paradigm for image capturing in mind, Cohen, with his colleague, Saeed Afshar, has been working with cameras that are made up of a grid of independent pixels that each work like photo-receptors in the eye. Rather than photographing static images, the pixels only fire when they see movement. It's this quality that makes them ideal for tracking fast-moving satellites in real time, which, as Cohen explains, is a crucial application, given our reliance on satellites for communications and GPS. When old satellites are eventually abandoned and left to float in space, they become potentially dangerous junk.

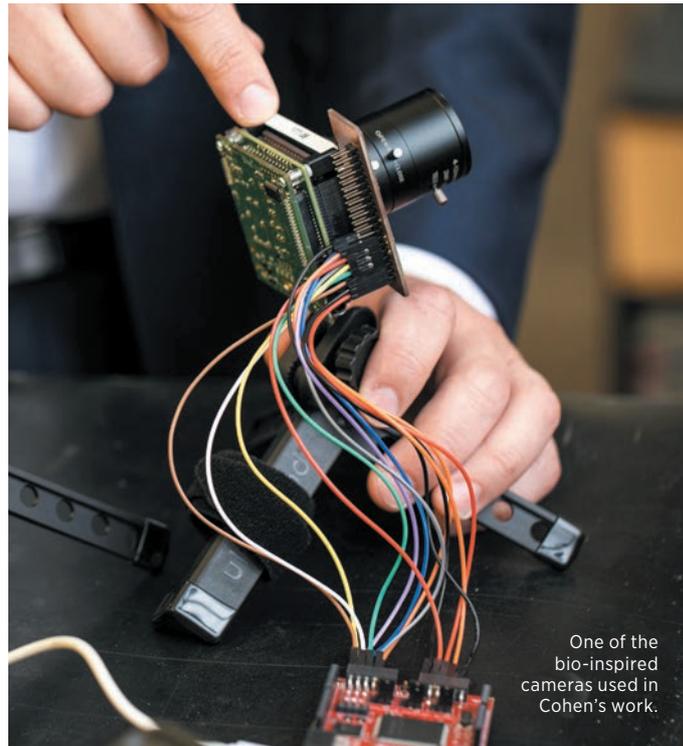
"We've been launching things into space for just over 60 years now," Cohen notes. "It's getting crowded up there." That means that the chance of collisions between satellites is high — and when satellites crash, they break apart. The International Space Station is regularly struck by such debris, moving at bullet speed, with larger objects able to puncture a hole in the station's side.

The doomsday scenario — outlined in the 1970s and known as the Kessler syndrome — is that a ring of high-speed junk will build up around Earth, making it too dangerous for us to launch craft into space,

pinning us to the planet. Such a ring of debris would also disrupt global communications, wireless internet, military intelligence and a host of other applications that rely on satellites

do this because its individual pixels do not image background daylight superfluously, so they do not become saturated.

Today, the gold-standard for tracking satellites is radar,



One of the bio-inspired cameras used in Cohen's work.

to function. Though we're a long way from that, the issue of space safety is taken seriously, notes wing commander Steven Henry, the deputy director of space surveillance with the Royal Australian Air Force, which is supporting Cohen's project. "There are more and more satellites, so the debris has increased," says Henry. "We can't go on without paying attention."

For Henry, a major attraction of the silicon-retina camera is that it doesn't just pick out satellites at night, but also during the day — something even the best optical telescope systems cannot do. The camera can

which works in the day and at night, but is power-hungry and expensive. By contrast, because the pixels only fire when necessary, Cohen's camera drains very little power, which is another advantage. "That's

ideal for putting into orbit or at a remote sensing site," says Henry. He hopes that they may be able to use the technology to start to build a critical network of sensors.

Most exciting for Cohen is that these benefits were found using general prototypes of the camera — which were originally built by the first generation of neuromorphic researchers, and are now produced by companies in France and in Switzerland, to help investigate how the eye works, rather than specifically for space applications. His WSU team is now tailoring the designs and the processing algorithms for space tracking to see how much better they will perform.

Cohen is also in talks with NASA and ESA scientists about using the cameras for deep space navigation. They could potentially be placed on orbital stations to look for early signs of asteroids veering dangerously close to Earth. Cohen also hopes that the cameras could one day find their way on to autonomous vehicles and drones, and be used by submersibles for underwater searches.

The take-home message, according to Cohen, which inspired him to come up with these applications for silicon retinas in the first place, is that engineers still have much to learn from biology. "I can have a sandwich for breakfast and then do tasks that high-powered computers and robots can't do — and I do them faster, and far more reliably, using far less power," says Cohen. "Clearly biology is doing things in a completely different, but far more effective and efficient way, than today's electronics." ♥

“WE’VE BEEN LAUNCHING THINGS INTO SPACE FOR JUST OVER 60 YEARS NOW. IT’S GETTING CROWDED UP THERE.”

Professor Sally Power
at the PACE facility.

BLUEPRINT

FOR A LAND OF DROUGHTS AND FLOODING RAINS

‘Stress testing’ pasture plant
species to help safeguard Australia’s
livestock and dairy industries.

© Michael Amendolia



The PACE facility at WSU's Hawkesbury Institute for the Environment.

NEED TO KNOW



- PACE measures the response of widespread pasture plant species to extreme climate conditions
- Early results indicate that warmer conditions may not be as good for cool-season pasture productivity as we might expect
- The PACE project is exploring ways to ensure the sustainability of the livestock, wool, meat and dairy industries

‘Extreme’ could become the new normal for pastoral conditions within the next 30 years, an ecologist at Western Sydney University predicts.

“Due to climate change, what we today perceive as ‘extreme’

conditions for pasture production may be considered ‘normal’ by the middle of this century,” says Professor Sally Power, leader of Western’s Pastures and Climate Extremes (PACE) project.

Climatologists warn that the severity and the frequency of extreme weather events will increase as the planet warms.

In Australia, these events are likely to include intense heatwaves, longer droughts and more frequent flooding, along with a more variable and less predictable climate. As a result, Australia’s natural and managed ecosystems, including pasturelands, will be exposed to unprecedented combinations of heat- and water-stress.

This could spell trouble for Australia’s dairy and livestock farmers. Cattle and sheep need a reliable and consistent supply of high-quality forage, consisting mainly of grasses and legumes. A future, more extreme climate, including changes in seasonal rainfall patterns, could disrupt this supply.

PACE, which involves 12 faculty members, three postdoctoral researchers and four PhD students, is investigating the response of widespread pasture grasses, including fescue, ryegrass and phalaris, and legumes, such as alfalfa, (also known as lucerne) to extreme climate conditions, including heatwaves, droughts and changes in rainfall regimes. This innovative project will help ensure the long-term sustainability of Australia’s pasture grazing systems.

“We know too little about the likely impact of climate change and climate variability on Australia’s pasturelands. PACE should provide important answers, helping to ensure the future sustainability of the livestock, wool, meat and dairy industries,” says Power.

Power has long investigated the effect of human activities on plants, as well as ecosystem functioning and sustainability. PACE fits well within this research agenda.

“The project is multi-faceted,” says Power, “We are interested in

how well pasture species perform when exposed to warmer, drier conditions, and understanding what biological characteristics influence species’ climate sensitivity. We are also interested in how the seasonal timing of growth and plant nutritional quality are affected by more extreme climates.”

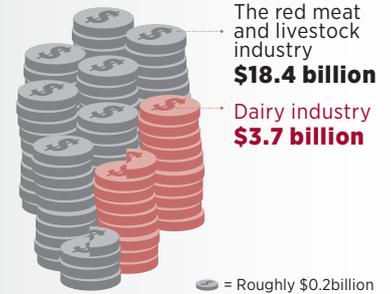
SETTING THE PACE

The PACE field facility is located at the University’s Hawkesbury Institute for the Environment. It includes six large polytunnels, each divided into eight plots. Each plot is further sub-divided into four sub-plots, resulting in a total of 192 experimental planting areas. Some of these plots are warmed using infra-red heat lamps, and because natural rainfall is prevented from reaching the experimental plots, researchers can experimentally manipulate rainfall patterns by artificial irrigation.

“The set-up will allow us to ‘stress test’ pasture species by exposing them to climate



ECONOMIC IMPACT



➤ In September 2018, Australia's Red Meat Advisory Council unveiled its 'State of the Industry Report 2018', compiled by Meat and Livestock Australia. The report notes that the red meat and livestock industry employs well over 400,000 Australians, either directly or indirectly, and that it contributed \$18.4 billion to Australia's economy in the 2016/17 financial year alone. The dairy industry contributed \$3.7 billion over the same period, according to Dairy Australia figures, while the value of Australian wool exports in 2016-17 was estimated to be around \$3.6 billion.

conditions predicted for the end of the century," says research fellow, Dr Amy Churchill. "For example, we are exploring the effects of warming and drought during the crucial winter and spring growth periods."

"Ours is a holistic approach," explains Power, "PACE provides the opportunity to go beyond plant-level studies, allowing us, for example, to delve into the role of plant-microbe interactions, and to assess what happens at the plant-soil interface. By undertaking detailed studies of above- and below-ground responses to warming and drought treatments, we hope to uncover mechanisms underlying climate sensitivity and resilience in pasture species."

The core facility was completed in 2017. Warming treatments

began in April 2018, and a seasonal drought treatment commenced in June, at the beginning of the winter season.

PACE has already revealed intriguing findings: "Winter 2018 was our first opportunity to examine pasture responses to the combination of drought and warming conditions," says Power, "As expected, we found that reduced rainfall in winter and spring greatly reduced the growth of most pasture species. We thought that warming might increase cool-season activity across the board, but what we actually found is that increased air temperature can have positive and negative effects on productivity, depending on species. Early indications are that warming can exacerbate the effects of drought through increased water stress, implying that warmer conditions may not be as great for cool-season pasture productivity as we might predict."

The PACE facility and research programme is co-funded by Western Sydney University, Meat

"WE KNOW TOO LITTLE ABOUT THE LIKELY IMPACT OF CLIMATE CHANGE AND CLIMATE VARIABILITY ON AUSTRALIA'S PASTURELANDS. PACE SHOULD PROVIDE IMPORTANT ANSWERS."

and Livestock Australia (MLA) and Dairy Australia.

"Australia is a land of drought and flooding rains," says Doug McNicholl, supply chain sustainability innovation manager at MLA, "The impact of these events determines the economic, social and environmental sustainability of the red meat and livestock industry. PACE provides industry with the ability to consider future feedbase

requirements, which is critical to our sustainability."

Dairy Australia anticipates that PACE will improve understanding of the impact of changing climate and extreme weather on the feedbase required for milk production. But it is also looking to future-proof itself. It is interested to learn, for example, what species will thrive under climate extremes and that could potentially be introduced to pasture-based dairy systems, as well as the reasons for their survival. "This knowledge will contribute to solutions for future dairy production under climate extremes," says Catherine Lescun, the programme development manager of feedbase and animal nutrition at Dairy Australia.

Power agrees. "Ultimately," she says, "PACE should inform the development of adaptation strategies, including new management practices, aimed at ensuring the long-term sustainability of Australia's pasture grazing systems, and reducing industry exposure to climate-related risk." ■

This research was supported by the Australian Government through the Australian Research Council.





HELPING CHILDREN REACH THEIR POTENTIAL

A maternal visiting programme developed in Western Sydney is helping children in Australia, and around the world, thrive.



Distinguished Professor Lynn Kemp, Director of the School of Nursing and Midwifery's Translational Research and Social Innovation team.

In her first year of school

at Campbelltown North Public School, Mindy Taylor is flying. With her proud mother Tina watching, she was called on to the assembly stage to receive an honour badge for her academic efforts.

“The principal was blown away by Mindy’s work and said, ‘You see her writing, she’s amazing,’” Tina recalls. The Indigenous mother of three girls under the age of seven considers it a miracle that her daughter, who spent the first days of life in intensive care, has thrived.

Mindy’s health, and engagement with learning, as well as Tina’s confidence in her parenting, is partly due to her involvement in a unique child and family health nurse home visit programme that is making an impact around the globe.

Before the birth of her first baby, Tina was approached to join the Bulundidi Gudaga (‘healthy pregnancy, healthy baby’) Maternal Early Childhood Sustained Home visiting (MECSH) programme for Aboriginal families in the Macarthur region, in south-west Sydney.

Although she had her husband, father and sister, Tina says her first pregnancy was an emotional time because it made the absence of support from her mother, who had died four years earlier, feel more acute.

“It was the first I’d heard of the home visit scheme,” she recalls. “The other women in my mothers’ group all had to make appointments to go to the doctors and weigh-ins, while I had the nurse coming to my home.

NEED TO KNOW

- MECSH stands for Maternal Early Childhood Sustained Home visiting programme
- It is embedded into existing services and builds up their capabilities
- It has helped around 15,000 families across Australia, the UK, the US and South Korea

I didn’t realise how easy it made having a baby until I heard other mothers’ stories.”

The weekly home visits in the early days of Mindy’s life were also critical for Tina’s mental health, having been through an emergency caesarean and traumatic birth. “Having them visit and talking to them was great because it is quite lonely being at home with a child. They knew my story so I didn’t have to keep retelling it,” she says.

Tina’s reflections are no surprise to Western Sydney University Distinguished Professor of Nursing Lynn Kemp, an international leader in the field of early childhood interventions in primary and community health and translational research. As the founder of MECSH, she has witnessed the benefits of the home visit programme for children like Mindy.

Like many of its clients, MECSH was born in difficult circumstances.

By the end of the 1990s, some societal structures were fractured in the Sydney postcode region of 2168 that centered on the suburb of Miller, just 38km south-west of Sydney’s CBD.

“There was unrest. The local community health centre got firebombed, most of the shops shut down, the police station moved, and the only GP in the area closed down,” Kemp recalls. “Even Pizza Hut wouldn’t deliver because kids were throwing rocks at the drivers.”

“I DIDN’T REALISE HOW EASY IT MADE HAVING A BABY UNTIL I HEARD OTHER MOTHERS’ STORIES.”

Through all the chaos, child and family health nurses continued to have access to families living in the area, and retained their trust.

In response to the social fragmentation, the NSW Government allocated money for community solutions, under which Kemp was tasked with finding ways to improve health and wellbeing outcomes for children aged up to two years.

“We knew that the only people getting in the door were the child and family health nurses,” says Kemp. She devised the key approach that differentiates MECSH from other programmes: “I realised that MECSH would be better if it was

embedded in existing services and improving their capacity, rather than setting up something separate,” she says.

The MECSH programme set up by Kemp and her colleagues at Western Sydney University, University of NSW, Macquarie University, and local health services, saw nurses regularly visiting the homes of pregnant women up to eight weeks before their child was born, to help prepare them for parenthood. Then continue those visits until their child turned two.

At the time, Kemp’s team only had enough funding to provide the programme to 50% of eligible families, creating the perfect conditions for a randomized control trial.

The trial results were striking. New mothers involved in the MECSH programme were more likely to have a vaginal birth and felt more confident to care for their baby and themselves, and created a home environment that was more conducive to their child’s cognitive development. The babies in the trial were breastfed for longer, met developmental milestones, and had stronger engagement with their mothers.

Tina’s experience reflects these results. Where many of her friends weaned their babies at four months, she breastfed all three children to six months and was supported by the child and family health nurse to feed the babies home-cooked food when they weaned.

“I’ve never fed the girls packet food because the nurses helped show me how to prepare fresh food and how to store it,” she says.

MECSH PROGRAMMES WORLDWIDE



Likewise, Mindy’s success in her first year of school mirrors the results of the original MECSH babies as they began school life. Serendipitously, the trial cohort started school in 2009, coinciding with the first Australian Early Development Census. The census showed that children in the 2168 postcode met, or bettered the national average in school performance.

For Kemp it was an outstanding validation of their work. “We know that the sensitive period in brain development for all domains occur in the first two years, it is a really critical period for laying the foundations for language, social development and emotional control,” she says.

“[Prior to MECSH] You would have expected these children to be doing poorly, but these children were equal to, or better than, the national average, so the programme clearly does have long-term and community-wide impact.”

Kemp believes these impacts are the result of how the programme is embedded into

existing services. “One of the important things about MECSH is that the training is provided to all nurses in the service. The skills then spill over into the way nurses work with every family so we get a whole community effect.”

“MY PERSONAL DRIVER IS THAT NO CHILD ON EARTH HAS THEIR OPPORTUNITIES LIMITED BY THE CIRCUMSTANCES INTO WHICH THEY ARE BORN AND LIVE.”

Beulah Lewis, who oversees MECSH implementation in Lewisham, in the United Kingdom, believes the flow-on impact is one of MECSH’s strengths. “One advantage that staff recognised immediately is that the MECSH training and

tools can be applied across all families, not just families recruited to MECSH. Early identification of further need is a key outcome of the programme delivery which enables effective targeting of resources and onward referrals to support a family’s health needs,” she says.

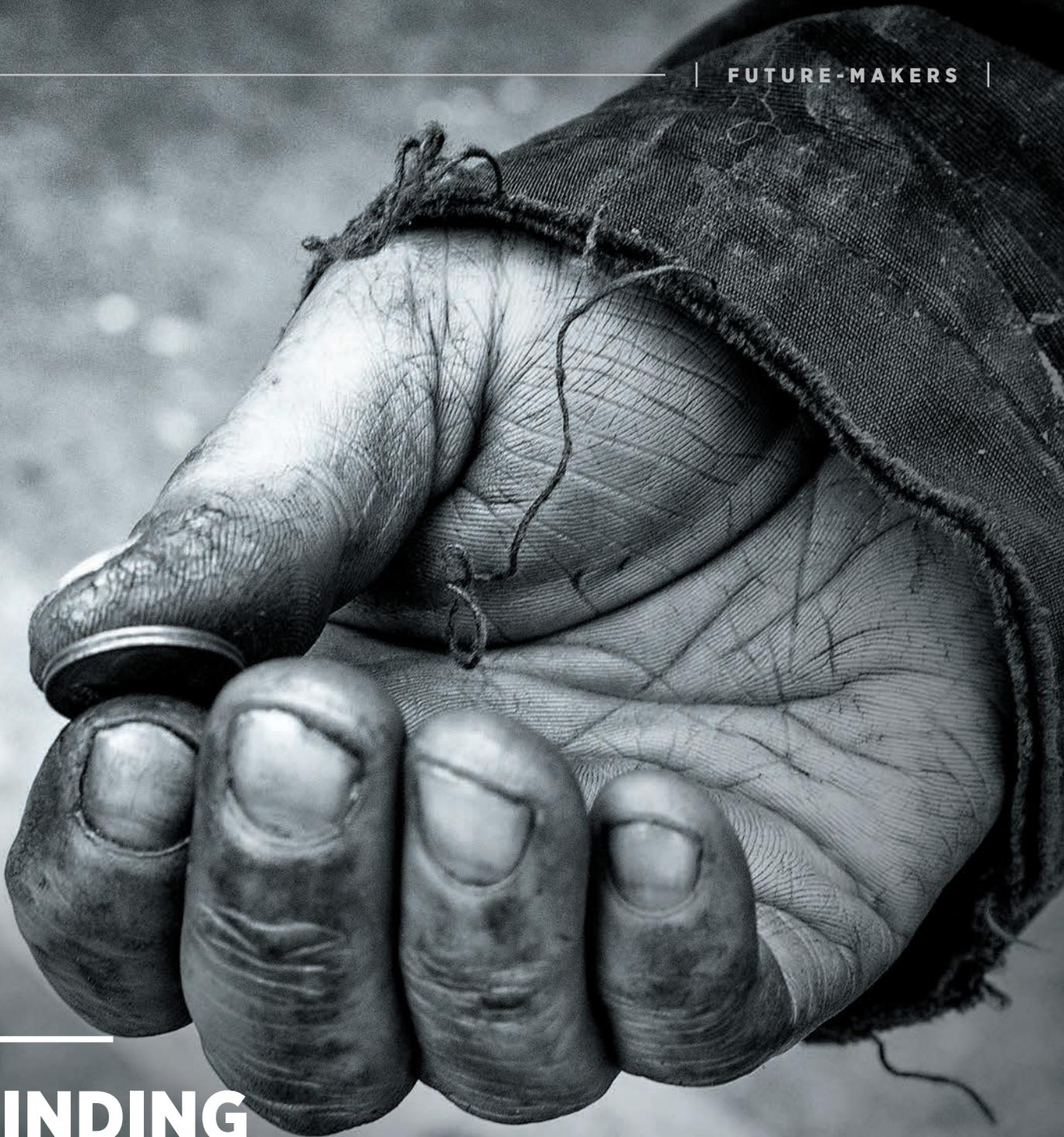
After receiving US federal government accreditation, MECSH began to attract global interest and is now operating in Vermont in the United States, as well as in the UK, and in South Korea. In Australia it is being rolled out across NSW, Victoria and Tasmania, and discussions are underway to implement MECSH in the Northern Territory and Queensland. It is estimated that around 15,000 families are part of MECSH programmes worldwide. In South Korea, Kemp’s work has been instrumental in the establishment of a universal child and family health service system, which includes the MECSH programme, serving the city’s 10 million residents, where previously families had no access to such support.

Young-Ho Khang, director of the support team for the Seoul Healthy First Step Project, and a Professor in the Department of Health Policy and Management, Seoul National University College of Medicine, says a key factor in adopting the MECSH programme was its ability to address health inequalities by delivering help as needed. “MECSH is not a cookbook in home visitation,” Khang says. “MECSH takes into account local situations. It could be applicable in many settings and thus could meet the needs of local areas.”

Ann Giombetti, from the Division of Maternal and Child Health, in Vermont’s State Department of Health, agrees. “It is designed specifically to coordinate and collaborate with Vermont’s statewide system of referral for families with young children,” she says. “This model also allows for more flexibility with regard to enrolment criteria and enables our communities to enrol at any point during pregnancy, including up to six weeks postpartum.”

Kemp is not surprised by its adaptability. “MECSH changes everywhere it goes. It is designed to embed and build the capacity of the local service system and local communities,” she says.

Fifteen years after MECSH was launched, Kemp’s goal continues to grow. “My personal driver is that no child on earth has their opportunities limited by the circumstances into which they are born and live,” she says, laughing at her vast ambition. “I can say to myself that at the end of every day, I feel like I’ve chipped away at my goal and that there is one more family being supported, one more community that is engaged.” ■



FINDING THE X-FACTOR IN RESILIENCE

Critical insights from a collaborative Western Sydney University-Mission Australia study could help identify and help families at risk of homelessness.

© Hugo Fernandes / EyeEm/Getty Images

This project was funded by Mission Australia.

NEED TO KNOW

- The number of homeless people in NSW has increased by 37% since the 2011 census (based on 2016 data)
- The MAC-K family homeless project aims to understand how some people avoid homelessness despite having similar risk factors as those who don't.

Nathan decided it was time to leave home when he had to sleep in the same bed as his two-year-old to stop his partner from taking the toddler with her to score drugs during the night.

For parents like Nathan (a pseudonym), the decision to flee violence and substance abuse often leads to homelessness. But Nathan had a different experience and now his journey to securing a home for himself and his son is helping inform research on family homelessness.

The Mission Australia Centre Kingswood (MAC-K) family homeless project, led by Western Sydney University's Dr Elizabeth Conroy, is breaking new ground thanks to insights gleaned from clients like Nathan.

As Conroy, from the University's Translational Health Research Institute, points out, research is scant on family homelessness in Australia. "Families account for just over half of all people

accessing specialist homelessness services in Australia," she says. "Yet we know little about their experiences because the research, where it exists, is mostly from the US."

The chance to address that lack of knowledge came in 2014 through a collaboration with Mission Australia, who had opened MAC-K as a centre for bringing together its services for disadvantaged families in western Sydney.

Conroy says the MAC-K project provided an opportunity for her team and Mission Australia to better understand both the risk and what allows some people to avoid family homelessness.

"Although we know poverty is a key driver of homelessness, it is not deterministic — it doesn't mean you will necessarily end up homeless." The study, she explains, aimed to understand how some people escape homelessness despite having similar structural risk factors as those who don't.

The project involved one-on-one interviews with Mission Australia clients about their lives and the circumstances that led to their current situation. "We looked for commonalities across these stories, and the key tipping points or risks that elevated people's likelihood of becoming homeless," explains Conroy. The interviewers also explored resilience in clients and how they overcame challenges.

Mission Australia Western Sydney area manager, Julie Jasprizza-Laus, worked with Conroy on the project, and says it was inspiring to see Conroy's team bring academic insights into the field.

"To have clients' stories heard, and evidence provided on what is and isn't working to help them is really beneficial, because in our sector there isn't a lot of evidence on how to support families," Jasprizza-Laus says.

Importantly, the research was able to identify what Jasprizza-Laus calls the "X factor," families that "can experience trauma and debt and be able to navigate through it".

"It means we can identify very early those families that don't have the resilience and wrap some services around them for support," she adds.

"WHILE THIS GROUP IS VULNERABLE, IT ALSO HAS AN INCREDIBLE AMOUNT OF STRENGTH."

Of the 14 interviewees, four Mission Australia clients including Nathan, had not experienced homelessness — and the "X factor" for each, was the existence of at least one family member who was always there for them. "Trauma, grief and loss were still quite prominent in their stories," Conroy says, "but they at least had one person they described as 'their rock' and were able to draw on that support."

Nathan's rock was his mother. The pair had formed a tight bond when they were forced to flee Nathan's violent father. When Nathan could no longer live with his partner due to her drug use, he moved in with his mother and

stepfather. When his ex-partner and her associates threatened violence, Nathan and his son moved interstate.

Subsequently, he returned to Sydney to support his mother after his stepfather died. It took five years for him to secure his own accommodation, with the help of Mission Australia, and he now lives within walking distance of his mum. "Everything I do, I do it for my son. He has made me a better person," he told interviewers.



Conroy says the support of a key individual is critical. Two other factors highlighted by the research: the importance of belonging to family; and achieving the right balance of self-reliance and support, also help stop the slide into homelessness.

With the knowledge gleaned from the interviews and a survey of clients, the research team then held workshops with Mission Australia staff at the Kingswood centre to help them interpret the findings.

They also developed a reflective tool to improve the centre's practices; an outcome Jasprizza-Laus says has been invaluable.

"Having a framework that provides questions to ask each other and challenge your thinking so that you continually improve and stay present in what is happening with your families is an amazing tool to have," she says.

Jasprizza-Laus says the study will also feed into Mission Australia's wider advocacy work.

"It really shows the importance of early intervention and knowing how to build resilience factors in those families that might not have the resources they need," she says. "Having that evidence and research allows us to have strong proof behind our advocacy."

Away from Kingswood, Conroy hopes the pilot study will also help redefine the thinking about the homeless community at a political and social level.

"There is often a portrayal of people at risk as being 'leaners', and it tends to paint a picture of people being incompetent, not putting effort into their lives and making the wrong decisions."

But as Conroy emphasises, the MAC-K project quite clearly demonstrates that such a portrayal is unfounded. "One of the clear messages coming out of this work is that while this group is vulnerable, it also has an incredible amount of strength." ■



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HOW AN ENCLAVE BECAME A CULTURAL HUB

From a haven for new migrants, to an attraction for curious Sydney-siders, Chinatown is now a cosmopolitan bridge between Australia and Asia.

Once a showcase of Chinese culture,

Sydney's Chinatown has changed over time and has emerged as an important gateway to Asia. As 'the Asian century' progresses, Chinatown is expected to evolve further. Pioneering work by researchers from Western Sydney University's Institute for Culture and Society is elucidating how cultural and economic changes are shaping the City of Sydney strategy for Chinatown in the 21st century.

The future of this much-loved feature of Sydney is anything but certain, says Ien Ang, Distinguished Professor of Cultural Studies at the Institute for Culture and Society.

"Sydney's Chinatown has always been seen as this exotic ethnic precinct where you can eat Chinese food and experience traditional Chinese culture," says Ang. "But we wanted to look at what is taking place in Chinatown now and demystify the stereotypes that surround it."

To explore what factors are shaping Chinatown in the 21st century, Ang and her colleagues

NEED TO KNOW

- Sydney's Chinatown emerged in the 1920s
- It became a magnet for tourists in the 1980s
- Chinatown has become more multicultural and transnational, incorporating elements of many Asian cultures

teamed up with the City of Sydney in 2012, funded by an Australian Research Council Linkage grant. The researchers used a variety of approaches, including an analysis of population, immigration and employment data, interviews, student surveys, and observation of participants at events such as the Chinese New Year Festival to research the factors impacting on the cultural development of Chinatown.

Real estate agent George Wing Kee has witnessed the changes. When Wing Kee first set foot

in Chinatown 50 years ago, it bustled with lively cookhouses run by Chinese families and migrants selling produce at street markets.

But today, Chinatown is home to Korean barbeque restaurants and Japanese karaoke bars, and hallmarks of other Asian cultures are beginning to emerge among the traditional food stores and Cantonese-style yum cha restaurants.

"From cuisine to property, there is a swing away from traditional Chinese culture," says Wing Kee, a co-founding member of the Haymarket Chamber of Commerce. "The growth in student and migrant numbers has altered the social structure of Chinatown."

A WOODEN START

Sydney's Chinatown was originally a timber storage yard on Dixon Street in Haymarket in the 1920s. The White Australia policy, Australia's racially exclusive immigration rules, restricted Chinese immigrants from working in most professions, thereby shaping >

This research was supported by the Australian Government through the Australian Research Council. © Panu Kosonen / Shutterstock

THE CHINATOWN AESTHETIC

➤ As Chinatown's demographic becomes younger, the area's facade is also becoming more contemporary. The traditional red-and-gold aesthetic is slowly being complemented by bold Australian-Asian art, such as the neon-blue angels of Jason Wing's artwork, *In Between Two Worlds*.

This modern take on Chinese culture is also finding its way into urban design. *The New Century Garden*, a sprawling public artwork at the junction of Thomas and Hay Streets designed by artist Lindy Lee, seamlessly merges with the area's streets and buildings, while the Chinese Garden of Friendship's more traditional walled design creates a space detached from the rest of the city.

'In between two worlds' an artwork by Jason Wing located in Haymarket, Sydney.

> the area and its activities. The Chinese population of the early 20th century sold produce in the nearby Hay Street market and opened shops, restaurants and lodgings to cater for the Chinese community.

When the White Australia policy was abolished in the 1970s, Chinatown was reborn as a tourist attraction with the trappings of an ‘authentic’ Chinese village. Ceremonial archways were erected at both ends of Dixon Street and street corners were decorated with lanterns, pagodas and stone lions (see right).

This revitalization soon transformed Chinatown from an ethnic ghetto into a tourist attraction. With the influx of tourists came a growing number of migrants from other Asian countries, such as Thailand, Indonesia, Korea and Taiwan, settling in the area and establishing businesses.

A CULTURAL CHANGE

Over the past 20 years, the number of residents in



Chinatown has increased eightfold. Data from the 2016 census revealed that some 68% of these residents were born in Asia, the highest density in greater Sydney. With the University of Technology Sydney and other educational institutions just a few blocks away, the number of visiting Asian students in Chinatown has also increased.

As a consequence of this surging population growth, the boundaries of Chinatown have expanded beyond Dixon Street to include the broader Haymarket precinct and beyond. Similar to Hong Kong and Bangkok, Chinatown’s residents live in newly developed high-rise apartments. Many of these buildings bordering Chinatown, such as World Square, and the soon-to-be-complete Greenland Centre, which is to be Sydney’s tallest residential tower, have

been funded by investors from China and elsewhere in Asia.

“THIS EXCHANGE HAS TRANSFORMED CHINATOWN INTO A BRIDGE BETWEEN AUSTRALIA AND ASIA.”

In addition to strengthening economic links between Asia and Australia, these developments have also created a thriving hyperlocal economy which shows no signs of slowing down. The majority of these businesses are small enterprises, including restaurants, beverage shops, and independent fashion brands. To stand out from the competition in the rest

of the city, Ang says that many businesses in Chinatown take their cues from trends in Asian cities, from restaurant design to shopping mall management.

“A lot of these businesses have links to their home countries, either through imported products or foreign capital,” says Ang. “This exchange has transformed Chinatown into a bridge between Australia and Asia.”

LOOKING TO THE FUTURE

Chinatown’s evolution into a vibrant multicultural hotspot has fostered both connection and alienation in its residents. On the one hand, many Asian students see Chinatown as a home away from home. But on the other, many older Chinese residents feel the area has become disconnected from its history. The move from tradition to inclusion, such as the renaming of the Chinese New Year Festival to the Lunar New Year Festival in November 2018, has also stirred up controversy between some in the Chinese community and other Asian groups.

Since the team’s report was published in 2016, the City of Sydney has used the findings to develop a strategic plan for the area. Ang’s team has also summed up the findings in a book, *Chinatown Unbound*, to be published in 2019.

Ang points out that as Sydney becomes a more globalised city, urban policies for the area need to strike a balance between celebrating heritage and strengthening global ties to ensure that Chinatown can continue to thrive in the 21st century. “It’s important that Sydney does not forget Chinatown’s meaning in the history of the city,” says Ang. ■

The Golden Water Mouth sculpture on Hay Street, Sydney.



REMEMBERING THE HEROES OF THE TOP END

Brett Bowden brings World War II to life in his book *Direct Hit: The Bombing of Darwin Post Office*.

Around 10am on February 19, 1942, in the Darwin Post Office, telegraph supervisor, Archibald Halls, was testing a connection to Adelaide when he interrupted himself: “The Japs have found us and their bombs are falling like hailstones,” he tapped out in Morse code. “I’m getting out of here. See you later.”

Halls sheltered with eight others, including the Postmaster Hurtle Bald and his family, in an air-raid trench dug into the backyard of the post office.



Archibald Halls (left) and Hurtle Bald (right).

NEED TO KNOW

- The Darwin Post Office was bombed in 1942
- It was the first ever wartime attack on Australian soil
- Brett Bowden is the first to examine aspects of the incident

They took a direct hit from a 500-pound bomb, smashing a crater the size of a bus. No-one survived.

It was the first of almost 100 raids by Japanese bombers on mainland Australia. The combined death toll on that day was more than 240 people, perhaps as many as 300.

Australia’s communications link with the world, an overland telegraph that met an undersea cable, had run through the post office and was severed in the strike. With Japanese planes still buzzing in the sky, three men emerged from their shelters to reconnect the line. The rest of Australia needed to know the threat. In less than an hour, they had jury-rigged a connection and tapped out a message that the first ever wartime attack had occurred on Australian soil.

Brett Bowden, Professor of History and Politics in the School of Humanities & Communication Arts at Western Sydney University, detailed the bombing and the heroic acts that saw Australia’s communications restored, in his book, *Direct Hit: The Bombing of Darwin Post Office*.

It was the first time the story of the post office had been told. Bowden dug out never-seen archives, comprising thousands

of pages of first-hand accounts to piece the details together.

“HAVING A GOOD UNDERSTANDING OF HISTORY MEANS THAT HOPEFULLY WE DON’T MAKE THE SAME MISTAKES AGAIN.”

Bowden was inspired when he stumbled across a personal connection with Postmaster Hurtle Bald. He hailed from the same town as Bald and he couldn’t put aside the thought that this important part of Australian history was missing the recognition it deserved.



The Darwin Post Office before (top) and after the bombing (bottom).

“People will go and walk the Kokoda Trail in remembrance and they’ll visit the Gallipoli Peninsula on Anzac Day, but very few bother to go to the north of Australia to see what happened in 1942,” Bowden says.

The popular history book was a change of pace from his usual, more academic work. Bowden says he found a great deal of satisfaction in telling the story. “I am still getting emails or letters, old-fashioned handwritten letters, from people who are grateful to me for telling this story.”

He says that it’s important, particularly with the recent rise of the far-right, that Australia knows its own history, “Having a good understanding of history means that hopefully we don’t make the same mistakes again.”

Ho Chi Minh City

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Western Sydney University is a large, student-centred, research-led university, embracing Australia's global city, Sydney. Established in 1989, the university proudly traces its history to 1891 through the Hawkesbury Agricultural College. Today the university has more than 180,000 alumni, 45,000 students and 3,300 staff.

The university is now ranked in all major global university ranking systems and is in the top two per cent of universities worldwide. Through investment in its academic strengths and facilities, the university continues to build its profile as a research leader in Australia and is nurturing the next generation of researchers.

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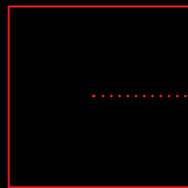
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