CHALLENGING RACISM
An app to examine attitudes

AT THE COAL FACE
Polluters heed water quality expertise

TURTLE POWER
Heroic effort to save a species

FUTURE-MAKERS

WESTERN SYDNEY UNIVERSITY

VISIONARY RESEARCH

What's next for cancer diagnosis

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ABOUT THIS MAGAZINE

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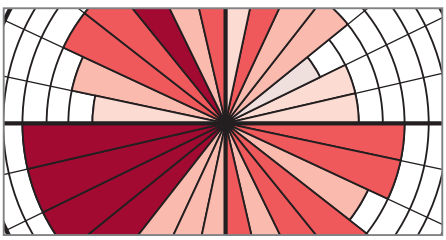
ABOUT

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.

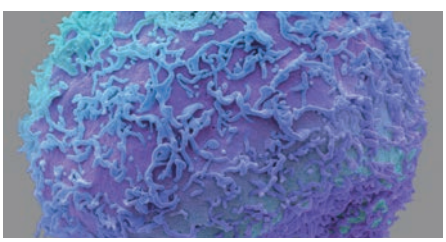
The University is now ranked in all major global university ranking systems and is in the top two per cent of universities worldwide. Through investment in its academic strengths and facilities, the University continues to build its profile as a research leader in Australia and is nurturing the next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

Western Sydney University graduates go on to take up rewarding careers that make real contributions to societal change, lifting the pride of students, staff and the community. A guiding principle for the university is that there is no limit to potential success for those with drive, talent, confidence and ambition.
www.westernsydney.edu.au

FUTURE-MAKERS



Cover story



WESTERN SYDNEY
UNIVERSITY

RESEARCH PATHWAYS

Have you considered a career in research? Have you ever thought about studying a PhD? Do you have skills and experience that you could apply to an impactful research project?

Western Sydney University provides pathways for those interested in a career in research and looking to further their qualifications.

MASTER OF RESEARCH (MRES)
The Master of Research is a two-stage program designed to provide you with the skills you need to confidently undertake a PhD. Previous research experience is not required.

Stage 1: Research training coursework.
Stage 2: Supervised research project.

The degree involves two years full-time (or equivalent part-time) study.

Scholarships are available for domestic students.

RESEARCH TRAINING AND EXPERIENCE
If you have completed a substantial research project as part of a previous qualification (such as a Bachelor Honours or Research Masters), you may be eligible for direct entry into the PhD program.

If you can demonstrate significant research experience in your role at work or in the community, this may be recognised for direct entry into the PhD program.

DOCTOR OF PHILOSOPHY (PHD)
The Doctor of Philosophy provides you with the opportunity to develop capacity to conduct research independently at a high level of originality and quality. You will uncover new knowledge through discovery, the formulation of theories and the innovative interpretation of previously established ideas.

A PhD qualification opens up a range of new career opportunities. It is also a great way for you to contribute the knowledge and experience you have gained in your existing career and make a positive impact to the research happening in your field of interest.

The PhD degree involves three years full-time (or equivalent part-time) study. Scholarships are available for domestic and international candidates. You will also be supported by the Graduate Certificate in Researcher Engagement, Development and Impact (GCREDI).

CAREERS IN RESEARCH

Academia
Lecturer
Researcher
Executive

Industry
Researcher
Business Development
Scientist

Government
Policy Advisor
Intelligence Analyst
Communications Specialist

w: westernsydney.edu.au/future/study/courses/research.html
e: grs.enquiries@westernsydney.edu.au

ON THE COVER

↗ Doctor Quang Vinh Nguyen, senior lecturer in visual analysis, computing and ICT uses virtual reality goggles to visualise genomic data on cancers to better inform treatment options. The technology was developed in collaboration with The Children's Hospital at Westmead and the University of Technology Sydney. **page 15**

Cover image:
© David Swift

FROM WESTERN SYDNEY TO THE WORLD

What if an app could be used to improve mental health and economic outcomes for 50,000 Sri Lankan farmers? What can subtle changes in the eating and breeding habits of turtles tell us about the condition of our rivers and aquatic ecosystems? What if good oral health plays a more significant role in healthy pregnancies than we ever imagined?

Researchers at Western Sydney University are answering these questions and posing many more, working closely with industry partners and community stakeholders. At Western Sydney University, we rank second among Australian universities for our collaborative publications. It is through genuine partnerships that our researchers make discoveries that are relevant, important and applicable. This publication presents some of those findings.

Welcome to the first edition of *Future-Makers*, our new magazine designed to highlight the incisive and innovative research happening at Western Sydney University.

With a mission to serve regional and international communities, Western Sydney University's research is designed to be impactful at both a local and global level. The University is among the top two per cent of universities worldwide, and in the top 100 universities less than 50 years old, according to the Times Higher Education World University Rankings. Our reach and impact are global, but the questions are generated locally in Western Sydney.

The stories of discovery you will read are significant, not just as research exercises but in terms of relevance to peoples' lives. They bring fresh perspectives to emerging and intractable problems, arriving at innovative and effective solutions. This is exemplified by work from the University's Institute of Culture and Society whose researchers are looking at the importance of trust in building progressive dialogue and policy on climate change. This is an approach that mitigates against ideology and political polarisation, and instead seeks to promote collaboration.

This first edition of *Future-Makers* tells the story of this vital research, along with articles about equally important and impactful research and their results across Western Sydney University that will contribute to the economic, social and environmental wellbeing of communities.

We encourage you to read on. More than that, we urge you to get involved and join us on our collaborative journey.

Professor Barney Glover
Vice Chancellor and President

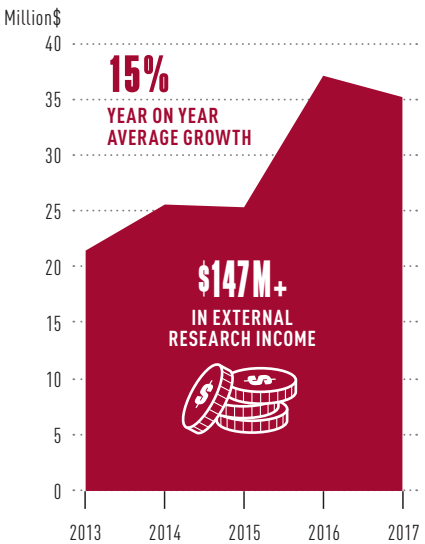
Professor Deborah Sweeney
Deputy Vice-Chancellor and Vice-President
(Research and Innovation)

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.

RESEARCH

RESEARCH INCOME



RESEARCH WITH IMPACT

Health effects of overweight and obesity in 195 countries over 25 years

Journal:
New England Journal of Medicine

Published: 2017

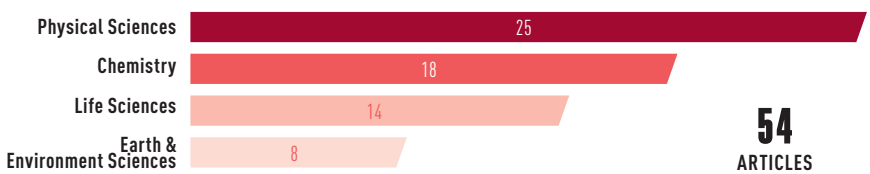
* More details at:
www.altmetric.com/details/20969637
(as of 17 May 2018)

HIGHER DEGREES BY RESEARCH COMPLETED IN LAST 5 YEARS

805
COMPLETED DEGREES (2013-2017)

RESEARCH OUTPUT BY SUBJECT

IN THE 2017 NATURE INDEX



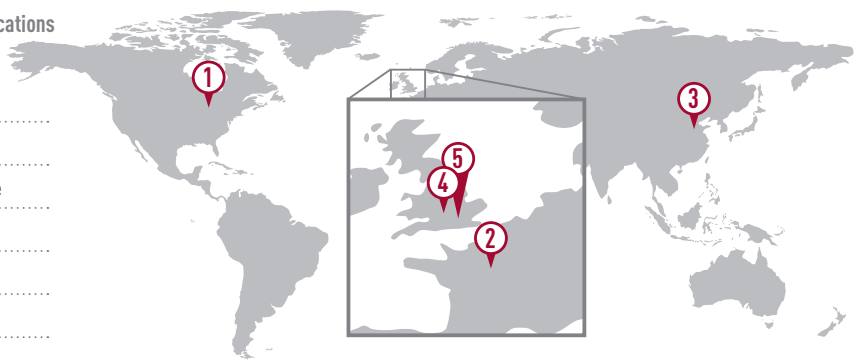
54
ARTICLES

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

TOP 5 INTERNATIONAL COLLABORATORS

based on co-authorship for 2013-2017 in Scopus-indexed publications

Number of papers		
1	109	University of Minnesota (UMN), USA
2	98	CNRSS Centre National de la Recherche Scientifique, France
3	95	Chinese Academy of Sciences, China
4	94	University of Oxford, UK
5	81	Imperial College, UK



STUDENTS

EDUCATIONAL ATTAINMENT IN FAMILY

42.6%
FIRST IN FAMILY TO OBTAIN UNIVERSITY DEGREE

44,797
TOTAL STUDENTS

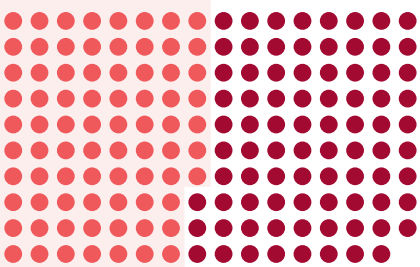
STAFF

GLOBAL PERSPECTIVE

61%
OF WSU ACADEMICS ARE FROM INTERNATIONAL BACKGROUNDS

WSU STAFF COMPOSITION

● = 10 people



770
RESEARCH ENGAGED STAFF

1,590
TOTAL STAFF

GLOBAL RANKINGS

2018 LEIDEN RANKINGS

Western Sydney University is ranked 2nd in Australia and 96th in the world for research collaboration

TOP 2

2017 TIMES HIGHER EDUCATION WORLD UNIVERSITY RANKINGS

TOP 2%

2015 EXCELLENCE IN RESEARCH FOR AUSTRALIA (ERA) NATIONAL REPORT WSU DISCIPLINES ABOVE WORLD STANDARD

★★★★★

- Applied Mathematics
- Ecological Applications
- Soil Sciences
- Ecology
- Plant Biology
- Forestry Sciences
- Materials Engineering
- Complementary and Alternative Medicine
- Oncology and Carcinogenesis
- Pharmacology and Pharmaceutical Sciences
- Cultural Studies

★★★★☆

- Macromolecular and Materials Chemistry
- Microbiology
- Civil Engineering
- Electrical and Electronic Engineering
- Nursing
- Public Health and Health Services
- Human Geography
- Psychology
- Linguistics
- Historical Studies

2017 GLOBAL SUBJECT RANKINGS

* CWUR: Centre for World University Rankings
ARWU: Academic Ranking of World Universities
QS: QS World University Rankings

NURSING
2018 CWUR

1st in Australia

4th in the World

Ecology
76-100 (ARWU)

Agricultural Sciences and Forestry
101-150 (QS)

Electrical and Electronic Engineering
76-100 (ARWU)

Sociology
51-100 (QS)

LEADING COLLECTIVE ACTION ON CLIMATE CHANGE

As trusted information sources, museums are ideally placed to facilitate climate change discussions and solutions.

Zaria Forman's Whale Bay No. 4 was the subject of a multimedia installation in the Climate Museum's first exhibition and the first work to be shown by the new museum.

© Zaria Forman

This research was partially funded by the Australian Government through the Australian Research Council.

NEED TO KNOW

- Museums are seen as trustworthy and impartial by the public
- They could be utilised to communicate science and policy on climate change

Western Sydney University researchers

have identified museums and science centres as important contributors to global discussions and decision-making on climate change.

Research by Dr Fiona Cameron, a senior research fellow at the Institute for Culture and Society, and her colleagues, found that museums are seen as trustworthy and impartial — even more so than government communication — making them ideal platforms for taking a lead in climate change conversations and decisions.

"We need to do more about tackling climate change. I feel very passionate about it," says Cameron.

Ninety-one per cent of those surveyed in Australia and eighty-nine per cent in the US feel powerless to influence climate change policy and decisions, with a similar number stating that citizens' views should be included in policy decisions.

Cameron and her research team surveyed communities, museum audiences, staff and management, and relevant politicians both in Australia and the US. They found that all groups thought it was important that museums are recognised as key players and cultural brokers in tackling climate change and its politics.

"Not only should museums talk critically about climate science, they can act as collection points for policy and encourage debate and discussion. Museums can maintain trust in the community as long as they present a range of options and aren't too political," she says.

> "MUSEUMS CAN ACT AS COLLECTION POINTS FOR POLICY AND ENCOURAGE DEBATE AND DISCUSSION"

Cameron and her team created a framework for museums to help address climate change in their exhibitions and through global multi-stakeholder alliances. Input into the exhibition guidelines came from conversations between communities, humanities researchers, climate scientists and museum staff.

Museums around the world, including Te Papa Tongarewa, the Museum of New Zealand, are now using Cameron's framework.

The work has gone on to support the creation of a dedicated climate change museum in New York, among the first such museums. It's a reflection of the cultural shift that is needed to address such an urgent and multifaceted problem.

A SUCCESS STORY OF TIME AND PLACE

Western Sydney is the birthplace of a new literary movement.

NEED TO KNOW

- WSU researchers have facilitated the birth of a new literary movement
- For the first time, the voices of western Sydney have been represented in Australian literature

Western Sydney, says the lead character in Felicity Castagna's novel *The Incredible Here and Now*, is a place where "those who don't know any better drive through the neighbourhood and lock their car doors".

The Writing & Society Research Centre at Western Sydney University and the Sweatshop Western Sydney Literacy Movement which is housed in the Centre, believe this perception has to be challenged. Culture, after all, is shaped by the stories a society tells itself.

"Western Sydney is the face of modern Australia," says Centre Director Anthony Uhlmann. "It reflects the diversity and richness of contemporary Australia." In 2007, the Centre, then led by Ivor Indyk, founded a group to connect young writers in the region and develop locally generated representations of Western Sydney. For the first time, the voices of Western Sydney are being written into the Australian literary opus.

As part of the process, four writers, Michael Mohammed Ahmad, Felicity Castagna, Luke Carman, and Fiona Wright, were given scholarships to complete doctorates in creative writing. They were guided by WSU academics, developing their writing and critical thinking skills and produced major works of literature representing Western Sydney that have gone on to win major Australian literary prizes (see box).

This project ultimately developed into Sweatshop, led by Michael Mohammed Ahmad, and a Crown Packer Foundation funded project called 'Creating Writing in Western Sydney', involving all of the writers.

Sweatshop's program has engaged with local schools to mentor budding writers. So far, it has yielded 10 anthologies and nine full-length works of fiction, non-fiction and poetry, published by Giramondo Publishing (also housed in the Centre) and Sweatshop.

Uhlmann suggests that a new Western Sydney literature movement is forming. "The idea of a 'movement' in literature points to something significant, involving a number of writers. This is what we have in this case."

Michael Mohammed Ahmad with a Lurnea High School student.

LITERARY AWARDS

The works supported by the program have won six major national literary awards and been shortlisted for many more:

- NSW Premier's New Writing Prize (*An Elegant Young Man* by Luke Carman)
- Nita B Kibble Award for Women's Life-Writing (*Small Acts of Disappearance* by Fiona Wright)
- Sydney Morning Herald Best Young Novelist Award (twice) (*The Tribe* by Michael Mohammed Ahmad and *An Elegant Young Man* by Luke Carman)
- Prime Minister's Literary Award for Young Adult Fiction (*The Incredible Here and Now* by Felicity Castagna)
- Queensland literary non-fiction award (*Small Acts of Disappearance* by Fiona Wright)

VIRTUAL JUSTICE

New technology could make court buildings a thing of the past.

Some court and tribunal hearings will one day take place without a physical courtroom at all, according to Western Sydney University's Professor David Tait. As coordinator of the Court of the Future Network in Australia and New Zealand, an associate researcher at France's Judicial Research Institute and member of the School of Humanities and Communication Arts at WSU, Tait (pictured above) and his colleagues have been developing a virtual courtroom to make justice more accessible and ensure safety of witnesses and juries.

For the traditional courtroom drama, participants convene in an archetypal wood-panelled room. However a physical gathering is not necessary for every hearing in today's justice system, the researchers say. Demanding all stakeholders attend in person not only inconveniences those who need to travel long distances to be present, it can endanger witnesses and juries attending high-risk or high-profile cases.

This is reflected by the trend of court closures around the world; Ireland has reduced its number of court buildings by more than half and in Australia, New South Wales and Victoria are on track to do the same.

Tait and his colleagues visited courts around the world, explored international best practice and consulted with architects and digital engineers to build a prototype of a distributed courtroom – a physical courtroom with the participants arrayed around the courtroom either on screens or in person. This led to the subsequent development of a virtual courtroom, in which the meeting takes place without the need for a physical courtroom at all, using the same virtual reality technology used in computer games.

"Judges can sit in their own chambers, lawyers and prosecutors stay in their own offices and clients of legal aid agencies take part from their offices," says Tait. The programme uses an architect-designed virtual environment, into which images captured by high-definition cameras are embedded with sound co-located with the image. Each participant has a life-size view of the other participants, positioned as if they were in a physical courtroom.

Participants – judges, lawyers litigants, defendants, witnesses, even jurors – from anywhere in the world could use this technology to take part. The facility provides protection for witnesses and jurors from onsite intimidation and harassment by a defendant or their associates. And it could offer enormous administrative cost savings by reducing the number of traditional courtrooms and court buildings. But the immediate use is most likely to be for less complex matters heard by tribunals.

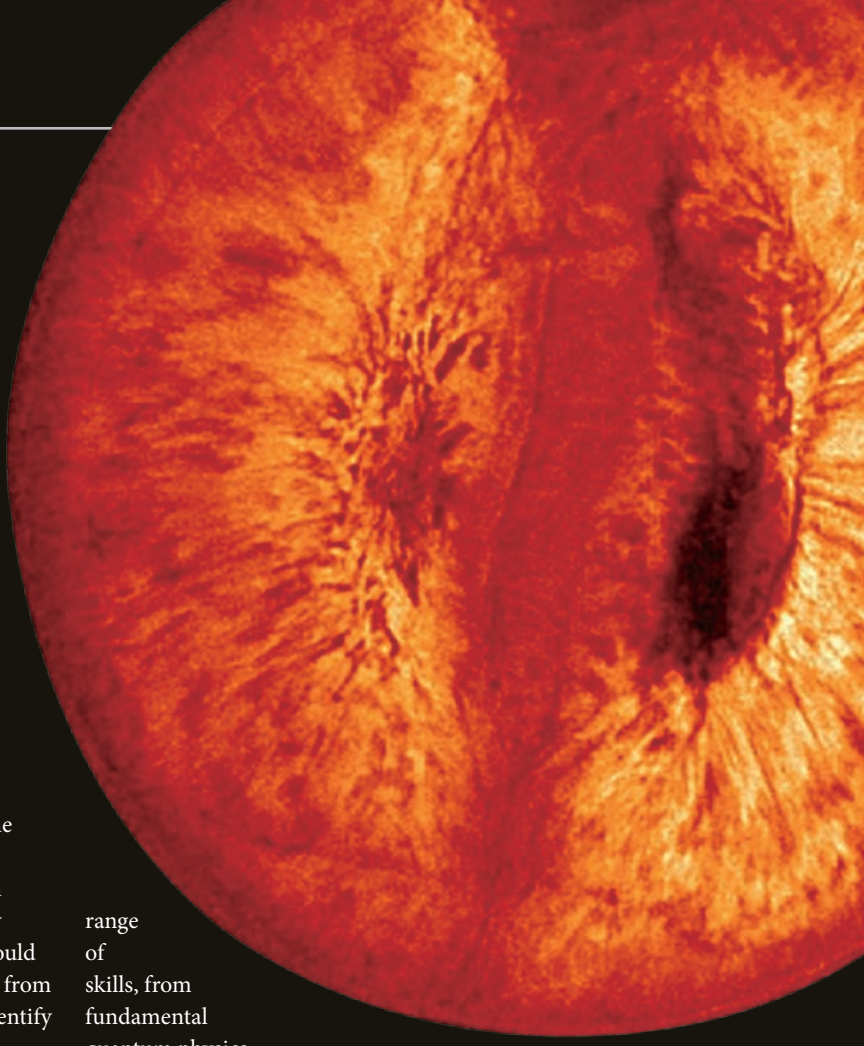
Tait says they're hoping to have the technology ready for use in real hearings within the next few years, and already have had expressions of interest from the United Kingdom, France and Germany.

NEED TO KNOW

- Court and tribunal hearings can take place entirely in virtual reality
- A prototype has been developed by WSU researchers

EXPLORING MRI AT A DEEPER LEVEL

WSU researchers are transforming the common MRI technique to glean unprecedented insights into human tissue.



NEED TO KNOW

- WSU research has improved MRI scans
- This can be used in early cancer detection
- It also has industrial applications

Cancer is a leading cause of death with over 14 million new cancer cases occurring each year worldwide. A significant proportion of the global burden of this devastating disease can be prevented by early detection and treatment of primary tumours.

Cancer patients around the world are likely to benefit from new diagnostic tools being developed at Western Sydney University. Invasive and risky biopsies are routinely used to diagnose cancer. But these could be replaced by a 'virtual biopsy' generated from safe MRI scans once the research of the Nanoscale Organisation and Dynamics Group at Western Sydney University is broadly adopted. A virtual biopsy would acquire enough information from an MRI scan to be able to identify the tumour, categorise it as benign or malignant and provide, ideally, all the information that can be acquired from a traditional physical biopsy but in a non-invasive manner.

And it doesn't stop there. The group's imaging skills are already helping brain disease researchers, environmental chemists, grape growers and geologists searching for minerals.

"This system is incredibly versatile, we can tackle just about anything you can think of," says the group's leader, Professor Bill Price.

"Whether it's a grape berry, brain tissue or sandstone, it's a porous medium — liquid contained in a cavity — so from an MRI perspective there's not a huge difference."

The group is a node of the National Imaging Facility (NIF), which has put them in contact with diverse groups of researchers. The group boasts a range of skills, from fundamental quantum physics, through to clinical experience, and with this breadth of knowledge, they have developed ways to extract more data from magnetic resonance scans.

> "THE GROUP'S PULSE SEQUENCES ARE SO EFFECTIVE IT HAS BEEN INCLUDED AS STANDARD BY A MAJOR MANUFACTURER"

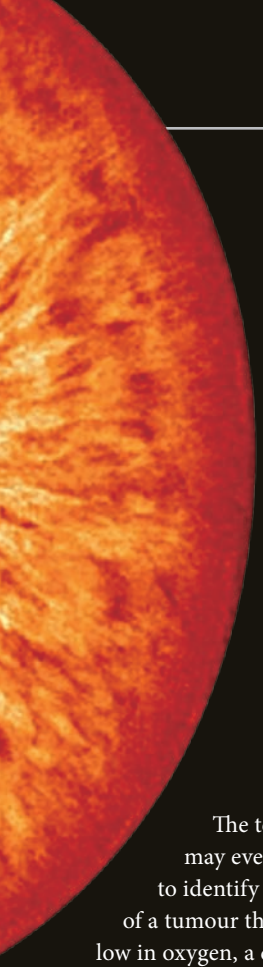
They have developed MRI techniques, known as pulse sequences, to extract specific information, or in some cases suppress unwanted effects, says Dr Tim Stait-Gardner, a NIF fellow who's part of the group.

"If a sample is dissolved in water there's a huge water signal that obscures the molecules of interest. We have developed techniques to remove the water signal so we can see traces of compounds such as brain metabolites," he says.

The group's water suppression pulse sequence is so effective that it has been included as a standard sequence by a major MRI manufacturer, Bruker.

Another strength is the group's ability to not only identify the molecules in a sample, but to measure their motion, a property called diffusion. The new parameter could assist in cancer diagnosis, says Price.

"Standard MRI measures the concentration of molecules, so it might not pick up a brain tumour, for example. Because the tumour cells might have a different internal viscosity than normal cells, with a diffusion filter you might be able to achieve good contrast between the normal tissue and the tumour."



The inside of a grape, as seen by an MRI scanner

The technique may even be able to identify parts of a tumour that are low in oxygen, a crucial breakthrough, as this hypoxic tissue is more resistant to radiotherapy treatment.

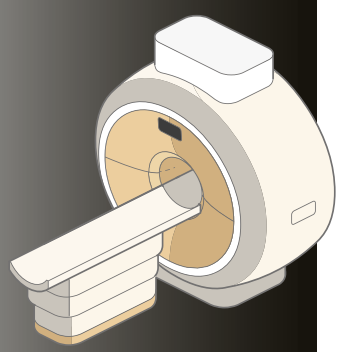
In addition to diagnosis, Dr Abhishek Gupta, a postdoctoral researcher, is working with nearby Liverpool Hospital to improve cancer treatment by combining their innovative MRI scans with radiotherapy to recommend more precise dosage. "You want to be able to see the fine boundaries of the tumour to make sure you treat all of it without damaging healthy tissue," Gupta says.

Gupta is also developing advanced MRI-contrast agents which can be injected into the body to improve the clarity of tumour images and enable accurate disease diagnosis and management.

Price believes the techniques will have a huge impact. "The developments in the field have been enormous. Ten years ago, what we're doing now was science fiction," he says.

WHAT IS MRI?

↗ Magnetic Resonance Imaging (MRI) is performed by a giant elongated doughnut-shaped magnet in hospitals in which patients must lie very still. A 'pulse sequence' uses radio-frequency pulses of electromagnetism to interrogate the hydrogen atoms in the relevant tissue or sample to generate a signal, which is reconstructed by computer to create an image. Because different tissues modulate the signals differently, a detailed picture can be assembled. MRI's advantage is that it is biologically safe, it can image soft tissue and in some cases, video can be created from the imaging.



COLUMN CHEMISTRY

A bright idea from WSU has doubled the efficiency of a common analytical technique.

NEED TO KNOW

- ↗ Chromatography is a common scientific analysis
- ↗ WSU research has improved its speed and accuracy
- ↗ The method has been adopted by a major chromatography supplier

"Everything we deal with in the real world is a mix of components," says Andrew Shalliker, a professor from the School of Science and Health at Western Sydney University. He is interested in finding better ways to separate those components rapidly for scientific analysis.

His team's improvements to a process known as chromatography will allow faster analysis of samples from environmental science, forensics, food science, drug research and more.

Chromatography is a method for separating chemicals in a sample by passing it through a porous medium, often a tube packed with tiny spheres. Different chemicals in the sample seep between the spheres at varying rates and reach the end of the tube at different times, allowing them to be identified by their retention times.

Shalliker says: "Chromatography is used in nearly every facet of modern life, but it's rarely recognised outside those people using it."

The team's technique solves a long-standing problem in chromatography which is that where the spheres meet the walls of the tube, the porosity is not uniform. The chemicals that travel near the wall move at a different rate from the chemicals in the centre of the tube, compromising results.

Shalliker realised the solution was to collect data only from the centre of the column and throw away the sample that had travelled along the edges.

The result was simple and cheap: an endcap that fits on the tube and prevents collection of components from all but the centre of the tube. "It was a lightbulb moment," Shalliker says. "Overnight we effectively doubled our efficiency in some of the forms of chromatography."

Chromatography equipment manufacturer ThermoFisher incorporated the team's ideas into their designs.

The faster analysis has prompted Shalliker to redesign other components — technology that he is spinning off into a startup company, to be called Chromaspeed. His new designs will allow even faster separations and higher efficiency.

"The columns we're designing make it easier for the chemistry to work," Shalliker says.

TUBERCULOSIS MODELLERS LEARN THEIR ABCS

Advances in maths and genomics are taking epidemiology places it's never been.

Tuberculosis (TB) is one of the top 10 killers globally. In 2016, there were 600,000 new cases that the best available antibiotics could not treat, so it's crucial to understand how the spread of the disease will change with these new drug-resistant strains.

A supercomputer experiment involving Western Sydney University scientists is providing that key information, which could help save lives globally.

In 2009, Andrew Francis, a professor at the University of Western Sydney, joined with a group of mathematicians, physicists and computational biologists to carry out an experiment using a supercomputer hosted at the University of New South Wales.

The researchers used experimental data which linked the genotypes (DNA information) of TB bacteria with their phenotypes (the characteristics of the organism) in laboratory settings. This data indicated that, at least in petri dishes, antibiotic-resistant TB didn't spread as quickly as non-resistant strains.

That didn't necessarily mean the same would be true in people, however. To understand the real-world implications of the lab tests, Francis, a mathematician, and his colleagues applied a new modelling approach called Approximate Bayesian Computation (ABC). It allows for the calculation of probabilities based on relevant background information, even when the dependence of those probabilities on model parameters is intractably difficult to compute.

NEED TO KNOW

- Supercomputers have modelled TB transmission
- They found antibiotic-resistant TB would infect just as many people as the standard type

It's as though the computer performed an epidemiologist's fantasy experiment. The computer effectively took 4,000 people with infectious tuberculosis (TB) and monitored the transmission of their disease for 40 years. Then the computer rewound the clock, tweaked the genetics of the bacteria, and ran through 40 years again. It did this tens of thousands of times, keeping watch for the signature of antibiotic resistance and its effect on transmission rates and bacterium survival.

The researchers calculated hypothetical real-world TB behaviour from the laboratory data using only eight parameters, half of which were fixed to literature estimates. This pared-down scenario predicted that, despite the observations in the laboratory, the relative fitness of resistant TB strains was similar to antibiotic-sensitive strains. This means that antibiotic-resistant tuberculosis bacteria would infect just as many

"THE COMPLEXITY OF DATA HAS JUST EXPLODED AND YOU CAN'T APPLY TRADITIONAL METHODS TO THOSE DATA"

© Kateryne Kon/Science Photo Library/Getty

people with TB as the kind that succumbs to treatment.

"In the wild, on average, each individual with a resistant strain is still infecting the same sort of numbers as an individual with a sensitive strain would," Francis explains.

It's an important conclusion that would have been impossible to arrive at through laboratory work alone. The model also suggested that virtually all resistant cases arise from transmission, rather than failed treatments, and that antibiotics reduce the prevalence of TB in a population, but raise the proportion of resistant cases.

The findings demonstrate the unique power of combining new Bayesian statistical approaches, new mathematical models and genomic data, an approach that continues to evolve and find new applications. In a second paper, Francis and his colleagues applied ABC to compute the real-world probabilities of TB acquiring resistance to two drugs simultaneously.

How is the broader scientific community taking to the new approach? "It is a very complicated methodology," Francis says. "They're not standard modelling approaches.'

But, Francis argues, techniques like ABC are valuable and necessary. "With the advent of new genetic technologies, the complexity of data has just exploded and you can't apply traditional methods to those data." In other words, a growing sophistication in laboratory methods needs to be met by increasingly advanced models. And with ABC the work has already begun.

PUTTING CIGARETTES OUT OF SIGHT AND OUT OF MIND

Reducing the availability of cigarettes could help smokers quit, and even retailers aren't against the idea.

© Terroa/Getty

Quitting smoking is hard. It's even harder when you can pick up a pack to enjoy while drinking a beer at the local bar or buying petrol at a service station.

Limiting the sale of cigarettes and the related signage, particularly at licensed premises, might help smokers resist the urge to light up and prevent some of the 46,335 hospitalisations and 5,460 deaths linked to smoking every year in New South Wales.

"The most problematic places where cigarettes are sold are pubs and clubs, because people are least able to resist the temptation to smoke when they are drinking alcohol," says Western Sydney University professor Suzan Burton.

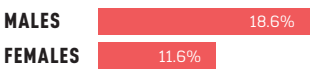
"We know that the widespread availability of cigarettes promotes smoking, and in particular it provides temptation to occasional smokers and people who are trying to quit."

A Western Sydney University research team led by Burton collaborated with Cancer Council NSW to explore the nature and effect of that temptation, and how it might be curbed to make quitting easier.

The team found that despite cigarettes being sold in plain packaging and from closed cabinets in shops, smokers are still heavily influenced by tobacco-related signage. "As somebody said to us in our research, the cigarette price list that you see in service stations and convenience stores is like a 'menu', tempting people to buy," she says.

SMOKING STATISTICS

* Based on the 2016 NSW Population Health Survey



NEED TO KNOW

- Even plain cigarette sales signage encourages smoking
- Cigarette sales are not vital to the survival of small businesses
- Legislation to reduce tobacco retailers could decrease temptation for would-be quitters

The tobacco industry has long argued that cigarette sales are important for the profitability of many small businesses, but Burton's research shows the opposite is true.

"We interviewed more than a thousand alcohol-licensed premises and found nearly 40 per cent don't sell cigarettes; many who do sell them say cigarette sales aren't important and they wouldn't care if they stopped selling them."

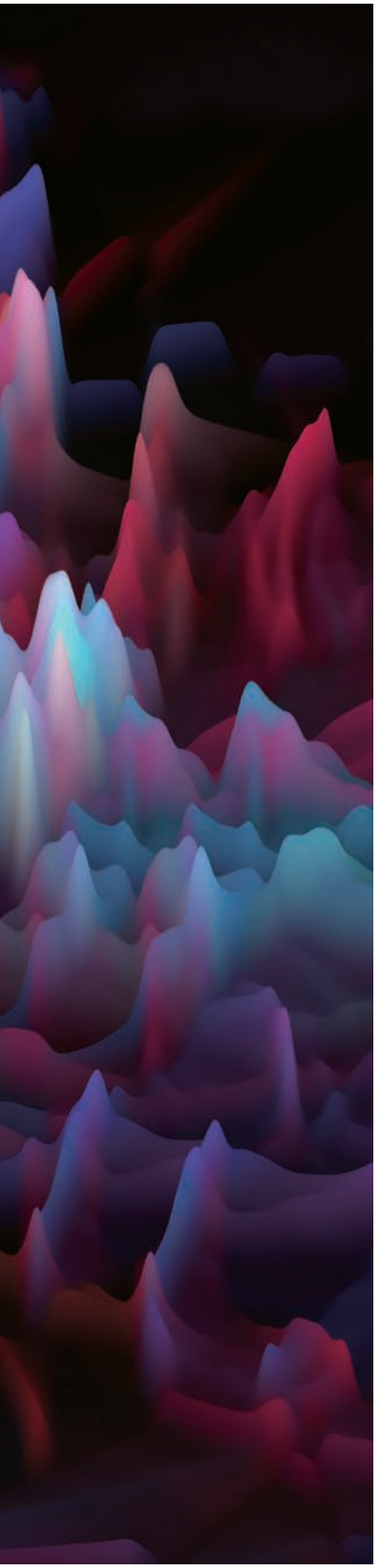
She said her research found that a significant number of licensed premises – especially pubs and clubs – do not oppose a ban on the sale of cigarettes in licensed premises.

"Despite what the tobacco industry says, policy changes that limit the number of cigarette retailers may even be welcomed by many who currently sell them."

Burton's research has led to the establishment of a state government taskforce on tobacco retailing and is informing modelling of policies to minimise the harm done by smoking.

CLEARING CANCER'S DATA CLOUD

Patient data from the past may help save lives today.



(Left) © oxygen/Moment/Getty (Right bottom) © David Swift

Two cancer patients

enter a hospital with the same symptoms, receive the same diagnosis, and are treated using the same protocols. One lives, while the other dies. Three Sydney-based academics believe the secrets hidden in the complexity of our genes may help clinicians explain why.

Over a decade, a Western Sydney University research team led by Dr Quang Vinh Nguyen in collaboration with researchers from The Children's Hospital at Westmead and the University of Technology Sydney have developed visual tools that give oncologists unparalleled insights into understanding complex patient data that enables effective decision-making for the treatment and management of cancer.

A major hurdle to effective cancer treatment is the myriad genetic and molecular changes, almost as individual as a fingerprint, which turn healthy cells into cancer cells. Similar patient presentation often belies very different genetic activity, curtailing the ability of clinicians and researchers to learn from each new case and effectively compare patients.

To overcome this, the team has produced interactive and visual analysis tools, underpinned by machine learning algorithms that can compare a new patient's genomic information to the wealth of historical data contained in The Children's Hospital at Westmead's tumour bank. Such comparisons can provide doctors with useful data on genetically similar patients, and illustrate the impact of differences in cancer's many genetic variations.

Clinicians at Westmead have praised the technology with the research team receiving feedback such as: "The tools were useful in capturing similarities and individual difference among patient genetics" and "the visualisation tools were useful in enabling personalised medicine to compare and identify a patient among a cohort".

Eventually, this system will provide personalised treatment recommendations based on the analysis and comparison of thousands of genes.

NEED TO KNOW

- Analysis of the genetic data of cancers can lead to better prognoses
- WSU research has made a tool to visualise the data to aid diagnosis
- The work has won praise and prizes

BIG DATA, BIG INSIGHTS

Alongside clinical applications, the team's data modelling could bring much-needed clarity to research. "Someone did a study into leukemia patients and found that the activity of 15 genes could predict the outcome of a group of patients," says Daniel Catchpoole from The Children's Hospital at Westmead. "We took the same 15 genes and found no outcome difference between our two groups. So, we expanded the list of genes to a couple of hundred, and found that the two groups were distinguished by genes associated with DNA replication. And when we looked at the treatments used by the two hospitals in the original study, the main difference was a drug that affected DNA replication."

An essential part of the team's work involves visualising these insights in a way that's accessible for potential end-users, says Nguyen: "Everyone interprets differently. We discuss with clinicians and researchers what their expectations are, what they want to see, and what platforms they'll use in their work."

One such visualisation is the "similarity space," a 3D cloud of data points where each point represents a patient, and the position of the points in relation to each other reflects the levels of genomic similarity between those patients' cancers. Groups of data points reflect shared genes, which can be further investigated for clinical relevance. Thanks to a grant from the tech giant Oracle, Nguyen (pictured) has added a second doctoral student to his roster, to further investigate visualising this type of data in immersive environments, as well as virtual and augmented realities.

The team's work is already gathering public and professional support, with Nguyen recalling the group's win of the Cancer Institute NSW 2015 "Big Data, Big Impact" award as one of his proudest moments of the last decade.

Study participants at BabyLab.

BABY BABBLE

Going gaa-gaa over babies has evolutionary roots, and may help infants to develop the power of speech.

The way parents speak to their babies is more important than what they actually say, WSU research is demonstrating.

Ongoing studies of hundreds of infants aged from five months at the MARCS BabyLab have found that parents exhibit consistent acoustic patterns in how they speak to their babies and that this is likely to be critical in helping children learn to communicate.

The BabyLab is one of the world's leading research units exploring the phenomenon popularly known as 'baby-talk' but referred to by scientists as infant-directed speech (IDS). It describes the characteristic way adults speak to very young children and it's been the subject of research worldwide since the middle of last century. One feature that sets the WSU work apart from research elsewhere is its specialised exploration of the acoustic qualities of baby-talk.

"What we are finding is that when parents talk to their babies they make a number of modifications to the way their speech sounds," explains BabyLab's Marina Kalashnikova, a researcher in infancy studies who has expertise in early language development. "We're not talking about the content of what they say but the actual quality of the speech."

Parents tend to speak slower and pause more often when talking to babies. They also noticeably increase their pitch and make the intonation fluctuate so it sounds like their voice is going up and down.

"But more importantly, what we have found is that parents exaggerate vowel sounds," Kalashnikova says. Consider, for example, the word 'sheep'. Parents will extend and exaggerate the 'e' sounds so they say 'sheeeep'.

"It sounds like a very small modification, but we have found that by doing so, parents make their speech more understandable to babies and easier for babies to learn those sounds and produce them themselves." And that's the basis for learning verbal communication, which is fundamentally important for development."

"What we propose is that [baby-talk] does have an evolutionary source, Kalashnikova

NEED TO KNOW

- The characteristics of baby-talk are key to babies learning language
- Fluctuating pitch may have evolutionary roots
- WSU has developed benchmarking for infant language development

BABY-TALK EVOLUTION

↗ Infant-directed speech transcends not only human cultures but also species and is likely to have an evolutionary basis, says Kalashnikova. There's evidence of it in other vertebrates that vocalise to communicate. Apes and many birds, for example, use a higher pitch when they interact with their offspring but lower tones when approached by potential predators.

says. "Initially when we did not have language, parents would make these really high-pitched vocalisations to appease their babies and also to appear less threatening to them, which we still see in other animal species (see box). Adults [humans] do exactly the same thing."

The BabyLab is also exploring how vocabularies develop in infants, an important predictor of vocabulary skills later in life and our ability to learn to read. This has led to the development of a tool known as OZI, which is a checklist of more than 500 words for use in children aged from 12-30 months.

In the hands of clinicians, such as speech therapists, it can help to identify children who are at risk from potential language delay so that they can be either monitored or referred for early intervention.

ALL-ROUND SOLUTIONS

A tool to assess sustainability developed by WSU researchers is making a global difference.

Managing enormous populations calls for solutions to immense problems, such as how to create fast, convenient transport with minimal air pollution and how to inspire social cohesion. A research team at Western Sydney University has developed practical tools to address such problems and facilitate the creation of sustainable cities and communities.

Professor Paul James, Dr Liam Magee and their colleagues have created a method for assessing and managing social and environmental sustainability that goes beyond early tools such as the 'profit, people and planet' approach of the triple-bottom line.

"Triple-bottom line set economics as the core consideration. Despite the attempt to get beyond this focus, it allowed companies to go back to the economic bottom line," says James.

"Our method is more comprehensive because it brings cultural and political issues to the fore."

They call the method Circles of Sustainability and it integrates cultural, political, ecological and economic data and presents them as circle diagrams. It highlights strengths and weaknesses, and most importantly, it points to where there are tensions.

"We provoke cities to confront the tensions and contradictions of their own policies," says James.

NEED TO KNOW

↗ WSU research has developed a tool to assess the sustainability of cities

↗ It has been adopted around the world

Michael Müller, mayor of Berlin, says, "Circles of Sustainability is an extraordinary guide to our way forward. By bringing together the clear insight of political analysts with the citizen-oriented perspective of experienced practitioners, [it] changes the paradigm of urban studies. It…will be used by cities such as Berlin as we seek a better world together."

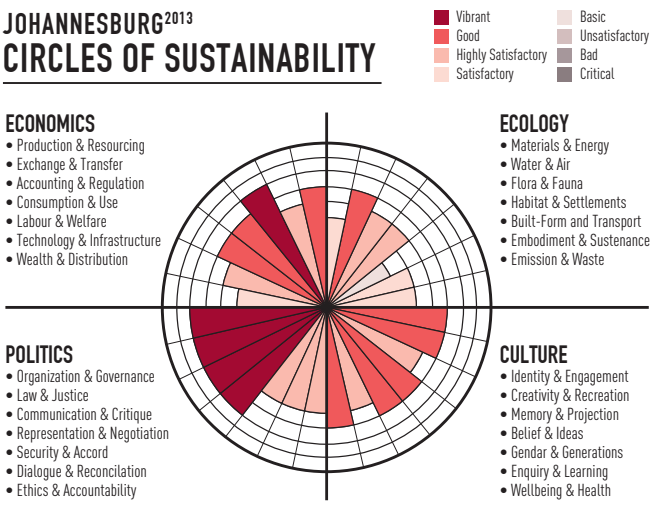
The team used the tool to understand why a new rapid bus transit system created to address spatial apartheid in Johannesburg, South Africa, was under-utilised. The analysis showed that the city hadn't considered the culture of the local community.

"People were reluctant to leave behind a gang-based minivan service, and were distrustful of the new service, even though it cost the same.

"The initial system was also developed around credit cards, but the people of Soweto did not trust banks," says James.

"The big shift came when they renamed the bus system 'Corridors of Freedom' and started employing the minivan drivers as bus drivers. The drivers were already known to the community and were happy to have more secure employment," says Professor James.

Circles of Sustainability is now being used all over the world, and has been adopted by Metropolis, a global network of 130 cities.



This research was partially funded by the Australian Government through the Australian Research Council.

THE FUTURE CUSTODIANS OF ANCIENT TALES

A collaborative film-making project has helped connect teenagers to some of the most comprehensive Aboriginal Australian genealogical data in existence.

NEED TO KNOW

- Elders in central Australian Aboriginal communities worried that young people felt disconnected from their culture
- The young people learned digital storytelling skills
- Together they engaged with a remarkable archive of cultural history

In the red centre of Australia, a land dry and sparsely populated, is the community of Hermannsburg, also known as Ntaria. Here, the effect of 200 years of white settlement on traditional Aboriginal culture was keenly felt by the younger people of the community. Sitting amidst two distinct, overlapping cultures, the young men and women lacked a thorough understanding of either.

WSU academics, led by Professor Hart Cohen from WSU's School of Humanities and Communication Arts and the Institute for Culture and Society, introduced a program to strengthen ties with both cultures and improve literacy for the teenagers. They worked in close collaboration with the elders and leaders of the Arrernte community and the Strehlow Research Centre in Alice Springs.

Twenty-two students from Ntaria School took part in a digital storytelling project that aimed to build their capacity for sharing intergenerational knowledge. A core part of the project involved the students exploring more than 150 years worth of genealogical information housed in the Strehlow Research Centre, which enabled the students to learn about their collective and individual social and cultural identities.

The experience was documented on film; a collaboration between the teenagers, community elders and teachers, museum staff, the Ntaria School, Professor Cohen and colleagues Associate Professor Juan Francisco Salazar and Dr Rachel Morley. A documentary filmmaker originally from Canada, Cohen has been working with the Strehlow material since the late 1990s. In 2001, he wrote and directed *Mr Strehlow's Films*, a movie about the founder of the research centre's collection, T. G. H. Strehlow, who was the son of German-Lutheran missionaries, and an Arrernte-speaking anthropologist and linguist.

Strehlow grew up on the central Australian Hermannsburg mission that is now Ntaria, 125km south-west of Alice Springs. Between the 1930s and 1970s, he amassed a significant collection of sacred Aboriginal men's objects, as well as family trees, photographs, and film and sound recordings.

The archive's genealogies, kinship diagrams and family trees are a unique resource, Cohen notes. "As it turned out, these are some of the most comprehensive records ever collected in Australia to do with Aboriginal people."

> "THESE ARE SOME OF THE MOST COMPREHENSIVE RECORDS EVER COLLECTED IN AUSTRALIA."

Uniquely, the archive documents not only family ties familiar to Western culture, but also family relationships, and birth and conception sites, which have a layered and totemic significance in Arrernte culture.

In 2011, with the support of the Australian Research Council's Linkage program, Cohen and the WSU team worked with project partners, the Strehlow Research Centre and the Northern Territory Library service, while engaging with key community members including the Ntaria School teachers and representatives from Wurla Nyinta, a community reference group, to create a knowledge system that would use the collection as the basis for a digital database.

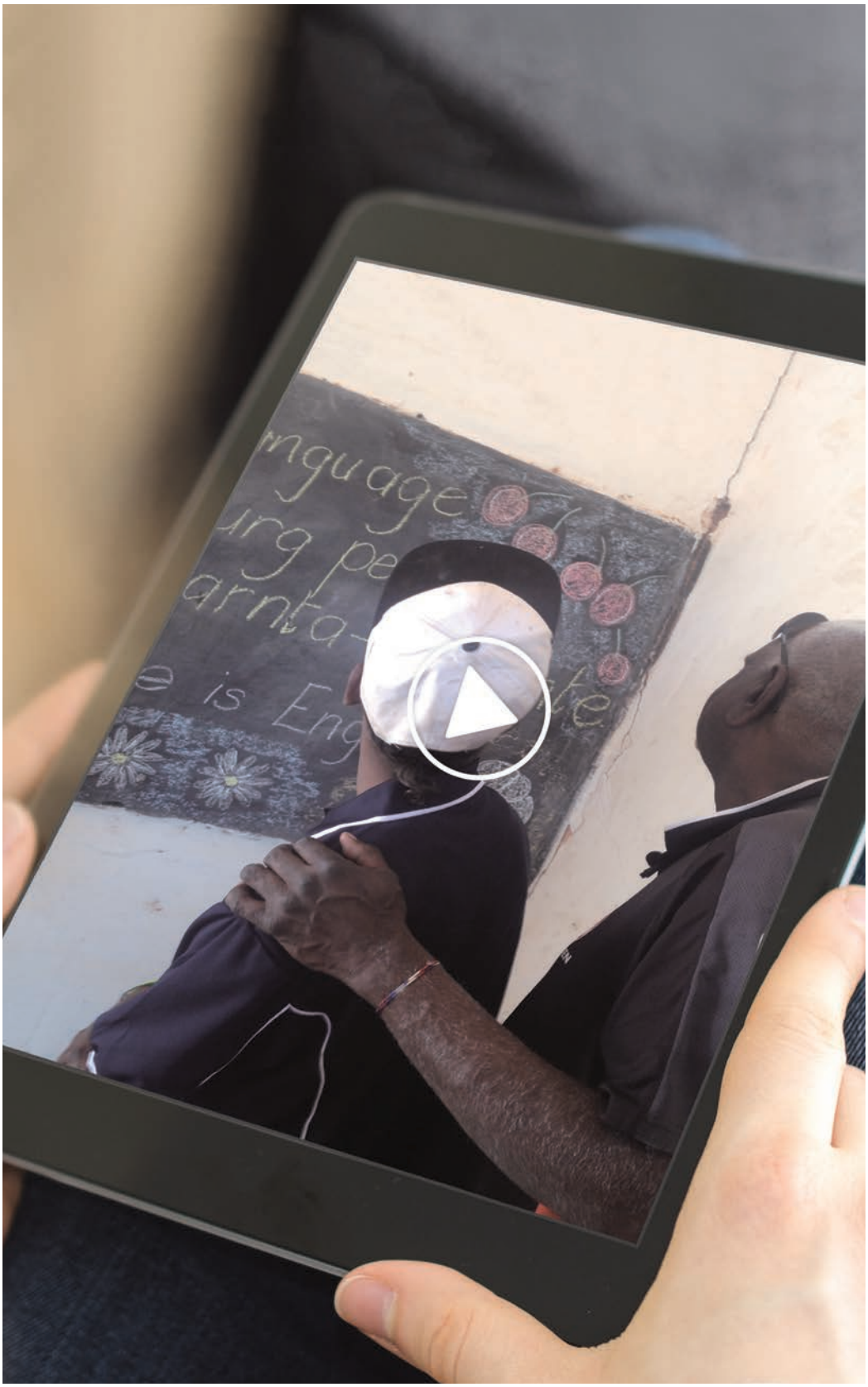
Cohen explains that the project took a sudden change of direction: "After speaking to many locals, we realised that they didn't really have the infrastructure to use [a digital database]". The local school provided a new avenue. "With the enthusiastic cooperation of both the Ntaria School principal and classroom teacher, we suggested that instead, we teach digital storytelling as a way of bringing students into contact with the archive."

In the film, called *Ntaria Heroes*, Western Arrernte elders, Mark Inkamala and Mavis Malbunka, were able to use the collection to talk about local history. Some of the students were able to trace their 'skin names' for the first time. This culturally important designation helps identify Aboriginal family, ties to Country and rules governing social etiquette.

Ntaria Heroes cinematographer and Arrernte man Shaun Angeles notes the importance and timeliness of the project, commenting "we need to do as much as we can with these young people while their elders are still around."

By improving their ability to find and share intergenerational knowledge, Cohen says he thinks the students came away with more tools to explore their identity. "It's been shown," he says, "that having a strong sense of an Aboriginal identity contributes to better outcomes for psychological health and well-being … so we think the project has had an impact on many planes."

Ntaria Heroes was first screened at the Ntaria School in August 2016, and it can be found online: vimeo.com/206014019



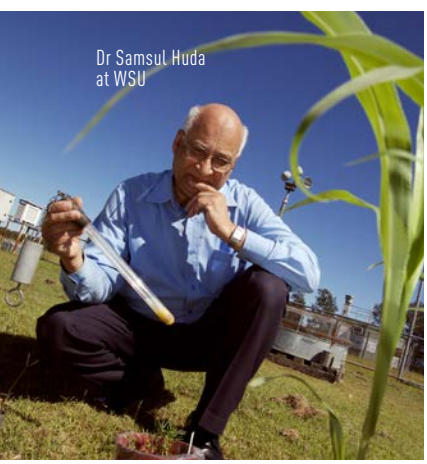
SUSTAINABLE FARMING FOR THE FUTURE

Innovative Australian research is being applied overseas to help the world's poorest farmers increase their yield.

As India's population grows ever higher — a baby is born roughly every two seconds — its natural resources are under increasing pressure. Its groundwater has been severely depleted, and the water table has fallen significantly over the past three decades.

Western Sydney University's Smart Agriculture Research Cluster comprises an interdisciplinary research team that developed solutions to two major problems affecting farmers and agricultural sectors in South Asia: uncoordinated agricultural markets and unsustainable irrigation practices.

Research by Professor Basant Maheshwari and his team, through a project funded by the federal government's Australian Centre for International Agricultural Research, has enabled Indian villagers and farmers in the adjoining states of Gujarat and Rajasthan to use groundwater more effectively and efficiently. The project, Managing Aquifer Recharge and Sustaining Groundwater Use through Village-level Intervention (MARVI), delivered impactful outcomes at the village level and notably is being adopted by the Government of India.



Dr Samsul Huda at WSU

To be sustainable, groundwater usage and replenishment must be in balance but removing more groundwater than was replenished by rainfall was all too common. Even though drilling new bores and deepening existing wells is illegal in several states, perpetrators are rarely prosecuted. "It's an emotional political issue. People need water for their livelihood," Maheshwari says.

Working with Western Sydney University, the CSIRO, and Indian agricultural research institutions, he recruited 35 volunteers across 11 villages to begin monitoring the water in the wells. Measurements were taken every Sunday morning. Each volunteer was paid Rs 1,000 a month (AUD$20). Maheshwari says the farmers were initially sceptical but, after six months or so, opinions started to change. "People started to become more objective about their groundwater situation and to concede that it was not unlimited."

WORLD BANK ON BOARD

Midway through MARVI, the World Bank began its own push, stressing that the shift towards groundwater sustainability in communities must start at the village level. It developed a proposal for a US$1billion project with the Indian Government to help improve sustainability of groundwater use in seven states and incorporated the MARVI project's village-level model of groundwater monitoring into its proposal.

The initial result has been the creation of five Village Groundwater Cooperatives — groups of up to 20 farmers working together on parcels of land about 30 hectares in size. Together, they recharge the groundwater during monsoon season (between July and September) by diverting rainfall run-off or damming creeks. They then share and use just the amount of water captured during the monsoon season. They have also introduced crops that need less water, with the ultimate goal of increasing both production and income without reducing groundwater levels.

One of the Bhujal Jankaars (a Hindi word for 'groundwater informed'), a local farmer trained in groundwater monitoring through MARVI said the project has made a meaningful difference to his life. "Farmers in our villages are now for the first time measuring rainfall amounts and groundwater levels and many of them are changing to crops that will use less groundwater. I think

NEED TO KNOW

Thanks to WSU research:

- Indian villagers are more sustainably managing their groundwater use and changing water intensive farming practices
- Sri Lankan farmers are better planning their crops
- Cambodian farmers are increasing crop production

[Top] Sion Ang/SOPA Images/LightRocket via Getty Images [Bottom] Ms Sally Tsoutas, Western Sydney University

through MARVI project, villagers came up with a new vision of their own and this project is leading to a sort of 'movement to save the village groundwater'," he says.

About 10,000 farmers are working under the MARVI model. Maheshwari believes it will be just the start. "If these go well, it will be thousands of villages and millions of people."

FARMING APP

Meanwhile, Professor Athula Ginige, a mechanical engineer by training, had become aware of a vicious circle affecting many farmers in Sri Lanka. An oversupply of some produce meant farmers could not sell what they grew, leading to wasted crops and no income for the farmers. A mismatch in crop production and demand led to increasing poverty among Sri Lankan farmers that has been linked to an appalling suicide rate of 4,000 farmers a year. Professor Ginige developed a tool that has been adopted by more than 5,000 farmers, improving their livelihoods.

Ginige identified that part of the problem stemmed from a lack of access to information to help farmers choose what crops to grow. "They were just deciding what to grow based on average selling price of crops from the previous season. For example, if onions were sold at the best price the previous season, then everyone grew onions the next season. "It's a fundamental coordination failure," he says.

To make a better assessment they needed to know the unfilled demand for various crops at the time they were planting. Aware there had been rapid growth in mobile phone use, Professor Ginige and a group of colleagues and students developed an app that gave farmers real-time information about the demand for suitable crops.

The system they developed works on a traffic light model: green means supply of a crop is less than 35 per cent of demand and signals planting is a good idea; yellow suggests the crop is already being grown at between 35 and 80 per cent of demand; a code red indicates supply is at more than 80 per cent and tells the grower to plant something else.

"It is not just an app. It is a digital knowledge ecosystem that connects everyone so they can share and coordinate," Professor Ginige says. "The app is just one way for the farmers to connect to the digital knowledge ecosystem."

> "THE APPROACH HELPED DOUBLE RICE PRODUCTION IN SIX YEARS."

VENTURE CAPITALISTS ON-BOARD

Just as the World Bank expanded Professor Maheshwari's idea, Indian venture capitalists heard about Professor Ginige's system and asked him to expand it into their country. A major trial is under way with 5,000 farmers in the state of Telangana.

Farmers in Sunderpura who are part of the MARVI programme

Dr Huda discusses his research with visiting scholars

Across Sri Lanka and India, the results have been positive. After six months, the farmers were found to feel markedly more empowered based on measurements of their motivation, self-efficacy and sense of control. Ginige hopes to have 50,000 farmers using the system by the end of 2018.

FARMING OUT DECISION-MAKING

Research by Western Sydney University's experts in agricultural sciences led by Dr Samsul Huda, has helped improve livelihoods in a range of countries by working with farmers to improve understanding of crop suitability, soil characteristics and changes in the local climate. Combined with farmers' local knowledge and leadership, the work of the WSU research team has yielded extraordinary results overseas.

In Cambodia, a collaborative approach focused on farming intensity and practice helped double rice production in the six years to 2013. In India, it helped breeders develop heat tolerant wheat and chickpea varieties more suited to the climate. In Qatar, where the government is so concerned about food security it has spent $500 million buying Australian farms, the project has helped reduce food waste and increase production. There have been similarly positive results in Bangladesh and China.

Perhaps the most striking results in terms of livelihoods was in Cambodia. At Ta Keo in the country's south, between 23 and 35 per cent of farmers are now regarded as "better off". Nearly a third of farming households now have electricity, half own motorbikes and 60 per cent have hand tillers.

"We learnt fairly early on that we can't make decisions for others," Dr Huda says. "But by working collaboratively and empowering farmers we can improve sustainable crop production."

This research was made possible by a NPRP award [NPRP 6-064-4-001] from the Qatar National Research Fund (a member of The Qatar Foundation). The statements in the Report are solely the responsibility of the authors.

STOPPING RACISM IN ITS TRACKS

The Challenging Racism Project combats Islamophobia through innovative multimedia tools.

A young woman in a hijab sits on a train. Three teenagers enter the carriage and aggressively ask her why she is wearing a "tea towel".

As the abuse continues, the woman's discomfort grows, along with that of the other passengers. The intensity of the passengers' internal debate between stepping in or turning away is palpable.

This type of racial abuse is all too common in Australia. Many onlookers choose not to intervene and instead stand by as witnesses.

Research undertaken by the Religion and Society Research Cluster led by Professor Kevin Dunn, Dean of Western Sydney University's School of Social Sciences and Psychology, is seeking to change that. The research team created videos using examples of positive action to show how the story could change.

In one video, a young man firmly tells the teenagers to leave her alone. Their response that they are "only having some fun" is rejected by one passenger, and then another. The surly youths exit the carriage after a dismissive "whatever". The woman at the centre of the abuse can breathe again. She turns to the passengers, gives a smile and her heartfelt thanks.

The video campaign, which shows four scenarios of racism, is part of the cluster's Challenging Racism Project, which seeks to understand why 'ordinary' people choose to intervene or remain passive in response to incidents of interpersonal or systemic racism.

Their research reveals several reasons why people don't speak up, says Dunn. "One is they are afraid of becoming a target themselves, and another is they say they didn't know what to say or do. We think we can help by spreading these resources."

Statistics show this belief is well founded. The videos have been watched in excess of 10 million times, have reached 27 million people, received nearly 500,000 likes, 150,000 shares and more than 23,000 comments.

One survey participant said, "Apart from the fact that [the video] reinforced my belief that there are plenty of peaceful Muslims here in Australia who wish to integrate into our multicultural society, the video taught me that racism is never acceptable!"

The videos have also been used for training in schools and community organisations. Dunn says their research shows the videos change behaviour, with one-third of the 10 million viewers reporting an increased intention to take anti-racism action. It's a figure that even impresses Dunn, yet the team, which includes PhD researchers from the Challenging Racism Project, Katie Blair and Rosalie Atie, won't stop there.

In a collaboration with the University of Melbourne and Deakin University, the research team have also produced an app called *Everyday Racism* that challenges players to experience a week in the life of a person from a minority group.

Through the app, participants receive a mixture of SMS and Facebook messages, tweets as well as audio and video recordings and are prompted to choose an action. This is followed by messages that challenge their assumptions and highlight the importance of speaking up against racism.

The app has been downloaded more than 28,000 times with 60 per cent of those who played it recording that they had spoken up against racism since, and almost 98 per cent saying they now saw the importance of taking anti-racist action.

Everyday Racism has been recognised globally — the app co-won the 2015 UN PEACEapp competition and was named runner-up in the 2014 Intercultural Innovation Award presented by the United Nations Alliance of Civilizations (UNAOC) and the BMW Group.

"MUSLIMS IN SYDNEY EXPERIENCE DISCRIMINATION AND VERBAL SLURS AT THREE TIMES THE RATE OF ALL OTHER AUSTRALIANS."

The success of these and other outreach projects by the team is underpinned by a deep understanding of Australian Muslims. This is best exemplified by his team's innovative, Australian-first survey of the Sydney Muslim community that recorded the experiences and attitudes of ordinary Muslims.

Dunn says there is a perception — fuelled by the media and some politicians — that Muslims do not integrate well into Australian society or share national values. Yet their 2015 Resilience and Ordinariness of Australian Muslims report exposed this as a myth.

NEED TO KNOW

- Islamophobia in Australia has been under researched and under documented
- Australians do not feel equipped to tackle racism
- An anti-racism campaign changed the attitude of 3 million+ people

They found that Muslims in Sydney had similar outlooks as non-Muslims, especially about big issues such as education and employment.

Despite the survey revealing Muslims in Sydney experience discrimination and verbal slurs at three times the rate of all other Australians, about 62 per cent of those surveyed felt relations between Muslims and non-Muslims were friendly, and 84 per cent are comfortable identifying themselves as Australian.

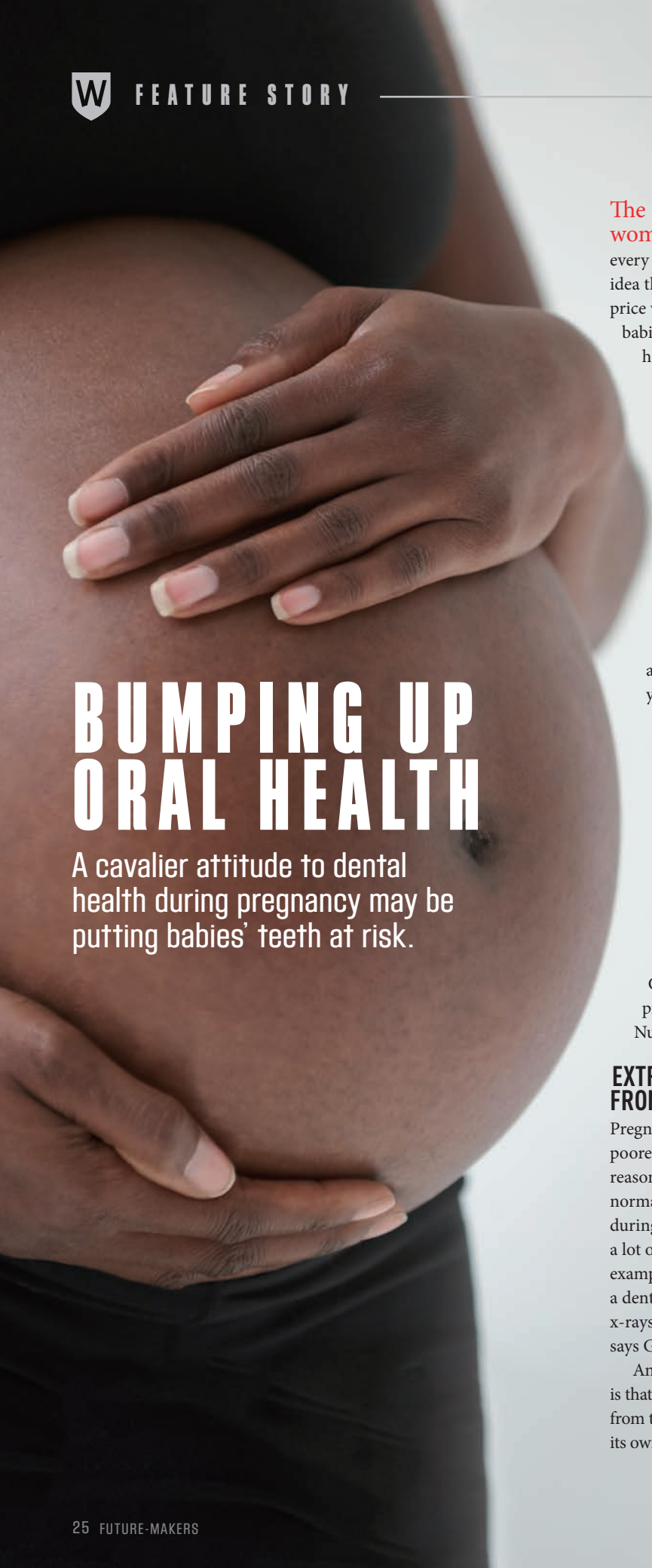
Like much of Dunn's work, the survey findings have been disseminated and reported on widely, and have been used in developing policies on counter-terrorism, policing, and community outreach. For many Australians, however, it was the 2017 SBS documentary, *Is Australia Racist?*, that brought Dunn's research to their attention. Dunn and Blair led a team that measured the extent and variations of racist attitudes in Australia. This SBS-commissioned survey of 6,000 residents informed the documentary, which used hidden cameras to capture the experience of racism through the eyes of those suffering it. Dunn also featured in the documentary to discuss the survey's findings.

AN AUSTRALIAN-FIRST SURVEY OF MUSLIMS

For Dunn, the constant standout theme is the sense of hope maintained by the Muslim community.

"They are hopeful because multiculturalism is an acclaimed goal for this country, so that generates hope," he says. "Muslims in Australia have a reasonable expectation that they won't always be the target because history shows the targets of antipathy change."

Dunn believes the ill feeling toward Muslim Australians is out of kilter and amplified by "some parts of mainstream media" and politicians who use Islamophobia for their own political gain.



BUMPING UP ORAL HEALTH

A cavalier attitude to dental health during pregnancy may be putting babies' teeth at risk.

The adage goes that a woman loses a tooth for every child. But the outdated idea that poor oral health is the price women must pay for having babies may be putting children's health at risk.

A Western Sydney research team led by dentist Ajesh George has introduced an oral health program for pregnant women that has been adopted across two states, significantly improving the health of women and children.

George became interested in oral health and pregnancy about ten years ago, following the publication of several studies linking gum disease with adverse pregnancy outcomes.

"At that time, Australia didn't have any guidelines on oral health for pregnant women, there were no promotional resources and no-one really discussed it during antenatal care," says George, now an associate professor at WSU's School of Nursing and Midwifery.

EXTRACTING TRUTH FROM MYTH

Pregnancy is associated with poorer oral health for several reasons. "Many women think it's normal to have bleeding gums during pregnancy, and there are a lot of other misconceptions, for example, that it's not safe to see a dentist, or fear about potential x-rays that might harm the baby," says George.

Another common misbelief is that the baby leaches calcium from the mother's teeth to meet its own needs; while it's true that calcium is mobilised from the mother's skeleton and absorbed from the foods she eats, studies have revealed that the calcium in her teeth is unscathed.

The likelihood of enamel erosion and dental decay are instead increased due to sugar cravings and vomiting caused by morning sickness. Increased oestrogen and progesterone also boost blood flow to the gums, which can cause them to become more irritable and susceptible to damage or infection. Approximately 60 to 80 per cent of women suffer from bleeding gums during pregnancy and almost a third have more advanced gum disease, where the gums begin to recede, and bacteria start eating away at the bone that supports the teeth.

The evidence regarding an association between poor oral health and adverse pregnancy outcomes including preterm birth and low birth weight is less clear. "What we think happens, is that bacteria from the periodontal disease enter the bloodstream, travel down to the placental barrier and trigger an inflammatory reaction, which

NEED TO KNOW

- Pregnancy is disproportionately associated with poor oral health
- A WSU program engaged midwives to educate on dental hygiene
- It led to an 87 per cent increase in dentist visits from participants

potentially results in preterm birth and low birth weight," says George. Studies have found a two- to seven-fold increased risk of such outcomes associated with poor oral health, although there is a paucity of research to demonstrate that it is a direct cause, or that increased dental visits result in improved birth outcomes.

Despite being at greater risk of poor oral health, fewer than half of pregnant women in the US, for example, seek dental care. In Australia, these problems are compounded by a lack of oral health awareness among pregnant women, limited emphasis on oral health during antenatal care, the high cost of private dental treatment, and limited public dental services.

Sarah*, one of the participants in the team's research commented, "I think it's important when women get pregnant to know that oral hygiene plays a major role in having a healthy child. I don't know if a lot of women know that your own oral hygiene plays a big role."

TRAINING MIDWIVES

George and his colleagues decided to upskill midwives in oral health education, because they play a pivotal role in the provision of antenatal care in public health services in Australia. Midwifery services are provided to pregnant women from the very early stages of their pregnancy, so educating midwives enables greater opportunities for oral health intervention. Canvassing midwives revealed widespread ignorance about the importance of oral health, as well as a lack of practical skills for assessing or addressing it. So, George and colleagues teamed up with the Australian College of Midwives to develop a comprehensive training programme; evidence-based promotional resources; and a validated screening tool to identify pregnant women who might be at increased risk of poor oral health and need a referral to a dentist. Midwives are also trained to conduct a visual inspection of the mouth, which, although optional, reinforces the idea that oral health is important: "If a midwife says, 'you've told me you have a problem, do you mind showing me where the problem is?' it suggests to the woman she should address the issue," George says.

> "A COMMON MISBELIEF IS THAT THE BABY LEACHES CALCIUM FROM THE MOTHER'S TEETH TO MEET ITS OWN NEEDS."

An evaluation of 638 pregnant women recruited from three metropolitan hospitals in Sydney, suggests this midwife-led approach is effective. It showed that the programme can significantly improve the knowledge and confidence of midwives to promote oral health and can be easily integrated into midwifery practice. The intervention also improved the uptake of dental services, oral health knowledge, and quality of oral health among pregnant women, compared to current practice, with the greatest improvement in uptake (87 per cent) observed when the midwifery intervention was coupled with an affordable and accessible dental referral pathway.

REMOVING BARRIERS

The research indicated that simply telling women to go and visit a dentist wouldn't be enough; they needed access to affordable services. George and the team worked with public health providers in Victoria to roll out the programme across the state and provide low-income pregnant women with referral pathways. The programme has become state policy and put in place across 55 maternity services. Meanwhile, the screening tool is being used by 75 per cent of hospitals in Victoria. In certain regions, the number of pregnant women being referred to and accessing dental services has risen by more than 50 per cent.

George and his colleagues are now investigating the possible longer-term benefits of the programme for women and the oral health of their children, some of whom are now four. Babies acquire most of the microbes living upon and within them from their mothers — including bacteria associated with dental decay.

"Usually, if women have poor oral health during pregnancy, this continues after birth, and if they engage in certain feeding practices, such as tasting the baby's food with their mouth, or sharing the same spoon, then their bacteria will be transferred to the baby's mouth causing early cavities, which is the most common chronic childhood disease world-wide," George says.

**Name has been changed for privacy reasons*

POOR ORAL HEALTH DURING PREGNANCY HAS BEEN LINKED TO

- ↗ Increased risk of preterm birth
- ↗ Low birth weight
- ↗ Increased risk of stillbirth
- ↗ Childhood dental decay

DENTAL GAPS

↗ A study which followed the health of 2,798 Danish twins into old age, found that women with lower socio-economic status lost one tooth per pregnancy, on average, while those from higher socio-economic groups lost a tooth for every two children they had. For men, the correlation was negligible.

This research was partially funded by the Australian Government through the National Health and Medical Research Council.

A TALE OF TWO TURTLES

With the imminent extinction of a rare turtle species, Western Sydney researchers rushed to help. But their studies revealed a problem far more complex than anyone had imagined.

It's a scorching Sydney summer day, the mercury nudging 44 degrees Celsius. Inside its artificially cooled greenhouse home, a fist-sized juvenile turtle looks perfectly comfortable, unaware of the conservation conundrum roiling above its scaly head.

This turtle is a hybrid; a blend of two species, each with a sad tale of population decline. But in an unfortunate case of conflict, the survival of each threatened species places the other further under threat.

Research by Western Sydney University ecologist Professor Ricky Spencer and colleagues, is helping save both endangered species of turtle. The intertwined fates of these two Australian species has the potential to instruct conservation approaches dealing with co-existing and competing threatened species not only nationally but internationally.

One parent of the hybrid is a Bellinger River Snapping Turtle, *Myuchelys georgesi*. Almost every adult of its kind has been wiped out from its only known habitat in the Bellinger River in northern NSW thanks to a mysterious illness.

The other parent is a Murray River Short-Necked Turtle, *Emydura macquarii*, a species thriving in the Bellinger River, unaffected by the plague. As its name suggests, its original habitat is South Australia's Murray River. No-one knows how it got into the Bellinger, but it was first documented in 1998. Back home, however, the Short-Necked Turtle is under threat, a victim of predation and habitat loss.

'OUR' TURTLE

Locals had once believed that the less common short-necked turtle was 'theirs', unique to the Bellinger River. But when Spencer and colleagues began looking at the genetics of all the river's turtles, they discovered it was the same species of short-necked turtle found in the larger Murray River and rivers inland of the Great Dividing Range. At that time, the Short-Necked Turtle wasn't endangered.

Instead, the Bellinger's more common turtle, the Snapping Turtle, was found to be unique

Ricky Spencer and Kristen Petrov in the quarantine facility at WSU's Richmond campus.

KISSING COUSINS

↗ A species is often defined as a collection of animals that can interbreed and create fertile offspring. However hybridisation, common in wild and captive populations alike, has long clouded this definition. So zoologists tend to classify species according to their physical features and detailed genetic profile. The fact that the Snapping and Short-Necked turtles can interbreed suggests they are very closely related.

NEED TO KNOW

- ↗ The Bellinger River Snapping Turtle was on the brink of extinction
- ↗ WSU intervention saved it
- ↗ Reintroducing the turtle to the river threatens a different endangered turtle

to the area. The locals readily redirected their loyalty to the Snapping Turtle and for a while, all was well.

Then in 2015, someone in the local community contacted Spencer saying that large numbers of Snapping Turtles were dying on the river's banks. Photos sent to him showed a devastating scene. The dead turtles were covered in ulcers, both on their skin and internally.

"It was 100 per cent mortality, spreading two kilometres upstream per day and just wiping them out."

Spencer had no idea what was causing the symptoms. It could have been bacterial, viral or even some kind of environmental pollutant. He knew he had to act fast. A desperate and massive rescue mission was launched, scouting upstream to find pools where the condition was not yet evident, and removing any healthy turtles.

They found only three unaffected waterholes. "We only got 16 turtles out and only five adult females," he says.

The survivors were transported by car, in damp cotton bags, a full day's drive down Australia's east coast to a purpose-built quarantine facility at Western Sydney University's Richmond campus. Until more about the problem was known, they couldn't be housed in zoos in case they were carriers of a disease.

Since then, those turtles have been found to be disease-free, and have relocated to a number of zoos around the country. Taronga Zoo's turtle breeding program has been successful, and there are now 21 Bellinger River Snapping Turtle hatchlings.

The disease remains a mystery. "They call it SCUDS, which is 'subcutaneous ulcerative disease', and underlying that

could be a whole range of different bacterial or viral pathogens," Spencer says.

Even more puzzling is the fact that the Short-Necked Turtle appears unaffected, and the disease only seems to kill adult Snapping Turtles, not juveniles.

While one group of researchers works to identify the pathogen, Western Sydney University PhD student, Kristen Petrov, is examining the differences between the two turtle species in search of a reason that one survived the disease and the other perished. She's using claw samples to work out how the diets of the two species differ, and also looking to see whether the two species overlap in home range and occupy similar habitats. Petrov is studying the immune systems of the turtles to see if there's some vulnerability that might have contributed to the Snapping Turtle's demise.

"A current hypothesis is perhaps the turtles were stressed in the lead-up to the disease and maybe the river conditions at the time weren't ideal for the prey that they were eating," Petrov says. "If adults and juveniles eat different things, maybe that's why the adults had the most die-off."

INVIDIOUS DILEMMA

The captive breeding program has prevented the Snapping Turtle from becoming extinct. But with the initial crisis over, Spencer and colleagues must decide what to do next.

There are a small number of juvenile Snapping Turtles still in the Bellinger River who will soon be mature enough to start breeding. A collection of these have been brought to Western Sydney University for the eventual creation of a second breeding population in zoos. At the same time, the original 21 captive-bred hatchling Snapping Turtles could soon be ready for release back into the river.

> "IT WAS 100% MORTALITY, AND IT WAS SPREADING TWO KILOMETRES UPSTREAM PER DAY AND JUST WIPING THEM OUT."

But the fact that the two resident species interbreed is as much a threat as any disease – over time, hybrids would replace the Snapping Turtles until the species was no more. There's no modelling to shed light on how long this process will take, but if 50 per cent of the offspring born are hybrids, it's an exponential process.

Meanwhile, the Short-Necked Turtle continues to thrive in the Bellinger River, but in recent years its numbers in its native Murray River have plummeted to the extent that it is now listed as vulnerable in some states.

The Short-Necked Turtles can't be relocated to their original habitat in case they carry the disease with them. But they can't be left where they are because of the hybridisation threat they pose to the Snapping Turtle's survival. Unfortunately, that may only leave one option: catching and euthanising the Short-Necked Turtles in the Bellinger River.

It's a decision no-one wants to make, but the clock is ticking. "They keep increasing; there'll be new turtles hatching out right now, so it gets harder and harder to eradicate them," Spencer says.

While such a dilemma of two competing, threatened, native species isn't new, Spencer says it's never been quite so extreme as in this case.

"It's going to set precedents for a whole range of other aquatic species if something like this happened elsewhere," he says. "What do you do?"

(Top, middle) Paul Fahy/Taronga Zoo (Bottom) © Michael Amendolia

MAKING THE CLASSROOM A LEVEL PLAYING FIELD

Western Sydney University education experts have developed new approaches to improve the educational standards of children from underprivileged communities in Chile and Australia.

© James Horan

NEED TO KNOW

- WSU researchers were invited to advise on Chilean education policy
- The successful approach incorporated children's cultural knowledge
- In Australia, a teacher mentoring programme showed significant advances in child learning

A child's early years lay the learning foundations for their lives. Research shows that a child's brain has the highest potential for learning around three years of age, demonstrating the critical role early education plays in a child's learning, cognitive skills development and socio-emotional growth.

However, children from poor communities often lack access to the educational and development resources available to children from higher-income families. Additionally, aspects of curriculum can sometimes feel disconnected from their reality, creating further educational disadvantage for these children at a critical time in their lives.

Research teams from Western Sydney University's School of Education, led by Christine Woodrow and Wayne Sawyer, are helping to address this inequality by working with teachers and families. Through two main programmes of research, their work focuses on better equipping children from socioeconomically-disadvantaged communities in Chile and Australia with the skills to succeed and contribute to society.

TRANSFORMING FUTURES

Chile, South America's most prosperous nation in terms of GDP per capita, has one of the highest levels of income inequality among OECD countries. This disparity is most evident in its school system, where the quality of education is dependent on a child's socio-economic status (SES).

To address inequality issues, in 2007 the Chilean government launched the *Chile Crece Contigo* (Chile Grows with You) initiative. The CCC provided a platform for supporting the development of under-fives, bringing together education, health and social and community services.

Under the auspices of the CCC, the *Futuro Infantil Hoy* (Children's Future Today) programme was created, initially as a three-year pilot in 2008. FIH focused on raising the educational standards of children from impoverished communities in northern Chile.

Over the next eight years the programme was rolled out across an entire region, comprising the provinces of Antofagasta, El Loa, and Tocopilla, and several very poor communities in Santiago, Chile's capital. In 2010, Woodrow, an associate professor in the School of Education and senior researcher in the Centre for Educational Research at Western Sydney University, led the design and implementation of a project based on the findings of the pilot, which aimed to improve children's learning achievements and to meaningfully engage families in their children's education. The project was funded through a private-public partnership involving Fundacion Minera Escondida, local municipalities and the government.

"Following presentations we had delivered at an international seminar in Santiago, the Chilean government asked us to develop a programme with them that would contribute to strengthening the quality of early childhood education in the country," explains Woodrow.

"They liked our focus on recognising diversity, developing locally relevant pedagogies and approaches that emphasised the importance of engaging families and family knowledge in their children's learning."

A NEW APPROACH

Using research from FIH, and in partnership with colleagues in Chile, Woodrow developed a model of pedagogical practice that supports educational success for children in vulnerable communities,

with a particular focus on literacy, family engagement and culturally responsive pedagogies.

"This approach requires a shift in how the teachers conceptualise the children they teach and their childhoods, and to view children as already capable and competent," says Woodrow

Educators built on what are known as the child's 'funds of knowledge'. These are created from the out-of-school experiences gained with their family and community. By bringing this knowledge into the classroom and by placing children at the centre of the pedagogical framework, FIH allows them to be more autonomous and engaged in their learning.

"The 'funds of knowledge' concept was invaluable in motivating the educators in developing relations with families and communities and to build learning experiences based on the idea of teachers and children as collaborators, with teachers as leaders of children's learning," says Woodrow.

"A key outcome from the programme was greater engagement from disadvantaged families in their child's learning."

BETTER ENGAGEMENT, IMPROVED LEARNING

The creation of an exemplary model of pedagogical practice in early childhood centres located in high poverty areas informed the Chilean government's national standards for early childhood teacher development learning for children up to six years and was incorporated into Chile's national policy framework in 2012.

Results from literacy and maths tests in Chile demonstrated that children whose teachers had participated in the FIH programme significantly outperformed those who did not, and that early childhood centres that had taken part in the programme achieved performances ranked as 'outstanding'.

A national quality assessment undertaken in 2010 found significant overall improvements for all participating early childhood centres compared to non-participating centres, with one centre achieving a top position in the National Quality Validation process in 2013.

Likewise, when the programme was implemented in Australia, all 18 Western Sydney preschools participating in the programme were rated in the Australian Children's Education and Care Authority (ACECQA) Assessments as 'Exceeding National Quality Standard' — the highest possible rating.

To date, the programme has benefitted more than 5,500 children and 530 educators in underprivileged communities in Chile and Australia.

"Parents from communities have increased aspirations for their child's learning trajectory and are keener to learn how to support their children's learning, attend more events and participate in centre-based learning activities," says Woodrow.

GIVING KIDS A FAIR GO

A student's socio-economic status has a significant effect on their performance at school, with students from low-SES backgrounds achieving lower test scores and having a higher drop-out rate. Ensuring that low-SES students engage with the learning process is key to addressing this educational disadvantage.

A teacher works with her student in Chile

Responding to this challenge, researchers from Western Sydney University, co-led by Professor Wayne Sawyer of the School of Education, in partnership with the NSW Department of Education, created the Fair Go Project (FGP).

"The programme began in response to the ongoing, international reality that schooling outcomes for students are intimately tied to their socio-economic status," explains Sawyer. "However, teacher action in the classroom also has an effect on a child's education, so we focused on assisting teachers by developing a model of classroom engagement."

Established in 2000, the FGP created a student engagement framework for teachers in low-SES schools. This was then used with teachers who had been identified as particularly successful in engaging students from low-SES backgrounds. Working directly with teachers, including those in their early careers, the FGP implemented the framework in a number of classrooms.

The project also worked on a model of the teacher being a researcher of their own practice by using teachers and academics to mentor others as well as training early mentees to later be mentors themselves.

"We set up mentoring relationships between newer teachers in schools and teachers who had been on Fair Go projects previously," says Sawyer. "This relationship was assisted by what we called 'teacher-research assistants' who would meet with the mentor-mentee pairs regularly and assist with their planning, observe and give feedback on the teaching."

One assistant principal who was a participant in the study gave glowing feedback to Sawyer: "The Framework [developed by the FairGo project] has certainly shaped who I am as a teacher and a leader. I have moved from being a classroom teacher into being a senior school executive since my introduction to that framework. It is very much a part of who I am and is in our school plan now."

The FGP's pedagogical framework has been implemented in more than 50 schools in Western Sydney and in almost 40 low-SES rural schools, and is "helping to address educational disadvantage by changing teaching practices and raising engagement," says Sawyer.

This research was partially funded by the Australian Government through the Australian Research Council.

THE WRITING ON THE WALL

Managing the eternal battle for Sydney's public walls.

NEED TO KNOW

- Public attitudes to graffiti vary
- The nature of graffiti demands dynamic management policies
- WSU research has informed 37 policy recommendations

More than 8,000 incidents of graffiti are reported annually to the New South Wales police. Indeed, it only takes a quick walk through the streets of Sydney to catch a glimpse of the diverse forms of graffiti and street art, from simple tags to elaborate murals. Some see it as art, while others decry it as vandalism. These differing perceptions make the management of graffiti and street art difficult for urban authorities.

Western Sydney University research led by urban geographer Dr Cameron McAuliffe, has helped local governments rethink their policies on graffiti and develop strategies that benefit the community.

"Street art is not a pure good, and graffiti is not a pure bad," says McAuliffe. "They both play an important role in growing creative economies and building communities."

For decades, many local and state governments in Australia have waged a zero tolerance 'war on graffiti'. Many local councils have explicitly criminalised graffiti and have introduced harsh penalties as a deterrent.

In 2008, the NSW government established a Graffiti Control Act outlining a series of graffiti-related offences. This included the sale of spray paint to minors and possession of graffiti-related tools such as marker pens "with the intention that it be used to commit an offence".

Yet while the war on graffiti raged, an interest in street art grew as the 'Banksy effect' – named for the famous British artist — fascinated the public.

"There's a general consensus from government organisations that the community hates illegal graffiti," says graffiti artist Matthew 'Mistery' Peet, who

was involved in the research project. "But there are areas of Sydney that view it as a part of the community."

This cultural shift first caught McAuliffe's eye when he was photographing legal graffiti walls in Parramatta as part of a postdoctoral project on youth culture and creativity in Western Sydney.

"Initially I thought legal graffiti was a contradiction in terms," McAuliffe says. "But many experienced graffiti writers had grown up and were looking for ways of doing their work without the risk of transgression."

Despite graffiti evolving into a legitimate art form, local government policies have not caught up. Urban authorities have continued costly removal procedures, which have been ineffective at keeping urban spaces clear of spray paint.

McAuliffe says that the ephemeral nature of graffiti and street art instead demands dynamic management policies that are aligned with a community's shifting values.

With Kurt Iveson from the University of Sydney, McAuliffe surveyed the graffiti and street art sites in the City of Sydney local government area. The researchers recorded and categorised various types of graffiti using a clear set of criteria. They used this data as the basis of an online graffiti register for the City of Sydney to help council staff keep track of sites and respond to community feedback appropriately.

Other research in metropolitan Sydney conducted by McAuliffe revealed that attitudes towards graffiti and street art vary depending on where it is located. These values can shift over time, for example, as existing graffiti is painted over by other writers or the property is sold.

To help the City of Sydney reframe its graffiti and street art strategy, McAuliffe and his team proposed 37 new policy recommendations. These included expanding legal wall networks, developing community engagement programmes, forming an advisory group and responding to complaints on a case-by-case basis.

"PUBLIC SPACE ISN'T JUST ABOUT ORDER, IT'S ABOUT BUILDING SPACES OF DEMOCRACY WHERE COMPETING IDEAS CAN SIT TOGETHER."

Other Sydney councils are already putting more progressive policies into action, with Northern Beaches Council and Liverpool City Council establishing thriving legal wall networks. Blacktown Council has embraced a more nuanced approach to managing graffiti and street art, including the expansion of a legal graffiti youth advocacy programme, art exhibitions and a laneways art programme.

Peet says that there is still a need for more legal spaces to cater to the large number of graffiti writers and street artists in Sydney. "Many writers are still doing their work in abandoned buildings and storm water drains, which is a safety issue," says Peet.

In addition to developing a graffiti and street art register for the City of Sydney, McAuliffe is taking a deeper look at how the community views graffiti and street art. This research sets out to explore the various ways people value graffiti practice in urban spaces.

The data will be used to inform local governments of different viewpoints in the community.

WORKING FOR THE RIVERS

For 15 years, Ian Wright's research has helped keep coal mine pollution out of the waterways of the Sydney region.

NEED TO KNOW

- Tip-offs from the community revealed river pollution from coal mines
- WSU research undertook long-term river monitoring
- WSU recommendations were adopted by authorities and industry

Ian Wright's research often starts with a tip-off from community groups. That's how this Western Sydney University water quality expert became involved with stemming the flow of pollution from a coal mine in the Southern Highlands of New South Wales into Sydney's main water supply.

As well as being home to Australia's largest city, the 3.6 million-hectare Sydney Basin hosts coal mines, industry and environmentally sensitive locations such as water catchments, national parks and wilderness areas. One such mine, the Berrima Colliery was shut down in 2013 after operating continuously for more than a century. But, a local community group had become concerned about ongoing discharge into the nearby Wingecarribee River, which flows into Warragamba Dam. In 2014, they asked Wright to investigate.

Australia's most published scientist on water pollution from coal mines, Wright heads a water quality lab at the University's Hawkesbury campus. For 15 years, Ian and his team have been working to alleviate the impact of coal mines on rivers in the Sydney Basin.

The team's interest in the old mine deepened soon after the community approach about Berrima when NSW Environment Protection Authority (EPA) officers also raised concerns during one of Wright's regular meetings with the agency about discharge into the Georges River from another coal mine, the Westcliff Colliery (see map on page 39).

At the time, Westcliff was one of five collieries in the Sydney area from which Wright's team was regularly collecting discharge samples. He had been exchanging notes about the poor quality of Westcliff's discharge with the agency and the mine's owner, South32, for about five years. Prompted by Wright's observations, South32 recently built a $10 million water treatment facility for all their mines in the Westcliff area.

The impact of this facility has been significant. "The final effluent is brilliant," Wright comments enthusiastically. "You could probably drink it!"

WORLD LEADERS

Wright and his team's work with the EPA and other stakeholders has improved the NSW government's environmental regulation of coal mines, and is now considered an exemplar of international best practice in environmental regulation.

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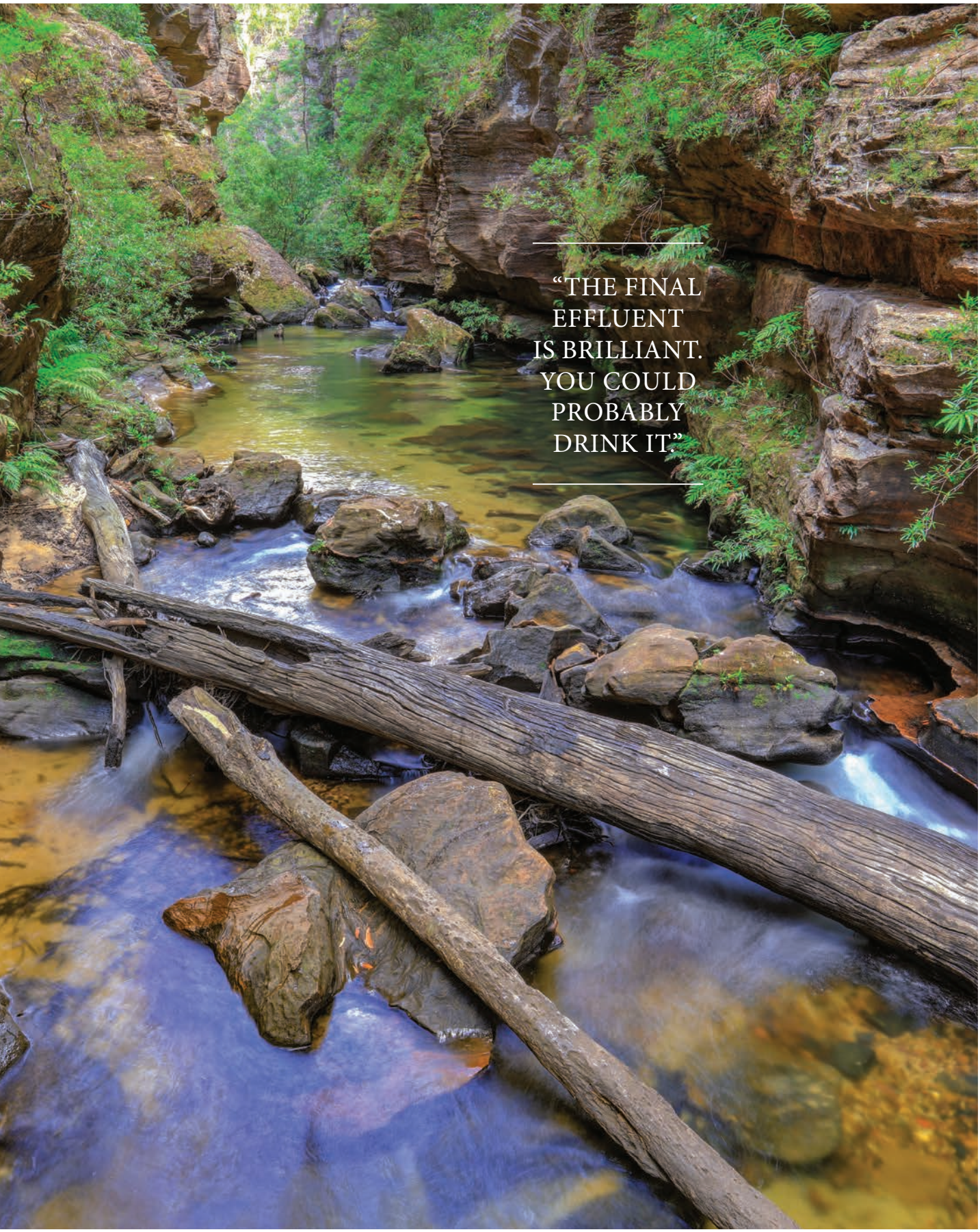


"THE FINAL EFFLUENT IS BRILLIANT. YOU COULD PROBABLY DRINK IT."

The Westcliff win was followed by another important project involving the EPA. Based on the results of research by Wright's team, the agency issued a revised environmental licence in March this year for the Clarence Colliery, which discharges into the Wollangambe River. It's thought to be the most stringent licence ever issued to an Australian coal mine.

Most recently, the Berrima Colliery became the latest addition to the suite of mines under Wright's watchful eye when he, PhD student Nakia Belmer and third-year environmental science undergraduate Ben Green began collecting water samples from the Wingecarribee above and below where the Berrima mine drainage enters. Within a few months it was clear that something was wrong.

With each set of samples, the pollution was becoming worse. Acidic mine drainage was increasing and so too was the leaching of heavy metals.

"The most incredible thing was that no one was monitoring it and able to assess its impact until we came along and did our research," Wright says. The existing EPA licence didn't set discharge limits on the metal pollutants coming out of the mine, so the most toxic and dangerous pollutants were unregulated, he says.

And although the agency required the company to measure pollution upstream and downstream, the downstream sampling was about 5km from the discharge – by which point, the pollution was not detectable.

Just before Christmas 2016, Wright met with the EPA, the NSW Department of Resources and Energy and Boral, which owns the Berrima mine, to alert them to the chemical contamination.

Then, in February 2017, Wright's team returned to study the impact on insect life in the river system. "When we got the invertebrate results we realised the ecosystem was really sick...the river below the discharge was dying," Wright says.

BERRIMA COLLIERY

2013
Berrima Colliery closes

2014
Wright is asked by a Southern Highlands community group to investigate ongoing discharge from the old Berrima Colliery —the NSW EPA also suggests to Wright that the mine is worth investigating

September, 2016
Wright and his team begin sampling the chemistry of the mine's discharge into the Wingecarribee River

December, 2016
Armed with three months of data Wright meets Boral, EPA and NSW Department of Resources and Energy to show them that the pollution from the mine is far more significant than anyone anticipated

Levels of key indicator organisms were much lower than expected. Mayflies, stoneflies and caddisflies, three groups with nymph or larval stages that develop in river beds, had dropped by 90 per cent in the water immediately downstream from the discharge site compared to the stretch above it.

> "WHEN WE GOT THE INVERTEBRATE RESULTS WE REALISED THE RIVER BELOW THE DISCHARGE WAS DYING."

Boral responded to the report and is evaluating the best way to treat the mine's discharge. Even though the mine is no longer operating, the company has installed a new underground treatment system to capture pollutants in the mine's waste water.

"I'm ecstatically happy," Wright says. "It's the first mine I've heard of in Australia that's shut down and the coal miner is now going back in to fix it."

In fact, Boral is keen for Wright to remain involved and will take him underground at Berrima to show him the treatment system when it's up and running. The company has also provided the team with access to their own records of the mine's water chemistry before and during closure. Combined with the post-closure data, it's allowed the team to look at the process in a way that's never been possible previously anywhere else in the world.

"[This provides] unique information on the relative changes in water chemistry through the coal mine closure process," Wright explains. And this may become increasingly valuable with many of the world's coal mines now facing closure as energy demands shift due to global reduction requirements in carbon dioxide emissions.

ACCIDENTAL ACTIVIST

When famed US environmental campaigner Erin Brockovich tweeted her approval for what Wright's research had achieved at the Berrima Colliery, Wright acknowledged that he might be seen as an activist.

He's quick to point out that he didn't plan for his career to pan out that way and that he's certainly not opposed to the coal industry.

"I was going to be a dairy or cereal farmer," he recalls. "But I worked on a cotton farm one summer 30 years ago during the second year of my undergraduate degree in agriculture and that changed me – I saw what we were doing to our rivers."

He ended up working for Sydney Water for 20 years before he came across the Canyon Colliery, now closed, and the pollution it was pouring into the Grose River.

"It's national park, a declared wild river, declared wilderness area and it was stunning - except for the pollution from this old coal mine," Wright says. "I thought 'this isn't environmentally just'."

The Canyon eventually closed. Wright completed his PhD thesis on the old mine through Western Sydney University in 2005, and his path was set.

February, 2017

Wright's team carries out invertebrate sampling in the water downstream from the discharge; the results reveal that river life is being severely impacted

May, June, July, 2017

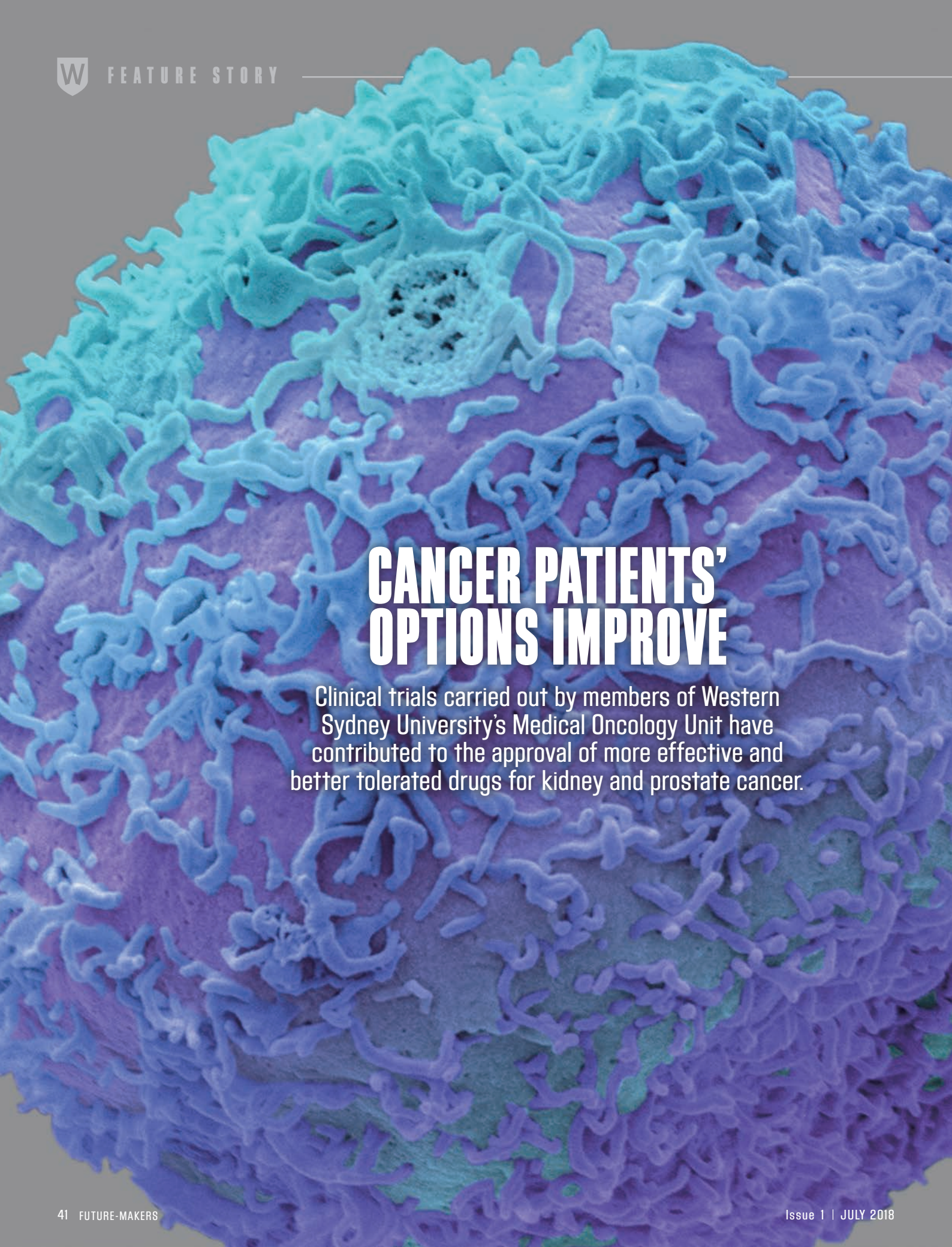
The invertebrate data triggers another series of meetings with the EPA, Boral and Resources and Energy

October 2017

The EPA issues a formal notice to Boral to fix the problem

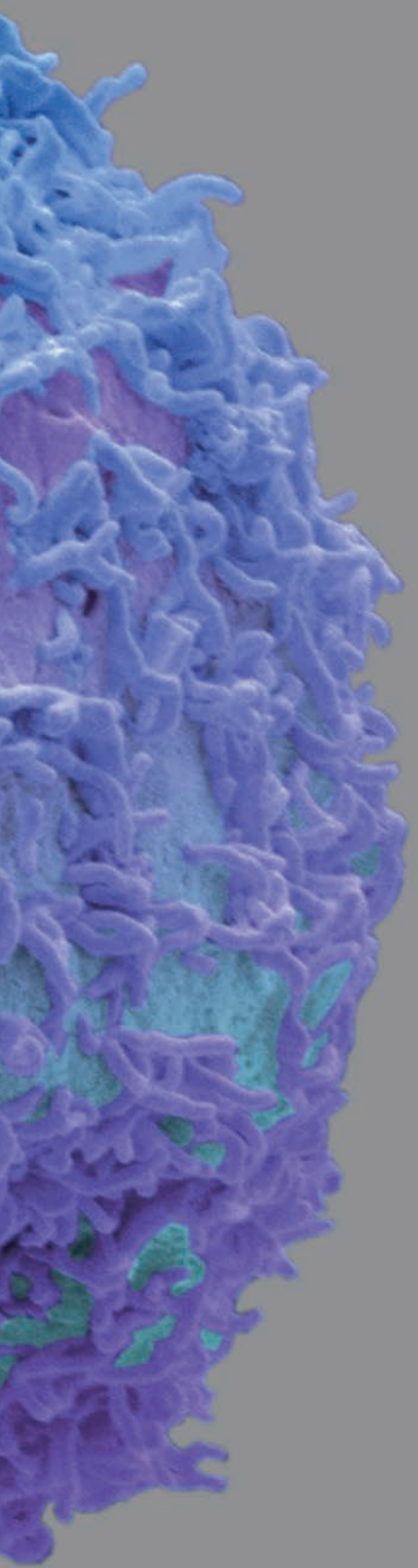
December 2017

Boral plans to begin treatment of the discharge



CANCER PATIENTS' OPTIONS IMPROVE

Clinical trials carried out by members of Western Sydney University's Medical Oncology Unit have contributed to the approval of more effective and better tolerated drugs for kidney and prostate cancer.



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NEED TO KNOW

- A clinical trial of a kidney cancer drug shows it works with fewer side-effects than a similar drug
- A clinical trial of a prostate cancer drug shows it is as safe and effective as a chemotherapy alterative
- WSU research has improved the quality of life of cancer patients

Prostate and kidney cancers are among the most commonly diagnosed worldwide. Research at Western Sydney University into the latest treatment is improving the quality of life and increasing survival rates of patients with incurable forms.

Kidney cancer (renal cell cancer) accounts for two to three per cent of all cancers and causes 144,000 deaths annually worldwide. Although recent advances in the understanding of the molecular mechanisms underlying kidney cancer have led to the development of targeted therapies for this disease, up to 30 per cent of patients have secondary cancers — known as metastases — at the time of initial diagnosis and fewer than 10 per cent survive more than five years.

Prostate cancer, meanwhile, is a leading cause of cancer-related deaths in men. When confined to the prostate gland, the five-year survival rate is almost 100 per cent, but when the tumour spreads or stops responding to first-line hormone therapy, the survival rate drops considerably. Metastatic castration-resistant prostate cancers (MCRPC) are incurable and account for approximately 258,400 deaths annually worldwide.

For both these types there is a pressing need for improved treatment options.

The Medical Oncology Unit at WSU carried out two pivotal clinical trials confirming the efficacy of a drug called pazopanib for kidney cancer, and one called abiraterone for MCRPC. The trials also provided further safety data and identified additional types of patients that will benefit from treatment. The results, published in the prestigious *New England Journal of Medicine*, have led to more effective and safer treatment options for patients with kidney cancer and MCRPC all around the world.

Foundational Professor and Head of the Medical Oncology Unit at WSU, Paul de Souza, says: "It was a privilege to be involved in the large international collaborative efforts evaluating the efficacy and safety of these drugs, and to be able to provide patients access to newly developed treatments."

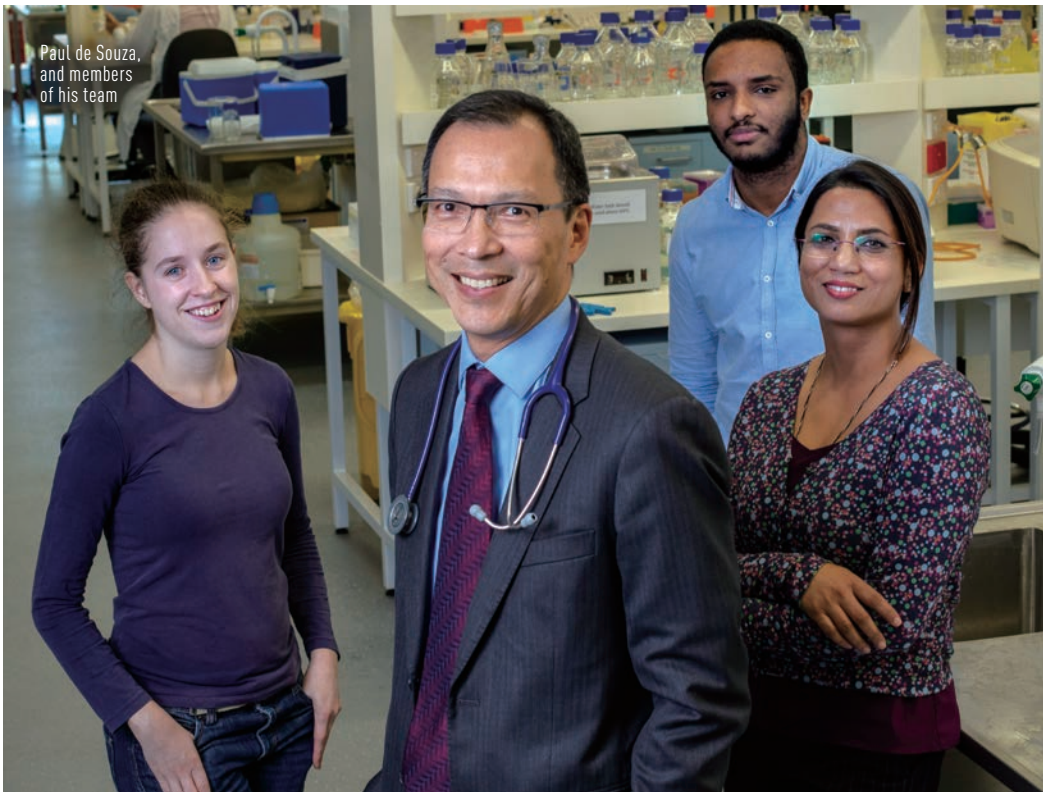
"A BONUS FINDING WAS THAT PATIENTS ON PAZOPANIB HAD A LOWER INCIDENCE OF SIDE EFFECTS."

COMPARING SAFETY PROFILES

de Souza and colleagues compared the effects of pazopanib to those of a previously approved kidney cancer drug, sunitinib. The trial involved 1,110 patients with the most common type of metastatic kidney cancer.

The drugs are very similar in terms of their mechanism of action: they both prevent tumours from forming new blood vessels, and halt cancer cell proliferation and survival by inhibiting the receptors for vascular endothelial growth factor (VEGF) and platelet-derived growth factor (PDGF).

The study, sponsored by GlaxoSmithKline, showed that pazopanib was as effective as sunitinib in helping patients survive.



Paul de Souza, and members of his team

A bonus finding was that patients on pazopanib had a lower incidence of side-effects including fatigue, soreness of the hands or feet, and soreness of the mouth, in comparison to sunitinib.

"When cancer drugs like pazopanib and sunitinib show similar survival benefits, other drug factors, like safety and quality of life, assume a greater importance," says de Souza. "Our clinical studies are helping to optimise the use of these drugs. Refining the drug dose and schedule, as well as identifying those patients that are most likely to respond will ensure we maximise the benefits and minimise the risk of newly approved therapeutics."

At present, pazopanib and sunitinib are among the first-line treatment options for patients across the world with inoperable kidney cancer or metastatic kidney cancer.

IDENTIFYING A NEW PATIENT GROUP

A second clinical trial carried out by WSU investigators explored the potential benefits of drug called abiraterone in patients with MCRPC who had not undergone chemotherapy. Abiraterone is a potent and selective inhibitor of cytochrome P-450c17, a critical enzyme for the production of male hormones. It was originally approved by the US Food and Drug Administration (FDA) for the treatment of patients with MCRPC who received prior chemotherapy containing docetaxel.

This study, funded by Janssen Pharmaceuticals, involved 1,088 patients receiving abiraterone acetate plus the immunosuppressant drug prednisone, or a placebo plus prednisone. The abiraterone–prednisone combination improved patient survival and

> "THE DISCOVERY OF BETTER-TOLERATED DRUG INTERVENTIONS HAS A SIGNIFICANT IMPACT ON PATIENTS' QUALITY OF LIFE AND SURVIVAL"

significantly delayed clinical decline and the initiation of chemotherapy compared with prednisone alone. Furthermore, patients receiving abiraterone were pain-free for longer and had better quality of life.

The results showed that abiraterone works as well and is as safe as docetaxel chemotherapy and have led to the drug being made available to patients earlier in the course of their treatment. Abiraterone is now used globally in men with incurable, advanced prostate cancer after failure of hormone therapy both prior to and after first-line chemotherapy.

Abiraterone and pazopanib are now approved by Australia's Therapeutic Goods Administration and are listed on the Pharmaceutical Benefits Scheme, meaning that many Australians with MCRPC or kidney cancer have access to these medications at reduced costs.

"Given the high incidence of renal cell cancer and MRCPC worldwide, the discovery of better-tolerated drug interventions, such as pazopanib, or of durable responses in a new patient group, as in the case of abiraterone in patients prior to chemotherapy, has a significant impact on patients' quality of life and survival," says de Souza.

WSU's Medical Oncology Unit works closely with local hospitals to conduct both early human studies and late-phase clinical trials to get the best, most innovative treatments to cancer patients faster. By working at the interface of academia, industry and healthcare, de Souza and colleagues are able to accelerate the translation of cancer research into new options for front-line therapy. WSU's commitment to embed research into healthcare creates a unique and attractive setting for students, physicians, researchers and patients alike.

A FULLER PICTURE FOR COUNTING COSTS AND BENEFITS

Economics has traditionally struggled to account for non-financial factors in cost-benefit analyses. But work by WSU researchers is finally helping those considerations to be included.

Contemporary understanding of economics is greatly devolved from its beginnings in ancient Greece as *oikonomia*, the management of the family or household. But, research by WSU economists Dr Kathy Tannous and Dr Neil Perry, shows that comprehensive study of the costs and benefits of our actions can be used to persuade decision-makers of the value of protecting what is priceless: the health and safety of families, communities and our shared 'household', the environment.

INVESTING IN FIRE PREVENTION

Each year in New South Wales more than 4,000 residential fires break out, killing around 21 people, injuring 500, and incurring health and property costs of $650 million. Despite 2005 legislation making smoke alarms mandatory in all buildings in which people sleep, many fires kill people in houses without an operational smoke alarm.

In 2014, Fire and Rescue NSW (FRNSW) piloted the Home Fire Safety Check (HFSC) programme. This sees firefighters visit homes to check that they have a functioning smoke alarm, inspect the home and provide an assessment of fire risk, and teach residents about home fire safety.

Dr Tannous assessed the cost-effectiveness of the HFSC programme and showed that for every dollar spent on the program, $12 in health and property costs were saved.

> "FOR EVERY DOLLAR SPENT ON THE PROGRAM, $12 IN HEALTH AND PROPERTY COSTS WERE SAVED"

This economic evaluation has been instrumental in providing a strong business case for continued funding and the programme's expansion, says FRNSW behavioural insights analyst, Susan Broomhall. It's also helping to change the way firefighters think about their role within their communities.

"Firefighters love helping people, but they have been historically reactive," Broomhall says. Tannous' independent assessment of the proactive HFSC programme has been critical to its acceptance by FRNSW staff, Broomhall says.

It was vital to show firefighters that the cost and commitment were worth it, says Tannous, who accompanied firefighters on many of the HFSC deployments. "The firefighters are going to be pounding the streets, knocking on doors in order to check there's a working smoke alarm and to provide all this information and material, and we had to demonstrate that it's worth doing," she says.

Tannous' study has changed how FRNSW incorporates research, analysis and planning into its work on fire prevention. FRNSW overlaid data on fire incidence with information about lifestyle choices to identify members of the community most at risk from house fires. This allowed FRNSW to maximise the effectiveness of home visits by focusing on people that were less likely to respond to other forms of fire safety

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NEED TO KNOW

- WSU economic research is better incorporating difficult concepts into cost-benefit analyses
- Firefighters found there was a 12-fold return on investing in fire prevention
- A coal mine expansion was halted when social and environmental impacts were costed

education, such as newspaper or radio advertisements.

Tannous' evaluation of the delivery of the HFSC programme has helped FRNSW tailor it to meet the cultural needs of indigenous and migrant communities.

Broomhall says the HFSC program has become a flagship for FRNSW.

"It's so important to be able to elevate the importance of prevention and education, not only within the organisation, but externally to places like Treasury," she says. "Having an academic, independent piece of research to validate the programme just transforms it to a different level."

INFLUENCING DECISIONS

WSU economic research also played a role in factoring the environment into economic calculations. Many argue that nature is beyond monetary value, and economic theory should be kept out of any environmental decisions.

But, Dr Neil Perry points out that economic considerations already drive most decisions pertaining to the environment. Perry's research seeks to better incorporate the concepts of ecology and conservation biology into the same cost-benefit analyses that are used to justify development proposals. His work has gone on to influence major planning decisions affecting Australia.

> "ECONOMIC CONSIDERATIONS ALREADY DRIVE MOST DECISIONS PERTAINING TO THE ENVIRONMENT"

"We've got to try to represent the environment better and point out the economic values that are derived from it," he says.

Development decisions often revolve around trade-offs that seem impossible to meaningfully compare. Is the ecological value of native vegetation worth more than the economic value of a farm crop? The economic consideration of environmental values has traditionally been quite superficial, says Megan Kessler, scientific director of the Environmental Defenders Office New South Wales (EDO NSW), a community legal centre specialising in public interest environmental law. The EDO NSW relies on advice from experts like Perry to ensure their comments on government reform are informed by the best available science.

In 2016, Perry's advice to EDO NSW contributed to the NSW Planning Assessment Commission's rejection of a proposal to expand the Russell Vale Colliery. Perry and EDO NSW argued the cost-benefit analysis for its expansion failed to properly account for the social and environmental impacts on the local community.

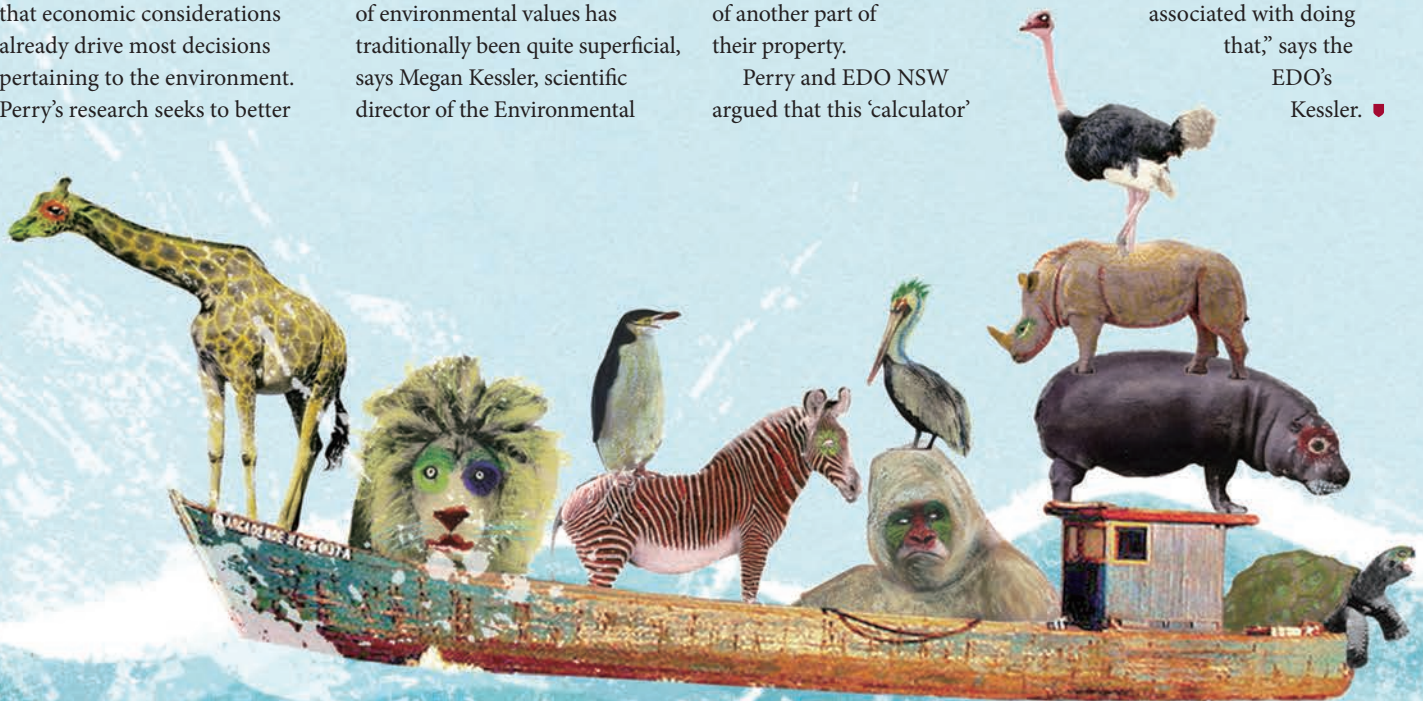
Perry's advice has also been pivotal to EDO NSW's arguments against the NSW government's controversial reforms of the state's biodiversity laws. Under legislation proposed in 2016, a land owner who wanted to clear vegetation could choose to pay into a biodiversity conservation fund instead of improving the environmental condition of another part of their property.

Perry and EDO NSW argued that this 'calculator' approach was both conceptually and economically flawed. Simply paying money into a fund will not prevent the local loss of biodiversity, Perry says, and the calculated price a land owner would pay did not represent the true cost of land clearing.

Despite the significant concerns raised by EDO NSW in its submissions, the NSW government implemented the new Biodiversity Conservation Act 2016 and the offsets payment calculator in August 2017.

This setback was countered by the growing traction of Perry's argument that there are better ways to represent the true economic value of the environment. Perry's articles in the media have generated interest and debate and he regularly briefs environmental interest groups on his research.

"If you are going to go down the path of monetising the environment, you need to make sure that you're actually considering all features of the environment and the risks associated with doing that," says the EDO's Kessler.



BENEFITS FLOW FROM WATER RESEARCH

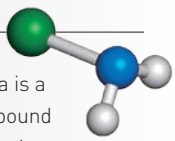
Protecting communities from floods and preventing drinking water contamination are complex and costly challenges for Australian governments. Two WSU researchers have taken their own childhood experiences of these problems, and formed research teams to turn them into solutions.

NEED TO KNOW

- WSU research has developed a better flood-mapping tool
- Other WSU research has developed a tool to assist water treatment plant operators
- Both have been adopted by industry

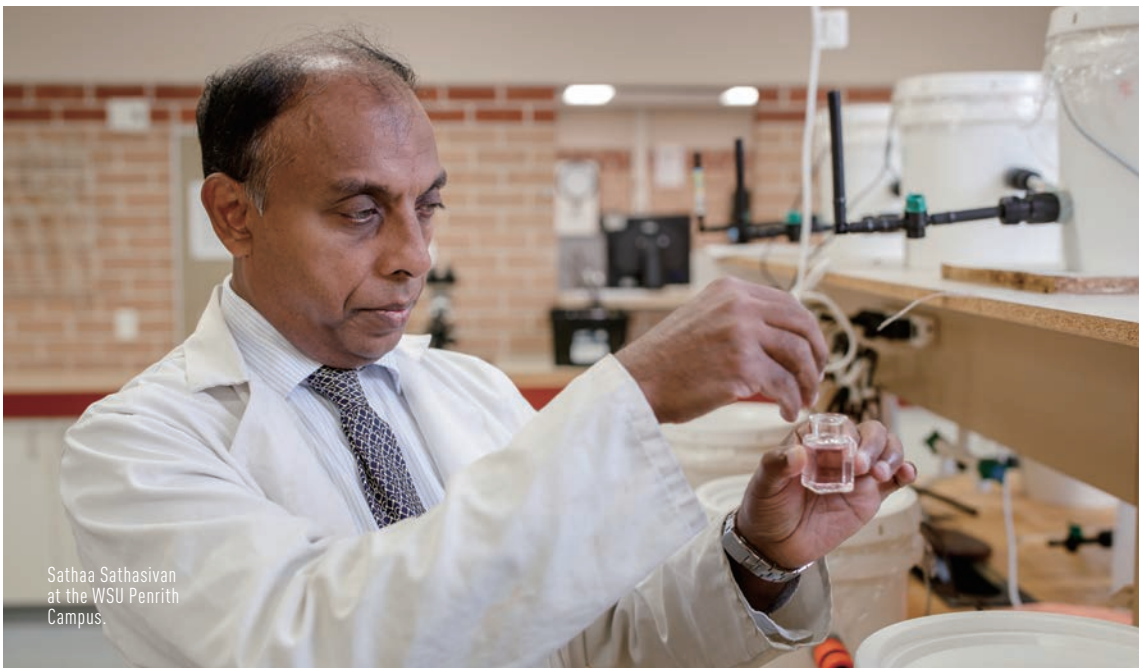
WSU researcher, Ataur Rahman.

CHLORAMINE



↗ Ammonia is a simple compound made of one nitrogen atom, with three hydrogen atoms arranged around it. In chloramine, the structure is the same, but one hydrogen atom is replaced with a chlorine atom.

The chlorine used for water disinfection has no nitrogen involved. Instead, it is two chlorine atoms bonded directly to each other.



Sathaa Sathasivan at the WSU Penrith Campus.

Growing up in Bangladesh, Ataur Rahman knew well the devastation caused by flooding. Nearly a fifth of the country is flooded during an average year and three-quarters sits less than 10 metres above sea level, so he lived with the ever-present threat of inundation.

"Bangladesh has a lot of flood problems," says the WSU water engineer, "so I had an interest in doing research in this area from a young age."

Several decades later, that interest led Rahman to a detailed study of flood risk across Australia and a research programme that has changed the practice of flood estimation nationally. It has been translated into a web-based tool that offers governments, businesses and farmers a picture of what is likely to happen if a flood hits their region. The programme's ultimate goal is to minimise future flood damage.

Floods account for nearly 30 per cent of Australia's natural disasters, and take a devastating toll. The series of floods that hit Queensland in the summer of 2010-11 killed 28 people, caused $2.3 billion in property damage, and reduced Australia's GDP by an estimated $30 billion.

Despite the scale of the problem, there is little historic flooding data for many of Australia's waterways, so developing the tool was difficult. The information gap had sometimes left engineers short of necessary data to plan hydraulic structures and perform environmental studies.

Prior to this research, the existing method of flood calculation was limited by risk being estimated within state borders. Rahman and his colleague Khaled Haddad discounted arbitrary provincial boundaries, instead dividing the country into 14 regions based on hydrological patterns.

The design of what is now known as the Regional Flood Frequency Estimation tool was assisted by Professor George Kuczera of the University of Newcastle, and flood hydrology and water resource allocation expert, Erwin Weinmann. In all, the project involved collaborations from 14 organisations and the National Committee on Water Engineering at Engineers Australia.

> "IN SRI LANKA, PEOPLE HAVE TROUBLE GETTING GOOD QUALITY WATER"

"For any point in Australia, if you put in the latitude and longitude, you can assess the risk of flood. It looks at what could happen, and helps minimise the impact," Rahman says.

"It's very fast and easy to apply using a web interface. It has been used to design bridges and embankments, and to better protect the community."

It has been particularly valuable in rural areas, he notes, where it provides vital additional details for the safe and effective design of farm infrastructure.

If floods are already a major problem for Australia, climate change means that minimising their damage will only become a bigger challenge in future. "The severity of rainfall is increasing and flooding is intensifying," Rahman says (see box).

The tool is already being used by local governments, state water agencies, road authorities and consultants. Rahman says it was recently used to estimate flood risk in 560 locations at once, delivering results within 30 minutes. It has been used as part of the Australian Rainfall and Runoff national guidelines, a public collection of data and software designed to help with risk mitigation and community resilience.

As the flood threat grows, Rahman intends to continue to develop the model. "Ultimately, we want to include more data to continually improve accuracy."

WATER TREATMENT

A childhood in Sri Lanka and the enthusiasm of an early mentor led Western Sydney University's Professor Sathaa Sathasivan to find a solution for treating drinking water.

"In Sri Lanka, people have trouble getting good quality water," Sathasivan says. "That was an area of concern to me."

Sathasivan had studied civil engineering before deciding to change direction and embark on doctoral studies in environmental engineering, where his PhD supervisor had a passion for drinking-water microbiology. The supervisor's enthusiasm was passed on, and Sathasivan has worked in the field ever since.

Sathasivan's work focuses on disinfectant technology. Amongst other things, he has been investigating a chemical called chloramine (see box), a safer and cheaper alternative to the more standard water treatment approach.

The traditional method combines filtration to remove larger contaminants and chlorine to neutralise smaller contaminants such as bacteria and viruses. While chlorine is effective, it is also expensive and a potential health hazard, producing by-products when the chlorine reacts with other compounds that might occur in 'raw' water. Some of these by-products are thought to be carcinogenic, although the evidence is far from certain.

Chloramine, which is formed when ammonia is added to chlorine, does not produce these unwanted by-products, is considerably cheaper, and much more stable than chlorine — lasting about ten times longer. All of this makes it a far more desirable chemical for water treatment.

However, chloramine has one major weakness: under certain conditions, bacteria may feed on free ammonia in the chloramine-treated water, producing a chemical called nitrite. The runaway chemical and biological processes sometimes consume all the chloramine in a water supply without any warning, leaving insufficient levels for effective treatment.

Sathasivan and colleagues addressed this problem, through a project funded by industry and WSU, by developing a tool to predict when runaway nitrification might occur.

The tool emerged from the team's research into factors that influence the likelihood of a nitrification event, such as the concentration of chlorine and ammonia in the water reservoir, the temperature and pH of the water, and other variables such as fluid dynamics within the reservoir.

The benefits of the research were so important that the Australian Research Council has now funded a Linkage grant of $1.1 million with industry funding from five water utilities in Sydney and Queensland.

WATER SAVINGS

The tool developed by Sathasivan and his colleagues does more than simply predict when nitrification events are likely to occur. It also helps water treatment plant operators decide what to do about a possible nitrification problem, and when to act; what dose of chlorine to use to bring the bacteria back down to safe levels; what impact this will have on the consumer; how long to treat; and also the possible impacts of outside events such as extreme rainfall, extreme heat or bushfires. It can also help identify infrastructure problems that might be contributing to a higher risk of nitrification, which can help with longer-term investment decisions.

Sathasivan's work is now being used by South East Queensland Water in its investigation of disinfection improvements. SEQ Water currently uses chlorine to disinfect at the treatment plant, but uses chloramine for secondary disinfection, when the water leaves the plant to its pouring out of the consumer's tap.

Brett Myatt, project lead for the South East Queensland disinfection optimisation project, says he's interested to see if disinfection improvements could be made.

SEQ Water regularly sends 1000 litre-samples of their treated water to Sathasivan, who continues to run experiments modelling the effect of environmental conditions on nitrification.

This work has revealed that water's pH has a particularly significant impact on the risk of such events.

The findings are helping SEQ Water to prioritise their actions. "We're talking infrastructure investment of millions of dollars," says Myatt. "So it's making us confident it will have a significant effect."

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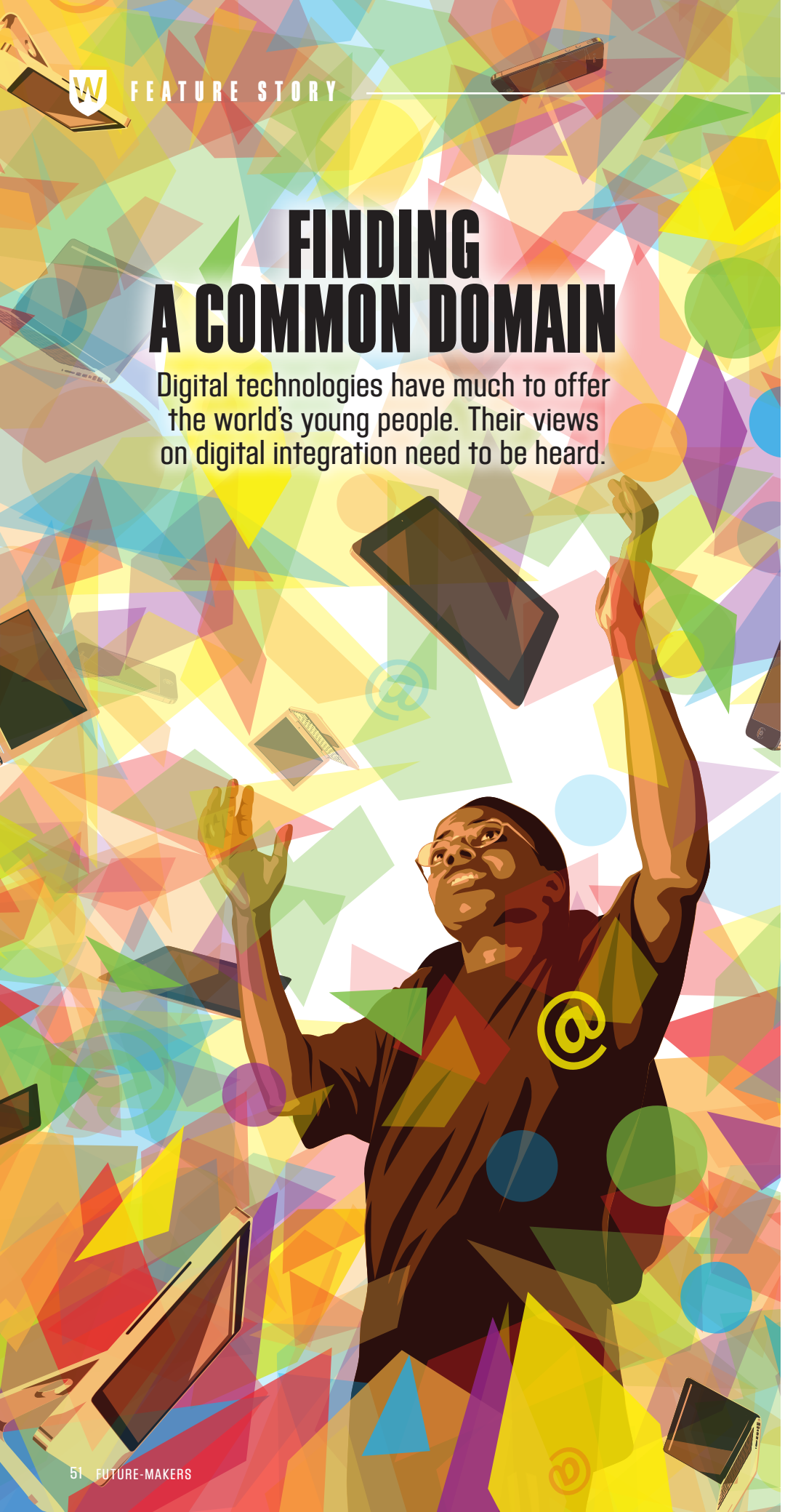
DEBBIE DELUGE

↗ In 2017, Tropical Cyclone Debbie devastated Queensland, northern New South Wales and northern New Zealand. In Lismore, it pushed the Wilsons River to a peak of 11.59 metres, breaching a levee built in 2005 for the first time. The peak was not as high as previous floods in 1954 and 1974, but the speed of the river's rise was noteworthy. Earlier events have typically followed extended periods of rain. Debbie dumped most of its rain in 24 hours, and it happened in a year without the La Niña conditions that have typically contributed to earlier devastating floods on the east coast.

FINDING A COMMON DOMAIN

Digital technologies have much to offer the world's young people. Their views on digital integration need to be heard.



It's an old saying that children should be seen and not heard. Yet for WSU researcher Amanda Third, such an attitude prevents us from using the power of digital devices to improve life for all children and society more broadly.

A principal research fellow in digital social and cultural research in the Institute for Culture and Society at WSU, Third has joined with colleagues to research how to ensure children's voices are heard. This has included an Australian Research Council-funded project and leading a multi-million-dollar research programme in the Young and Well Cooperative Research Centre.

"I believe that by listening to children we can get better outcomes," Dr Third says.

The team's research focuses on young people's use of digital technologies such as mobile phones and social media apps, exploring children's attitudes towards such technologies and their potential to improve young lives.

The research has been adopted by Australian telecommunications giant Telstra as part of its digital inclusion strategy and has helped the children's safety charity Alannah and Madeline Foundation support digital literacy and online safety in 2,200 schools and 900 libraries.

The team's reports have also raised public awareness of the benefits of young people's use of digital media for safety and wellbeing, particularly in creating connections within marginalised groups such as the homeless, Indigenous young people, the disabled and same-sex attracted young people.

With the Young and Well CRC, Third and her colleagues have developed evidence-based support tools such as web and mobile apps and online resources that have reached 36 million people globally.

"It's about delivering technology, programs and education in a way that meaningfully intersects with a young person's experience of life. If we don't do that, they won't buy in, and the interventions won't have impact," she says.

GLOBAL IMPACT

The team's research feeds into the United Nations Convention on the Rights of the Child, the most widely ratified treaty in history. In particular, Third is focused on promoting Article 12, which states the opinions of young people should be considered in making decisions about issues involving them. Her approach is unique internationally.

"Many people representing three generations in multiple countries have benefitted from [the team's] innovative, highly collaborative approach to changing the global conversation about youth and technology," says Anne Collier, former chair of the USA's National Task Force on Online Safety.

In 2014, ahead of UN celebrations to mark the 25th anniversary of the Convention on the Rights of the Child, Third and her team were invited to present at the opening of the Day of General Discussion. Third's group delivered a seminal report, Children's Rights in the Digital Age, which drew on 17 organisations, 16 countries, and eight languages. Appropriately, the starting point for the UN study was input on its design from members of the Young and Well CRC's Youth Brains Trust — a group of 20 people from across Australia aged between 12 and 25.

The report was distributed to more than 3.2 million recipients and has since played a key role in setting the global agenda on children's rights in the digital age. It is also central to a larger study involving 500 children from 26 countries, who took part in workshops to discuss their experiences with information and communication technologies and their hopes and fears for the digital age. Their views on the impact of digital technology on family life, social wellbeing and political advocacy were included in UNICEF's 2017 State of the World's Children report.

"If young people can see they can play a role in setting the agenda then we are helping create the next generation of change-makers," says Dr Third.

Most recently, studies from Third and her colleagues have supported the Children's Commissioner for England to call for a General Comment on children's rights and digital media. In UN parlance, General Comments are non-binding statements that accompany UN rights. Third says they provide critical guidance to states and NGOs on the meaning and interpretation of rights and they help set agendas for policy and practice.

NEED TO KNOW

- WSU researchers are exploring how young people and technology interact
- The work has reached 36 million people globally
- It has informed UN work on the rights of the child in the digital age

POINTS OF VIEW

Third says a key challenge of her work is the difference in perspective between adults and young people about digital media. "In an area like privacy, adults worry about stranger danger and children being exposed to potential predation [whereas] kids are more worried about privacy from nosy adults. The emphasis is different."

> "I BELIEVE THAT BY LISTENING TO CHILDREN WE CAN GET BETTER OUTCOMES"

It is in these differences in emphasis that Third sees a potential bridge for the generation gap. She points to a recent study where young people were asked to design online scenarios around situations such as online stalking after a relationship break-up; too much time online; or even mobile phone costs. Then they sat with an adult and showed them how they would address the issue digitally. The results exceeded expectation. "We had hoped for skill transfer and for the adults to see things through the child's eyes a little bit," says Third. "But it very quickly became a conversation between adults and young people about the meaning of social media and the way digital media is reconfiguring the world for us."

Third's team published a report which outlines best-practice approaches in creating opportunities for intergenerational exchange of knowledge around social networking and cyber safety.

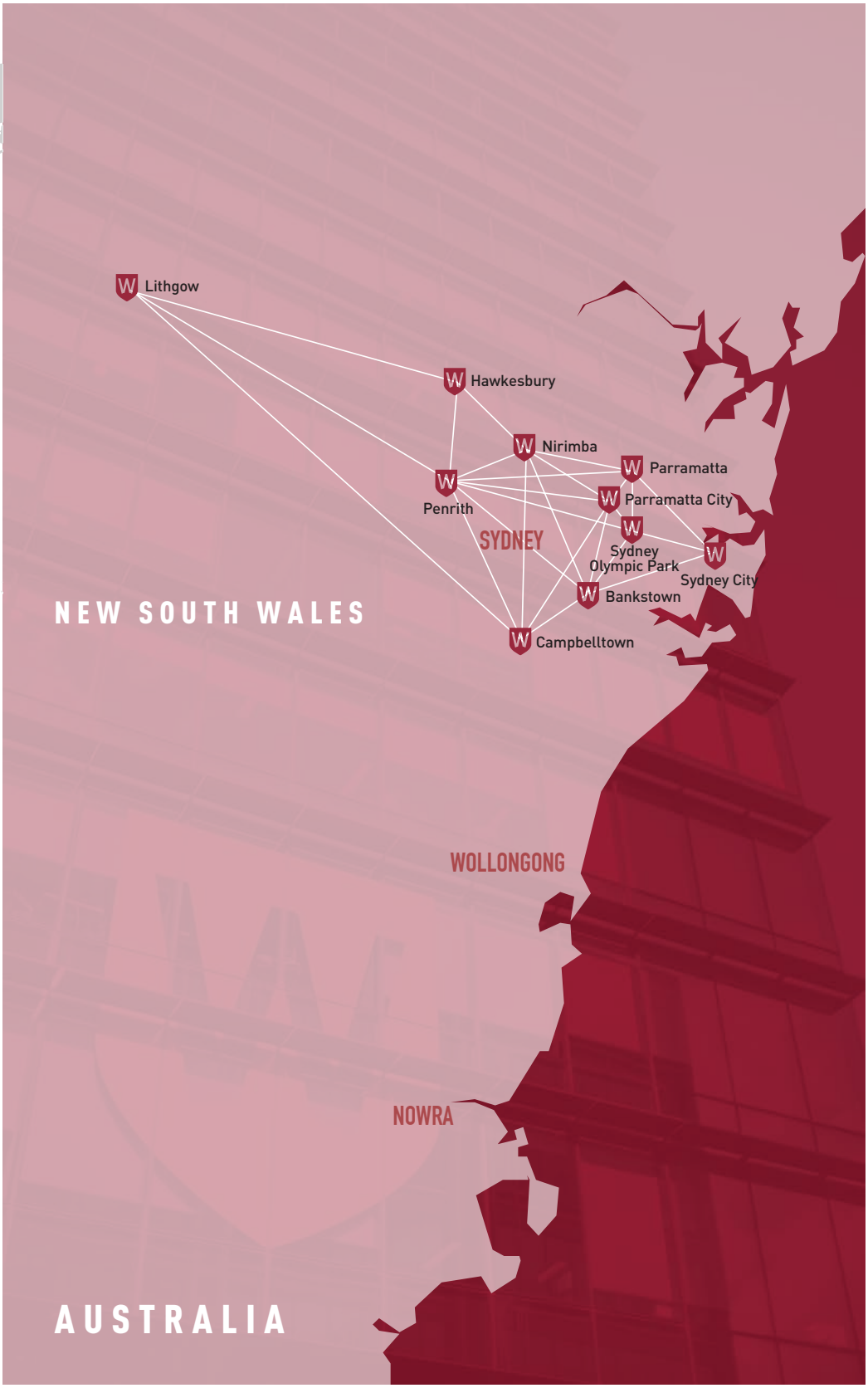
BULLY BEEF

At the heart of Third's work is her commitment to using digital technologies to improve the opportunities, mental health and wellbeing of young people. "We know that, under certain circumstances, digital spaces can powerfully support young people's mental health and wellbeing, but we are yet to understand how to best support those who are most vulnerable," she says.

While she concedes cyberbullying can pose a threat to vulnerable children, Third believes there is an over-emphasis on the issue by adults and the media. "Cyberbullying stories often demonise young people and their digital and social media use," she says. "The research suggests that hyperbolic stories about how bad things can get are actually frightening young people."

The focus on cyberbullying also risks missing the bigger picture. "We are on the precipice of a new era," says Third. "Technologies such as virtual reality, augmented reality, artificial intelligence and robotics are here and while we are preoccupied with cyberbullying we are not paying enough attention to the risks and opportunities of these new developments."

Researchers are just beginning to understand what knowledge is needed to leverage the powerful potential of digital media. "Children need to be embedded in the processes of researching and designing interventions. We need a lot of goodwill to achieve these things but I am confident we will get there."



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Institute for Culture and Society

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