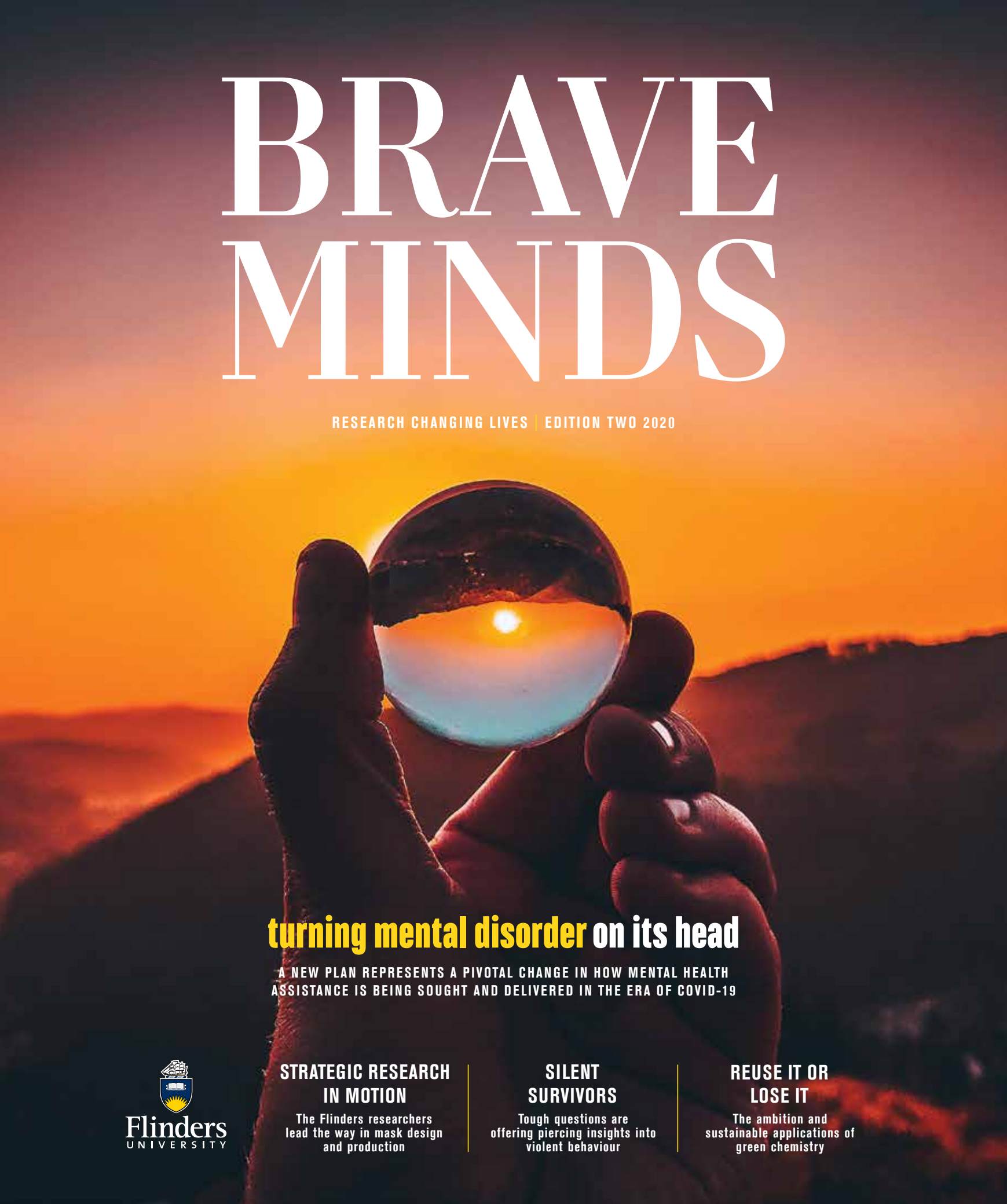
BRAVE MINDS

RESEARCH CHANGING LIVES | EDITION TWO 2020



turning mental disorder on its head

A NEW PLAN REPRESENTS A PIVOTAL CHANGE IN HOW MENTAL HEALTH ASSISTANCE IS BEING SOUGHT AND DELIVERED IN THE ERA OF COVID-19

Flinders UNIVERSITY

STRATEGIC RESEARCH IN MOTION

The Flinders researchers lead the way in mask design and production

SILENT SURVIVORS

Tough questions are offering piercing insights into violent behaviour

REUSE IT OR LOSE IT

The ambition and sustainable applications of green chemistry

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Writers: David Sly, Bill Condie

CONTENTS

NOW, MORE THAN EVER, WE NEED EXPERTS AND EXPERTISE TO HELP US NAVIGATE THE COMPLEXITIES AND UNCERTAINTIES WE FACE AS A SOCIETY – BRAVE MINDS TACKLING BIG QUESTIONS AND FINDING SOLUTIONS THROUGH RESEARCH THAT TRANSLATES INTO REAL-WORLD OUTCOMES.

As a research-intensive university, our research base is broad. Our researchers are investigating topics including new glaucoma tests to prevent blindness, vertebrae development in fossilised fish, new interventions to stop domestic violence and the application of advanced technologies in shipbuilding. This important research is continuing with only limited interruption from the global COVID-19 pandemic, which has opened up a new pressing need for research.

Our researchers are rising to the challenge of the pandemic, with 35 projects underway related to the medical, economic and social impacts of the novel coronavirus. These projects span a range of disciplines and are being undertaken in collaboration with a number of industry partners. They range from the development of 3D-printed facial guards to assessing the effects of the pandemic on the wellbeing of individuals, but what they – and all our research – have in common is that they have been designed to make an impact in the real world.

There is no question that the challenges facing the world are great, but our capacity to rise to the challenge is what defines research excellence at Flinders University. I know we can emerge from this time as a more resilient, healthy and caring society.

I trust you will enjoy reading this update on some of the research undertaken at Flinders University.

PRESIDENT AND
VICE-CHANCELLOR
PROFESSOR COLIN J STIRLING

IN 1966 WHEN FLINDERS UNIVERSITY WAS ESTABLISHED, FOUNDING VICE-CHANCELLOR PROFESSOR PETER KARMEL STATED HIS AMBITIONS FOR THE UNIVERSITY "WE WANT TO EXPERIMENT, AND EXPERIMENT BRAVELY". IN THE SPIRIT OF THIS TRADITION, WE RECOGNISE THE "BRAVE MINDS" OF OUR RESEARCHERS.

MANY OF HUMANITY'S GREATEST CHALLENGES ARE BEST ADDRESSED BY RESEARCH THAT INCORPORATES BOTH TECHNOLOGICAL DEVELOPMENTS AND SOCIAL IMPACT ANALYSIS. THIS ALLOWS OUTCOMES TO RESONATE MORE POWERFULLY AND THEREFORE ENHANCE THE LIKELIHOOD OF RESEARCH IMPACT.

As a comprehensive research-intensive university, Flinders embraces both the technological and the social challenges inherent in many problems. Over recent years, the issue of models of care, whether that be caring for the elderly, for those with disabilities or those with mental health and wellbeing challenges, have increasingly taken centre stage in our communities. Flinders has been proactive in combining technological and social research to tackle these issues head-on with focused research initiatives led by the recently established Caring Futures Institute, the Órama Institute for Mental Health and Wellbeing, the Social Work Innovation Research Living Space and the Flinders Digital Health Research Centre. Their research is featured in this Brave Minds magazine as examples of research outcomes that are rapidly improving the world in which we live.

Another area of both technological and social challenge is the transformation we are seeing in industrial production as the world transitions to advanced forms of manufacturing commonly referred to as Industry 4.0.

The technological demands required for a company to move to Industry 4.0 are substantial, but so too is the requirement to encourage the workforce to embrace such new technologies. Also featured in this magazine is the work of Flinders researchers at the Australian Industrial Transformation Institute and College of Science and Engineering, who are researching ways to facilitate such transformation.

A huge component of all of these research activities is the depth and breadth of the direct connection between our researchers and industry, where we work in close partnership with businesses, not-for-profit enterprises and government to ensure that our research results in the types of innovation and transformation that benefit society.

Of course, you'll find many other wonderful research stories in this magazine, the consistent theme being that it is the needs and interests of members of our communities that drive us and define us. These are the fundamental values that explain why our research succeeds – because it reinforces our collective humanity.

DEPUTY VICE-CHANCELLOR (RESEARCH)
PROFESSOR ROBERT SAINT

STRATEGIC RESEARCH IN MOTION

THE NEED WAS URGENT. COVID-19 TRIGGERED ENORMOUS DEMAND FOR ADEQUATE PERSONAL PROTECTIVE EQUIPMENT (PPE) FOR PEOPLE WORKING AT THE MEDICAL "FRONT LINE". THIS CHALLENGE SET PROFESSOR KAREN REYNOLDS' STRATEGIC RESEARCH BRAIN IN MOTION.

As Director of the Medical Device Research Institute at Flinders University, Professor Karen Reynolds knew the University was well placed to address this challenge, given its advanced facilities and world-class cross-disciplinary personnel.

"We have the right people, expertise and resources, so we made logical connections and brought together a team able to tackle problems head-on and provide a vital service to the community," says Professor Reynolds. This team brought together expertise from engineering, physiology, chemistry, materials science and environmental health.

With the support of the South Australian Government, and in collaboration with colleagues from UniSA, the team established the South Australian Mask Testing Facility. The new facility provides domestic industry with an opportunity to meet consumer demand in a severely disrupted market due to COVID-19-affected global trade and transport logistics. The first request came from local company Detmold, which was establishing new manufacturing capability tests for medical respirators and surgical face masks in South Australia.

"Until the pandemic, much of the testing for these items had been done outside of Australia. With increased demand resulting from COVID-19, the time taken for these tests to be run overseas was growing. Our facility has provided a sovereign capacity to conduct the testing here, assisting both domestic manufacturers and importers," says Professor Reynolds.

With additional support from Flinders Foundation, Flinders has been able to expand the facility's function to include textile testing, which allows surgical gown manufacturers to test resistance to bacteria, viruses and fluids, and extends the nation's capabilities for testing of PPE.

However, Professor Reynolds wasn't satisfied with merely measuring items against existing standards. The uncharted frontier of COVID-19 risk management demands increased rigour and expanded investigation. It also requires thinking differently about problems to achieve better outcomes. She is urging Flinders' research teams to reach higher.

"Once the new testing facilities were activated, it opened up new research questions. Testing the effectiveness of materials used in face masks is one important matter, but what about leaks around the edges of masks? That's where aerosol penetration can occur. What value is a test that shows a fabric effectively filters out 95% of coughed or sneezed aerosol delivery, when the mask design allows 50% leak around its edges?

"WE BEGAN TO ASK WHETHER THE STANDARDS THAT UNDERPIN EXISTING TESTS ARE ACTUALLY ASKING THE RIGHT QUESTIONS. A BIG PART OF OUR CURRENT ACTIVITY IS ESTABLISHING NEW, IMPROVED REGIMES THAT ARE UNDERPINNED BY RESEARCH."

"We began to ask whether the standards that underpin existing tests are actually asking the right questions. A big part of our current activity is establishing new, improved regimes that are underpinned by research." This set Flinders researchers on innovative paths. Associate Professor Kirstin Ross is an environmental health researcher who was testing the efficacy of surgical masks against aerosolised virus particles when she noticed a student fashion designer creating matched face mask and lingerie sets. "I scoffed, thinking it wouldn't work – but then I had to admit that I just didn't know," says Associate Professor Ross. "I already had the testing apparatus in place, so I thought I'd test these fashionable cotton masks to measure their protective capabilities. This is exactly the type of simple scientific question that the public needs answered. And to my surprise, these masks were very effective."

PROFESSOR KAREN REYNOLDS

The study that resulted from these tests, published in Pathogens journal, showed that commonly available fabric masks are very effective in reducing the number of aerosolised viruses a wearer could be exposed to. The study found that even the poorest performing mask filtered at least 63% of virus numbers in aerosols typical of those produced by coughing and small enough to be inhaled.

A Flinders University research trial is also underway to test personalised 3D-printed face mask seals that are moulded to fit the faces of individual healthcare workers. These are designed to reduce the potential for any infection caused by ill-fitting masks when treating COVID-19 and during other high-risk procedures.

Thinking outside of the original research brief, Professor Reynolds is promoting wider applications for innovations driven originally by the COVID-19 response. "We tend to think of face masks at this time as a COVID-19 protective measure, but there is much broader need for respiratory protection equipment. This has been highlighted by the terrible bushfires of recent years, the intense smoke they have generated and firefighting measures that people have been forced to take."

This research is among a raft of 35 COVID-19 related projects active across Flinders University's six Colleges, some in collaboration with external partners. They encompass a myriad of societal aspects, recognising that the social implications of COVID-19 are broad reaching, greatly affecting the general community and not just those afflicted by the disease.

Conversations about new collaborations with industry continue. Professor Reynolds says more than 100 businesses and organisations from around Australia have contacted her team to explore COVID-related assistance, helping industrial designers, manufacturers and importers with vital research, testing and product development.

As part of this expanding network, Professor Reynolds has also led the Medical Device Partnering Program in developing Australia's first dedicated online Capability Directory for the medical device sector. With more than 2,600 Australian organisations already listed in the directory, it aims to boost innovation and development of cutting-edge medical devices and technologies across the country – and it places Flinders in a pivotal position at the centre of this activity.

"Our goal is to build on the current research and manufacturing capability across the nation and develop Australia's position as a global leader in the growing medical devices market," says Professor Reynolds. Through these initiatives, Flinders is underlining its role in the medical device sector and has highlighted the important capabilities within the university."

THE (ANTI)SOCIAL NETWORK

THE WORLD HAS MOVED TOO QUICKLY IN 2020. BUSHFIRES. RELIEF APPEALS. COVID-19. 5G CONSPIRACY THEORIES. BLACK LIVES MATTER. ANTI-LOCKDOWN PROTESTS. ALL THESE DECISIVE MOMENTS HAVE TRIGGERED SURGING SOCIAL MEDIA INTERACTION, AND ALL DEMAND CLEAR ANSWERS AS TO WHY PEOPLE REACT AND RESPOND.

This new, uncharted area of scientific research is the focus of Associate Professor Emma Thomas, and her expertise is in high demand.

Online technologies are providing a powerful lens that is magnifying critical aspects of social behaviour. This year, people have inevitably engaged more and with greater intensity online, prompting questions about many psychological aspects of online engagement.

"The technology may be new, but the psychology is old," says Associate Professor Thomas, recipient of an SA Young Tall Poppy Science Award in 2018. "There is a set of psychological responses that probably have motivated political engagement and extremism since the beginning of time. Now we can see that these behaviours of people engaging in revolutions and political violence, or even misinformation and rumour, are being expressed and exposed on an immense, never-before seen scale thanks to social media."

Associate Professor Thomas suggests that we are all participating in a vast global social experiment where online technologies make everything possible. "What motivates people to donate to relief funds, or take to the street in protest? What makes them co-act with other people who share their ideals about how they want the world to be? These are gritty scientific questions, underpinning real-world problems that need to be better understood."

Shaping such new research requires breaking down many accepted norms. The idea that people form groups based on their shared opinions – the subject of Associate Professor Thomas's PhD study – was contrary to psychologists' accepted view that meaningful groups are primarily based on gender, race or other formal affiliations. And for a field of science that focuses on social influences, very little research examined real, actual social interactions between people. Yet while other academics quibbled over the idea that people form strongly polarised groups based on social and political ideals, the global firestorm of online interaction began to take off. Facebook, YouTube and Twitter started to have a resounding effect and a new field of study gained traction.

Standing at the frontier of something so very new is daunting, but not overwhelming. "Sometimes people say to me that these events are so multifactorial and complicated, that they are impossible to study via the traditional methods of science. But I say if the human body, in all its complexity, can be studied by breaking it down to examining molecules, cells and enzymes, then we can use the same kind of methods to understand these social and political phenomena," says Associate Professor Thomas. "We conduct experiments, but we're still trying to describe and understand. Understanding the motives from the perspective of the person who is engaging is the first step. It's only after achieving this that we can start to intervene more effectively."

However, her studies also involve extreme groups, aiming to identify what binds them and maintains their belief structures. It ranges from right-wing extremists to groups sharing aberrant beliefs, such as anti-vaxxers or people who believe 5G caused COVID-19. "If you're the only person who thinks that the telecommunications network is making you sick, you would probably be treated as someone with a psychological delusion. If you share that with someone online and they agree with you, it's no longer just an individual thought, but can become the basis for forming a new group around shared opinions and beliefs about social relations.

"The same mechanisms that can be used to organise good in the world can also explain how people mobilise around ideas that seem completely bizarre to someone outside of that group. The psychology has similar elements, although some of the key ingredients are different."

Associate Professor Thomas's perspective came from wanting to study what motivates people to make social protests. She initially studied psychology believing it would help her to get a job that involved working with people, but during the course her interest in unsolved questions about social influence ignited a passion for research. "It was the scale of charitable response to the Boxing Day Tsunami in 2004 that struck me," she says. "Other entrenched forms of disadvantage don't elicit the same extraordinary levels of public support, so my early work set about identifying what motivates people to support humanitarian causes."

In 2010, the relevance of social media activity fuelling the Arab Spring democracy uprisings proved that her research had hit a decisive new vein of social analysis. "The speed of online engagement showed something new, that you could mobilise people who wouldn't usually be interested in an issue and have them move beyond just an emotional response to actually put their money where their mouth is and try to change something."

Much of her current work is attached to growing defence interest in cybersecurity that extends to online influence and misinformation. "There's strong national security interest in how people radicalise online and what forms of online interaction drive that increasing commitment to violence," says Associate Professor Thomas. "Misinformation is different from disinformation. Disinformation is spread with intent to make someone do something you want them to do. These things have measurable impacts on communities and how they respond to threats."

To identify trigger points around why people mobilise, Associate Professor Thomas seeks to discover why and how people engage in the first place and, on the flip side, when violence is adopted to meet desired social or political means.

ASSOCIATE PROFESSOR EMMA THOMAS

"People don't just go from not caring to taking up violence. We know that they engage first and only adopt violence because they perceive that other means are not going to work. It's a complex psychological process that is unique to each individual but has elements we can identify. Patterns emerge."

Such a rapidly changing area of research pulls together many resources at Flinders University, with ties to criminology, psychology and collaborative work with the Torrens Resilience Institute. The speed of change has also shifted Associate Professor Thomas's worldview. "When I started in this area of research, I felt excited about the role new technologies would have in improving justice and inclusion for disadvantaged groups. That excitement remains, but now I see it also being used to co-opt more insidious forms of social and political conspiracy, misinformation, radicalisation. Protests and other forms of collective action are critical for a healthy, functioning democracy – we need people to engage. But the conspiracies that fuel societal division and political violence have enormous personal, social and economic costs."

Associate Professor Thomas is now looking at the role of imagined futures and hope in inspiring people to engage with pressing social problems of climate change and global inequality, within an Australian Research Council (ARC) Discovery Project with Flinders Psychology colleague Professor Michael Wenzel.

"A lot of literature on activism and social mobilisation looks at anger as a really important emotional response in people who want to change the world. Fear is another important motivator. But we want to investigate the role of hope in allowing people to essentially overcome apathy, and whether it's an antidote to despair."

The early results have been surprising. "We're finding evidence that hope by itself doesn't really engage people. You need people to be angry as well. You need an angry hope to evoke change and not just a wistful hope."

TURNING MENTAL DISORDER ON ITS HEAD

PROFESSOR MIKE KYRIOS

A NEW PLAN REPRESENTS A PIVOTAL CHANGE IN HOW MENTAL HEALTH ASSISTANCE IS BEING SOUGHT AND DELIVERED IN THE ERA OF COVID-19.

The Órama Institute of Mental Health and Wellbeing at Flinders University, in partnership with the South Australian Health & Medical Research Institute (SAHMRI) Wellbeing and Resilience Centre, has found that 80% of participants in its research are showing high levels of psychological distress or low levels of wellbeing since the start of COVID-19 restrictions, up from around 50% pre-COVID.

This is the reason that waiting times to see a mental health professional have increased dramatically since COVID-19.

However, Órama inaugural director Professor Mike Kyrios and his team have smart and helpful solutions to offer, implementing new evidence-based strategies that can be delivered effectively online in a group format by trained facilitators.

When the pandemic bit, Órama acted swiftly, issuing online mental health and wellbeing advice built around several acronym-led suggestions for how to cope with COVID-19: the STREAM, APPEAL and CARE frameworks. But the great leap forward has been introducing the Be Well Plan, developed in conjunction with the SAHMRI group. This evidence-based online program enables participants to tailor their own suite of exercises and strategies for building strong, positive levels of mental health and wellbeing, and data on participants show it has excelled in prevention, alleviating mental distress after only five online sessions undertaken during COVID-19. The program was particularly effective for those participants with pre-existing mental health challenges.

By providing early intervention through such a convenient online delivery method rather than placing increased pressure on already over-burdened mental illness assistance systems, the Be Well Plan represents a pivotal change in how mental health assistance is being sought and delivered.

“We call it a mental health system, but in truth it's a mental illness and mental disorder system – and this is rather removed from addressing mental health,” explains Professor Kyrios. “The mental health system only looks at people with disorder. It ignores a very large group of people with low wellbeing, and this represents a high risk factor for future mental illness.”

Professor Kyrios says the Be Well Plan is built upon vast review and analysis of all studies that have recorded mental health and wellbeing outcomes. “We have only incorporated strategies or interventions that are proven to be effective. We’ve translated them into a language that is easy for people to understand, and continue to measure their effectiveness through the community – including very specific cohorts such as Indigenous healthcare workers, hospital healthcare staff, high school students and university students.”

Professor Kyrios says the Be Well Plan provides a toolbox that people can keep dipping into as their circumstances change. He notes that when people are shown a lot of trust and responsibility to steer their own care path, they respond with increased positivity to treatment. “Self-agency is one of life’s most important skills. Being given a sense of hope and permission to take control, along with the skills and guidance on how to do things, improves a person’s self-esteem immediately,” says Professor Kyrios.

“People start to identify other strengths that they didn’t know they had. Traditionally, the clinical world looks at what deficits people have and focuses on how to get rid of their symptoms. It has only recently looked at directly targeting how to improve the quality of lives. We take the approach that the glass is half full, rather than being half empty. We want to fill that glass by augmenting people’s strengths.”

The plan is now supported with Be Well Tracker, an ongoing online assessment of wellbeing that people can keep monitoring. “This is the beauty of the online world,” says Professor Kyrios. “The program is nimble enough to be reactive and adaptive. It’s able to provide a snapshot of what is happening right now, and this helps people who are at risk.”

The easily accessible online delivery of the Be Well Plan plugs a gap that exists in current mental health assistance. It is clear that online programs will now flourish, as the pandemic has accelerated people’s online literacy in many areas, including the telehealth delivery of mental health services. “The first thing young people do is go online to find help,” says Órama researcher Dr Dan Fassnacht. “If they find something that appeals to them, then they will use it online as well.”

This provides a versatile platform for mental health delivery – via mobile apps, SMS messages, Zoom meetings, online portal access to treatment programs – that offers both formal support (such as sessions with doctors and specialists) and informal support, such as social networking to maintain contact with others.

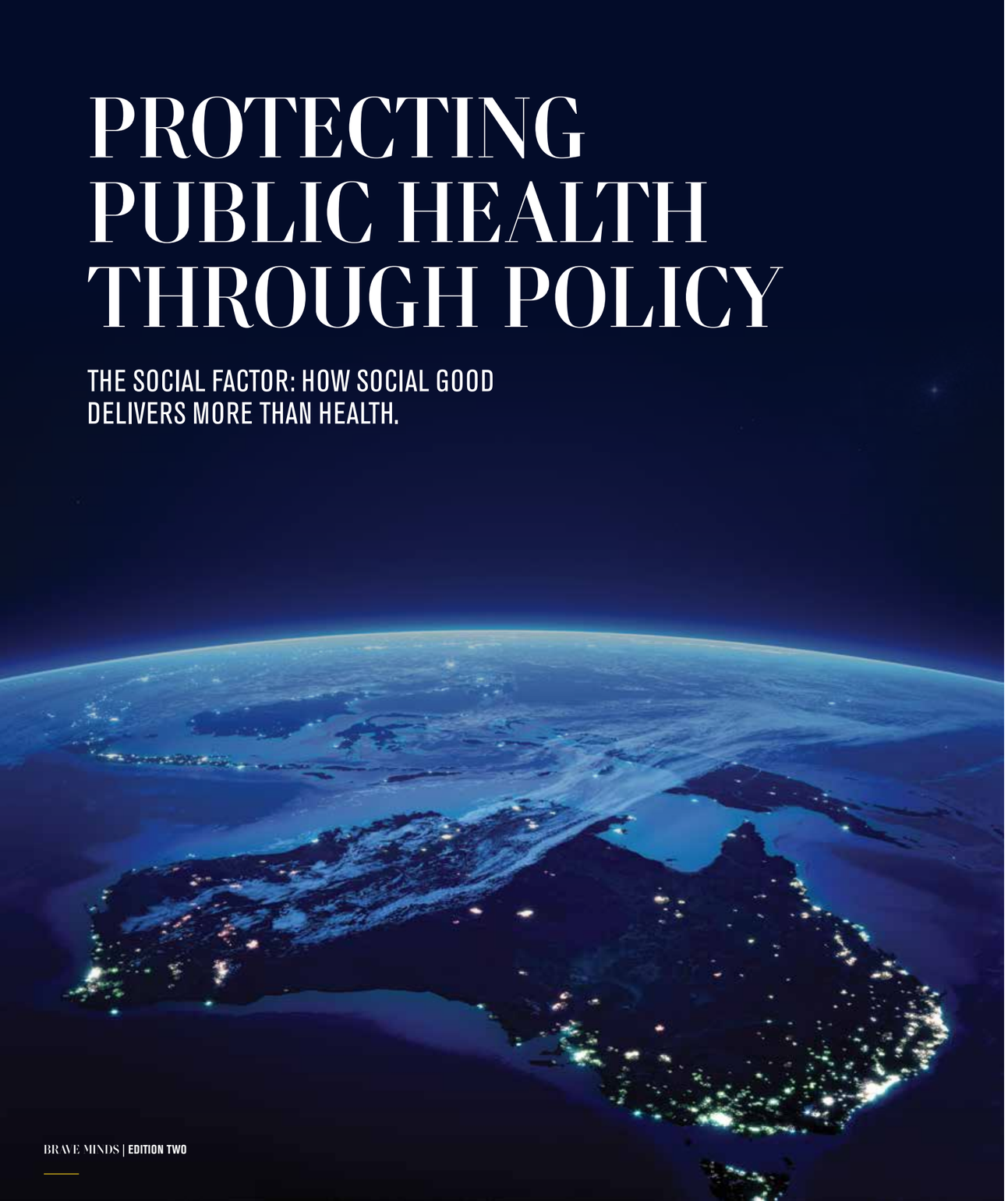
“The key is to make certain that people in need know where to find evidence-based help, so the introduction of the tested Be Well Plan can have far-reaching policy and service implications,” says Professor Kyrios. “Everyone talks about multi-step care in mental health delivery, but at present our public health systems do not really provide it. The Be Well Plan can provide the element of change by delivering an easily accessible and up-scalable program that will save money for governments, industry and the community – and it will support individuals in their lives.”

For more information visit:

flinders.edu.au/institute-mental-health-wellbeing

PROTECTING PUBLIC HEALTH THROUGH POLICY

THE SOCIAL FACTOR: HOW SOCIAL GOOD DELIVERS MORE THAN HEALTH.



Are we governing for health and wellbeing or are we governing for profit?

How we answer that question over the next few years could determine whether life expectancy, which has steadily gained in Australia for decades, begins to fall, says Professor Fran Baum, Director of Southgate Institute for Health, Society and Equity at Flinders University.

“Health inequities, particularly over the last 25 years, are increasing in Australia and I predict that, for some groups at least, we're likely to have declining life expectancy in the next five years,” she says. ”It's already happened in the US and UK for lower socioeconomic people and I think we won't be far behind.”

While governments and oppositions may haggle over healthcare budgets, that is to miss the point, says Professor Baum.

“Health care is just picking up the bodies at the bottom of the cliff,” she says. “What we're trying to do is take people away from the cliff and give them a good life so they don't ever go near the edge.”

Professor Baum has been studying the social, political and economic determinants of health since the 1980s with international acclaim. This year, Southgate Institute was designated as the World Health Organization Collaborating Centre on Social, Political and Commercial Determinants of Health Equity.

“There's a number of studies that show that standards of health care are not the main contributors to life expectancy. It's what happens in the rest of our lives – how we're employed, the kind of housing we have, our access to education. These are much more powerful determinants of life expectancy than care.”

Estimates suggest the healthcare system contributes about 20% to a person’s life expectancy, genetics a similar amount, but around 60% comes from broader social determinants.

Professor Baum hopes that the COVID-19 pandemic may open people’s eyes to the choices our policymakers make between short-term profit on the one hand and the best wellbeing and health options for the populations.

“I think we're seeing as a result of this pandemic that what's good for health in the long term is also good for the economy,” she says. “Some issues, like opening a coal mine, might benefit us in the very short term.

"But in the long term, there's going to be a lot of health disbenefits of that coal mine.”

She concedes that the equation is more complex than just health for profits, but rejects the notion that at all times we must let business go ahead at all costs.

Those costs can be huge in terms of human misery. Professor Baum points to the toll the gig economy has taken, thrown into sharp relief during the COVID-19 pandemic.

“It has terrible health ramifications even without a pandemic,” she says. “There is good evidence that insecure jobs adversely affect people’s health and there have been studies that show some jobs are worse than unemployment for health outcomes.”

Not only is the insecurity of the work stressful – with all the health implications of that – the lack of social relations found in an established workplace is also harmful.

“When we did a study of Mitsubishi closing in Adelaide, people would say things like, ‘it was my family’. They clearly got a lot more out of their workplace than just the pay: a lot of companionship, friendship, a sense of belonging somewhere.

“Gig economy jobs don’t give you that.”

While the prospect of changing the mindset of governments at a macro level may be a daunting long-term project, there are changes that can be made at a more local level. Professor Baum is currently studying the role urban planning can play with public health.

It is an area where she has a long history, having worked with World Health Organization (WHO) since about 1990, as variously an advisor or consultant. On a project called Healthy Cities, Professor Baum encouraged local governments and mayors to adopt the type of health approach that WHO has been developing around the world, with Southgate as a collaborating centre.

“If we look at outer suburbs in Adelaide, they really don't support good health outcomes. They don't have local shops with fresh food, they’re hard suburbs to work around, families often have to have two cars to make that area work because there isn't good public transport.

“So we've been funded this year by Wellbeing SA and Flinders to develop an instrument called the Healthy Urban Neighbourhoods Transition Tool.”

PROFESSOR FRAN BAUM

This will allow an evidence-based assessment of a suburb providing a framework to suggest ways in which it could become healthier.

“That might be by widening the footpath so that's easy for people to walk, or seeing if there can be ability to, say, open a café, or a place for people to go and meet.”

That makes policy imperatives more palatable to politicians.

“If we wanted an infrastructure project, it could be upgrading those suburbs and maybe subsidising some small business that employs local people to make a place more liveable. It wouldn't take that much. You want to encourage what's known as ‘active transport’, where people either walk, cycle, or walk to public transport. You need to have footpaths where you can use wheelchairs or push chairs to make it easier to walk places, or planting trees of course – just these little things would really upgrade service.”

For those who say there is not enough political will to make these changes happen, Professor Baum points to the renewable energy transformation of South Australia. She is about to publish a paper of a study into how government managed to push ahead with renewables in a hostile atmosphere.

“They created a dependency on the transition that couldn't be reversed. And of course, it was popular with people because it is clean and green, and it will bring down the price of power. So, you can see how that can be done.”

“THERE IS GOOD EVIDENCE THAT INSECURE JOBS ADVERSELY AFFECT PEOPLE’S HEALTH AND THERE HAVE BEEN STUDIES THAT SHOW SOME JOBS ARE WORSE THAN UNEMPLOYMENT FOR HEALTH OUTCOMES.”

THE MICROBES THAT ARE KEY TO OUR HEALTH

THE MICROBES THAT ARE THE SUM OF US.

PROFESSOR GERAINT ROGERS

FOR THOUSANDS OF YEARS, FOR EXAMPLE, WE HAVE EATEN PREDOMINANTLY PLANT FIBRES AND PROTEINS.

WHEN THE MICROBES IN OUR GUT FERMENT THESE, THEY PRODUCE METABOLITES THAT DELIVER AN ARRAY OF BENEFICIAL EFFECTS, FROM SUPPRESSING INFLAMMATION, TO ANTI-INFLAMMATORY COMPOUNDS, TO PROTECTING US AGAINST CANCER.

What happens when an extremely ancient biological system comes face-to-face with a 21st century lifestyle? The results can be seen all around us, says Professor Geraint Rogers, in the diseases of affluence – diabetes, cancers and cardiovascular problems – all signs of our microbiome scrambling to keep up with the dramatic changes we have brought upon it.

The microbiome – the trillions of microbial communities that inhabit our bodies – has been with us always, but it is only relatively recently that we have discovered the close links between healthy microbiota and a healthy human.

To Professor Rogers the connection is unsurprising, so close is our relationship with the microbes that live on the skin and throughout our digestive tract.

"It's really symbiosis in a true sense," Professor Rogers says. "These organisms have been picked up from the environment, live in a nice, warm, protected world of, for example, the gut. They have functionality, which is shared with our own genetic material, and this means that over time, if we have mutations in our own genes that cause us to lose the ability to make certain vitamins, for example, we can get those from the microbes in our gut."

As those relationships develop, they create ties that bind us together – we need them and they need us.

"Those organisms become increasingly specialised to living on, or in, us and lose the ability to live outside of it," says Professor Rogers, "so our fates become completely intertwined and rather than being separate entities, we are really one sort of metaorganism."

For millennia this system operated without anyone noticing.

"Fast forward to the 17th and 18th centuries and the emergence of microbiology at a time when what killed people overwhelmingly was infectious diseases," says Professor Rogers. "So we needed to devise a system to identify individual pathogens amongst all of this noise."

And that's what we did, cultivating colonies of bacteria in agar plates, studying them and learning how to eradicate or at least control them.

But the whole relationship between us and our microbiomes began to change in the second half of the 20th century.

"We got clean water, we got antibiotics, we got vaccines and for the first time in human history, we took control of infectious diseases to a large extent," says Professor Rogers.

At the same time, agriculture's Green Revolution meant we could produce as much food as we wanted. All of a sudden we were no longer dying from infections, nor starving to death. But with those out of the picture other ailments took centre stage – chronic heart disease, vascular disease and cancers associated with obesity and type 2 diabetes and associated conditions.

While it became increasingly clear that the effect of exposures to many of these hazards were mediated by the microbiome, we were ill-equipped to explain how. Our historic systems were good at identifying individual microbes but were not up to understanding the complex interaction of whole ecological communities with each other and the behaviour of the system.

"If you want to understand from the productivity of a forest, you need to understand the nitrogen cycles, you need to understand the sun, water systems, and so on. You can't understand the sum of the parts by looking at any one aspect in isolation. And that's the same with us and our microbiomes," says Professor Rogers.

Enter DNA sequencing and the realisation that the same technology that was used to sequence the human genome could sequence the genes in the microbiota. We could now identify all of the organisms in a microbial system, such as a stool sample.

"And then you could see what the characteristics and relative abundances of those organisms were and you could correlate that information with exposures or clinical outcomes, such as the correlation between people's diets and the severity of vascular disease," says Professor Rogers.

And the correlations that are still emerging are alarming, as our ancient biological systems, that served us so well for millennia, try to keep up with dramatic changes in our lifestyles.

For thousands of years, for example, we have eaten predominantly plant fibres and proteins. When the microbes in our gut ferment these, they produce metabolites that deliver an array of beneficial effects, from suppressing inflammation, to anti-inflammatory compounds, to protecting us against cancer.

"Over thousands of years, we've selected those bugs to do those functions," says Rogers.

"If you then go to a 20th century diet, which is saturated in fats and refined sugars which changes your gut microbiome, you lose the protective functions. And what's more, these microbes produce metabolites that are pro-inflammatory and increase the risk of the development of things like obesity and type 2 diabetes.

"So it's a double hit, we've lost the much needed protection of an organ of our body and we've also inherited something that doesn't function properly."

Combined with that, the modern over-use of antibiotics creates further dangers by wiping out beneficial microbes, and providing opportunities for pathogens to invade the niches that they leave behind.

The answer, says Professor Rogers, is as simple as it is elusive.

"We want to live in a very narrow band in the middle. Because if you go to developing countries, obviously there are horrific levels of infectious diseases and child mortality. But if you track the other way too far, then you go into chronic inflammatory diseases and immune mediated problems.

"It's trying to find the line that sits between those two and we've sort of lurched from one to the other."

There is no more important time for creating a healthy microbiota than the period right at the beginning of life. From our first breath outside the womb we – and our immune systems – are on their own and we start to calibrate our immune systems to compile this list of friends and enemies – good microbes in our microbiome and pathogens which could kill us. Our metabolic systems also learn to account for the metabolites that they produce. And those calibrations stay with us for life.

"There's a plasticity in the first months of life, which we don't get back," says Professor Rogers. His research has uncovered the problems that can flow from giving children antibiotics around birth that wipe out microbes and force a change in how the immune systems are set up, which is sort of tattooed into them and is there forever.

"We know these kids respond differently or less well to vaccinations. They're more likely to get inflammatory conditions like asthma, allergies, and auto-immune diseases. So you've got this sort of hyper immune response, because you haven't been exposed to lots of bugs, which have allowed you to calibrate yourself properly."

A VOICE FOR CHANGE

PEOPLE WITH DISABILITY KNOW WHAT IS NEEDED TO IMPROVE THEIR OWN LIVES, YET MANY ASSUMPTIONS ARE MADE ON THEIR BEHALF AND CHANGE IS LARGELY INTRODUCED TO THEIR LIVES WITHOUT THEIR INVOLVEMENT.

It leads to persistent tensions between how people with disability want to be treated and the quality of care and support being delivered to them.

At worst, this divide results in violence, abuse and neglect for people with disability trapped within an inadequate care system. The awful neglect that led to the degrading death of Ann Marie Smith in her Adelaide home provided grim evidence of a system that is failing the people it is supposed to assist.

The Royal Commission into Violence, Abuse, Neglect and Exploitation of People with Disability is demanding action to change this situation, and Professor Sally Robinson's research provides evidence to argue for people with disability to have greater authority over their own care decisions.

"For over a decade, our researchers have been working with people with disability who rely on daily support.

"They not only described deep-rooted violence and abuse, but also their ideas and strategies for resisting it," says Professor Robinson, Professor of Disability and Community Inclusion at Flinders University. "It's striking that the more entrenched people become within closed systems, the less they are heard. In our research, many service providers and policy makers see these problems differently, and often as less of a priority."

Professor Robinson has listened carefully throughout her research career, working alongside people with disability as colleagues and co-researchers. "We need to avoid the us-and-them conversation. We have to find more effective ways of working together if we are going to provide adequate solutions."

Her body of research demonstrates that both adults and children with a wide range of disability have significant knowledge, ideas and strategies about how their needs can be best served. She also learned that largely these voices have either been ignored or dismissed.

She insists the voices of those people must have an influence in forming policy and practice. "They are the ones with new knowledge about solving old problems. Privileging their voices can lead to policy change that can be scaled up. People with disability represent 20% of the population. They are not a minority population group. Their views count."

The Royal Commission into Violence, Abuse, Neglect and Exploitation of People with Disability, established in 2019, is highlighting the urgent need to improve the level and quality of care available to people with disability, but also to ensure that care and human rights go hand-in-hand.

Professor Robinson's research agenda connects the prevention of violence and abuse with improving the quality of support systems and relationships, as a pathway for building safer and more connected lives.

Recent research published with colleagues in the international Disability & Society journal identified the importance of rights in working relationships, noting that paid workers need to employ respect in their working relationships with young people with disability, to avoid the risk of people being viewed as an object of care.

"Caring is only part of the job. Respecting and valuing what each person contributes not only helps turn the focus on the capabilities and other needs of the young person, but brings both people into a mutual support relationship where the contribution of the young person with disability is more readily acknowledged. This must be enhanced by training and leadership from provider organisations employing support workers in our community."

While the Royal Commission has triggered agreement that things must change, clear direction is needed about what new measures will be effective and valuable.

The holistic nature of what needs to change is sweeping, and Professor Robinson says it's critical we look beyond the disability support sector to other key domains where people with disability are very much affected by the quality of policy and practice – the domestic violence sector, the transport sector, the general health sector, the education sector. "It's all connected.

"People with disability don't just exist inside the disability sector – they are our family members, our neighbours, our workmates and schoolmates. They live in the world. It's up to all of us to recognise that and build greater inclusion."

"As a society, we tend to think this is a 'disability' problem, but it's a social problem. It isn't an easy or an instant process, but we have to make sure that people don't turn away from the hard realities of making significant change and improvement. Making space to listen and respond to the priorities and perspectives of people with disability is a critical starting point."

PROFESSOR SALLY ROBINSON

KIDS WITH DISABILITIES ZOOM AHEAD

FOR MANY PEOPLE WORKING FROM HOME DURING THE CORONAVIRUS PANDEMIC, CONFRONTING TELECONFERENCING SOFTWARE SUCH AS ZOOM FOR THE FIRST TIME HAS PRESENTED DISORIENTING CHALLENGES. JUST IMAGINE HOW THAT MUST FEEL FOR CHILDREN WITH DISABILITIES STRUGGLING WITH LANGUAGE AND LITERACY.

As Professor Joanne Arciuli tells it, in 2020 these kids have had to adjust to an online environment just like everyone else because attendance at schools and clinics has been affected during the pandemic.

“It starts with the basics, just making sure the volume's right, the brightness on the screen, everybody's looking at the right thing at the right time, reducing distractions in the background,” she says.

Professor Arciuli is Dean of Research at Flinders' College of Nursing and Health Sciences. Her specialty is human communication and much of her career has been focused on child development and disability, especially speech, language, literacy and the learning mechanisms underpinning that.

“For a long time people thought autistic kids must learn to read differently, and kids with Down syndrome must learn to read differently again,” Professor Arciuli says.

“People were searching for these disability-specific ways to help children acquire literacy skills. And then it turns out that, actually, there are really key aspects of literacy instruction that are good for all children.

“And, yes, some kids with developmental disabilities might show slower progress in their literacy acquisition or you might be able to tailor some of the content to their particular interests. That can be quite important with some autistic children in the way it helps with motivation.”

For several years, Professor Arciuli has been working with a freely available, computer-based literacy instruction program called ABRACADABRA.

She introduced it to one of her PhD students, and together they were the first to test the program with autistic children using one-to-one instruction in their own homes. It went well, but one-to-one instruction in family homes is quite labour intensive and not really scalable.

“A school approached me,” says Professor Arciuli, “and so we decided to do the ABRACADABRA program slightly differently.”

To make the program work in a school setting, we needed to upskill teachers to deliver the program. Instead of being entirely one-on-one, it was kids sitting at individual computers for some things, and coming together in small groups for other activities, sometimes sharing computers.

“That went quite well, slightly different results in some aspects of literacy, but still quite promising,” says Professor Arciuli.

And then along came COVID-19 to upend children's schooling and additional clinical and educational programs, along with so much else. The PhD student mentioned earlier is now Dr Ben Bailey. He and additional collaborators from Flinders University, including a new PhD student, Annemarie Murphy, are part of Professor Arciuli's COVID-19 literacy response team.

“COVID has affected school attendance and attendance of clinics for lots of kids, especially for kids with developmental disabilities,” Professor Arciuli says. “They haven't been able to get the extra support that they might've had, such as a speech pathologist coming into the classroom a couple of hours a week. Or they might've been attending a clinic outside of school hours for additional literacy support.

“So all of that got thrown up in the air and we had to think about clever ways of doing things.”

Professor Arciuli and her team came up with a hybrid system of teaching that still involved the ABRACADABRA program, but delivered to children over Zoom by a facilitator. At the same time the team set about upskilling parents so they could work with their children during shared book reading at home, so that it became more structured.

“We're giving parents some tips on how to interact with their child during sharing reading activities, and encourage parents to do this regularly. This is to complement the facilitated ABRACADABRA sessions.”

PROFESSOR JOANNE ARCIULI

Overall the Zoom/hybrid delivery of learning programs is showing some promising results, while showcasing the flexibility of ABRACADABRA as a platform.

"The ABRACADABRA program is very engaging for children,” says Professor Arciuli. "It consists of cartoon characters that appear in a series of game-based activities."

“We find that the kids really do see it as a game, rather than a lesson. They get into it to score their points in various activities which may involve reading or spelling words or trying to comprehend meaning. ABRACADABRA has many different ways of reinforcing involvement and learning.”

It has also provided unexpected opportunities to bring parents further into their children's development. Researchers such as Professor Arciuli have known for a long time that the home literacy environment is important. The number of books in the home, and parents' own literacy skills are both predictors of literacy. But this is strengthened further by giving parents a little bit of information about how to interact with their kids during shared reading time.

We need to make sure parents are neither overcorrecting nor undercorrecting. We need to make sure they are neither overpraising nor underpraising. And there are multiple things to focus on such as reading accuracy but also reading comprehension. “We find that a lot of parents pull their kids up on the fact that they haven't pronounced a word correctly and that they're not necessarily reminding kids about the whole meaning running through the story or whatever it is they're reading. And comprehension can be a particular issue for some autistic kids. So increased opportunities to practice comprehension skills is a good thing” says Professor Arciuli.

Without a clinician or educator present, it becomes an instructional experience for the parents to build their child's knowledge about literacy skills.

In 2021, Professor Arciuli is leading the largest ever efficacy trial of the ABRACADABRA program with autistic children. It is funded by a Linkage grant awarded by the Australian Research Council in collaboration with a partner organisation, the Luke Priddis Foundation. Co-investigators include researchers from Macquarie University and University College London.

“We are going to take learnings from the COVID-19 literacy response team into this new project. The world has changed for all of us and it is great to be working with a program like ABRACADABRA that can be used flexibly.”

WITHOUT A CLINICIAN OR EDUCATOR PRESENT, IT BECOMES AN INSTRUCTIONAL EXPERIENCE FOR THE PARENTS TO BUILD THEIR CHILD'S KNOWLEDGE ABOUT LITERACY SKILLS.

A CONSUMING

CHALLENGE

BY THE TIME THE ALARM BELLS RING, AN EATING DISORDER MAY ALREADY BE WELL ESTABLISHED. SEEKING HELP EARLY IS ESSENTIAL FOR BOTH INDIVIDUALS AND FAMILIES.

“The biggest problem when you have a child with an eating disorder is this: every tactic you have ever used in parenting is useless.

"Worse than that: it’s wrong,” writes journalist and author Caitlin Moran in a moving account of her daughter’s eating disorder.

It is an expression of desperation that Professor Tracey Wade understands only too well.

She has worked as a clinician in the area of eating disorders for 30 years and knows they become a family rather than an individual problem.

“We’re interested in trying to get people to seek help as early as possible for an eating disorder,” Professor Wade says. “And that includes families as well as those people with an eating disorder.”

Eating disorders mainly emerge in early adolescence – although not only then – and are often dismissed at first as “a phase”. The usual trajectory is an insidious beginning, with wanting to eat a bit less, then to lose a bit of weight, then to become a vegan, then not to eat with the family. “By that time, it’s really starting to ring alarm bells,” says Professor Wade.

While intervention can seem difficult, it is essential to confront the problem early.

“Particularly when your teenage child says they want to lose weight, I think you need to really work that through with them. Do they need to lose weight? How much weight? Can we agree on a limit? So, it's actually being monitored.

But a common pattern for people with eating disorders means that once a weight goal is reached, they still don’t feel that good about themselves, so they think I'll just lose a bit more weight. A vicious cycle that continues ad infinitum, even when they're at 39 kilos."

The “crucible” for the development of most eating disorders, Professor Wade says, is at that early adolescence to mid-adolescence point, “especially if they’re in a peer group that's particularly critical of appearance and they’re being bullied or teased about appearance”.

“We also know there are character traits that predispose people, like perfectionism and high levels of anxiety. So when we talk about an eating disorder, we think that it is seen as solution to a problem – often a sense of low self-esteem and feeling a bit out of control.

“And so the focus on the weight, the number on the scales becomes very beguiling because that can be the answer to your problem.”

As to the causes, perhaps surprisingly, there is a genetic contribution to eating disorders of about 50%, only slightly lower than for schizophrenia or bipolar affective disorder.

“It's certainly higher than most people think,” says Professor Wade. “There is a bit of stigma around eating disorders, thinking that it's self-imposed or just silly girls wanting to be thin.”

But there is nothing trivial about eating disorders, which are one of the highest mortality psychiatric disorders.

Professor Wade has worked closely with Flinders colleague, epigeneticist Associate Professor Sarah Cohen-Woods. “With Sarah, we want to look more closely at specific environments, particularly protective environments, so that we can protect people by decreasing the chances that genes will express themselves as an eating disorder. We know that peer teasing about appearance is an important trigger of genetic susceptibility.”

Most people automatically think of eating disorders as an adolescent girls’ problem, and it is true they are at high risk, particularly in the two windows of entering adolescence and then entering adulthood.

“About 20% of young women in their twenties have disordered eating and are preoccupied with their weight and shape, either bingeing or purging or have low weight.”

But men are not immune.

PROFESSOR TRACEY WADE

“Interventions are very hard because of an ambivalence to the condition. They might not like bits of the disordered eating such as the binge-eating and the vomiting, but they don't want to gain weight or they want to continue losing weight,” Professor Wade says.

“Our treatments help between 30 to 50% of people recover. So that’s a start, but obviously it’s not good enough. But I don't know that we're going to come up with radically new psychotherapies.

“We know that cognitive behaviour therapy for bulimia nervosa is good, but again it only helps 50% of people recover."

Professor Wade does not expect any magic bullets anytime soon.

“OUR TREATMENTS HELP BETWEEN 30 TO 50% OF PEOPLE RECOVER. SO THAT’S A START, BUT OBVIOUSLY IT’S NOT GOOD ENOUGH. BUT I DON'T KNOW THAT WE'RE GOING TO COME UP WITH RADICALLY NEW PSYCHOTHERAPIES."

“At any time, we would probably only have one or two men coming through our clinic but they really seem to have a worse course of the illness if they get anorexia nervosa as a teenager. They're usually highly obsessive and perfectionistic and often end up in hospital and have a longer course of the illness.”

Older women in their forties and fifties are another group vulnerable to disordered eating, with about 15% struggling with that at any one time.

But effective treatment remains elusive.

“I think we're looking at really hard and methodical work of using individual profiles to find a good-enough treatment, but then to ask what we need in addition to that. What's the genetic profile? What's the personality profile? What are the particular risk factors? What would make sense to add to the good-enough treatment so it's actually very effective for the individual?”

It’s these challenges that present the next research frontier for Professor Wade and her colleagues as they comb through clinical, chemical, and environmental factors in their quest to bring order to the much maligned, life threatening chaos of disordered eating.

PROBLEMATIC PREGNANCIES

CLUES THAT DISCLOSE A PERSON'S FUTURE HEALTH MAY BE FOUND IN UTERO. STUDYING PREGNANCIES, BABIES AND PLACENTAS HOLDS CRUCIAL ANSWERS – ESPECIALLY WHEN DELVING INTO THE DIFFICULT, LARGELY UNSPOKEN SUBJECT OF PROBLEMATIC PREGNANCIES.

PROFESSOR CLAIRE ROBERTS

Professor Claire Roberts is searching for signs that can identify and therefore prevent dangers to the health of a mother and baby but also predict their lifelong health.

"Families are at the centre of our society, but difficulties that are still being faced in pregnancy and childbirth are so often overlooked. We tend to think that in an advanced western society, all pregnancies will turn out fine. But it's a hidden fact that over 35% of the more than 300,000 Australian pregnancies each year has one of four major complications. There are also 2000 stillbirths in Australia every year, yet mostly we assume that nothing goes wrong."

Previously a Deputy Director of the Robinson Research Institute that focuses on women's and children's health, Professor Roberts came to Flinders University in 2020, establishing the Pregnancy Health and Beyond Laboratory (PHaB Lab) to focus on women's and children's health. Current projects in the PHaB Lab include studying fetal sex differences in pregnancy outcomes, maternal nutrition and the placental transcriptome (genome-wide gene expression assessed by RNA sequencing).

Professor Roberts' research program brings together Flinders University's research strengths and the clinical activity at Flinders Medical Centre – a synergy that perfectly realises the intention of the university campus and hospital being built beside each other as companion institutions. "FMC has everything needed to look after women and babies: obstetrics services, an adult intensive care unit, a neonatal intensive care unit and paediatrics department. It is South Australia's centre for the unwell woman. For example, SA pregnant women with placenta accreta, that can cause severe blood loss, are all treated at FMC and those with COVID-19 would all be treated here too."

Through follow-up of her large pregnancy cohorts, Professor Roberts and her team are following the long-term health pathways of women and children, particularly those who had a complication during pregnancy. "We now know these women are more likely to get chronic disease later in their life, and not necessarily a lot later. For example, women who have preeclampsia are more likely to have hypertension, stroke or heart disease in middle and older age. Gestational diabetes is on the rise and these women are more likely to develop Type 2 diabetes."

These are uncomfortable statistics that are not widely discussed, but Professor Roberts wants to radically change the conversation. Originally a placental biologist, she has pursued this broader vision of pregnancy and placental study to promote a wider view of interconnected health issues.

Professor Roberts' work has involved studies that stretch from population and hospital cohorts down to cellular and molecular levels, giving her a rare perspective.

"If we can identify risks for health problems in pregnant women, it may mean we can intervene early and prevent or delay the onset of chronic diseases for these women in the future. Prevention is far better than cure."

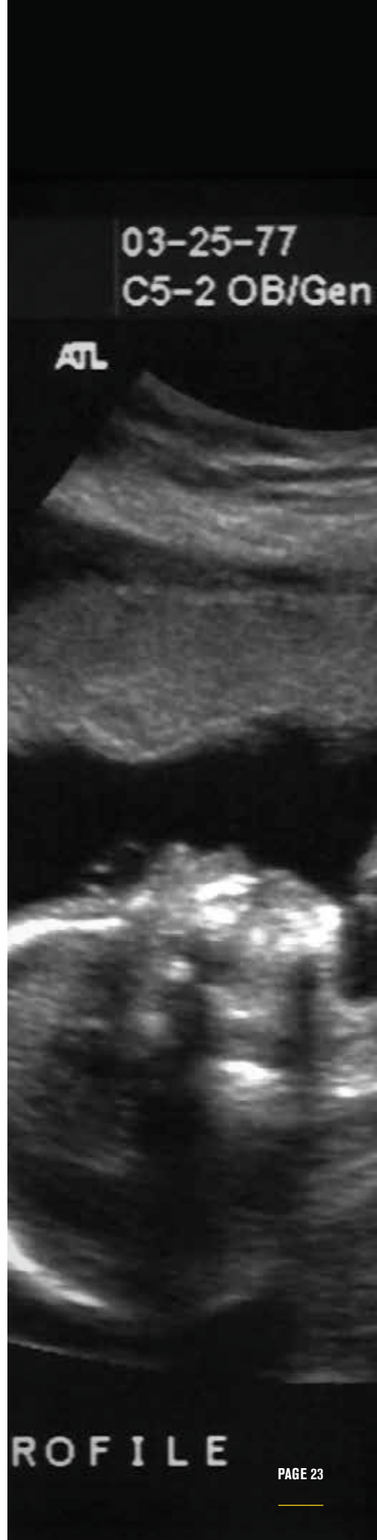
Professor Roberts has a strong personal motivation for this research. The first of her three children died when he was five days old from a serious heart defect. Now a grandmother of four, she cherishes family and is alert to the vulnerability of mothers and babies. "I've always wanted to solve problems in pregnancy. I knew it would require big picture observations to achieve it."

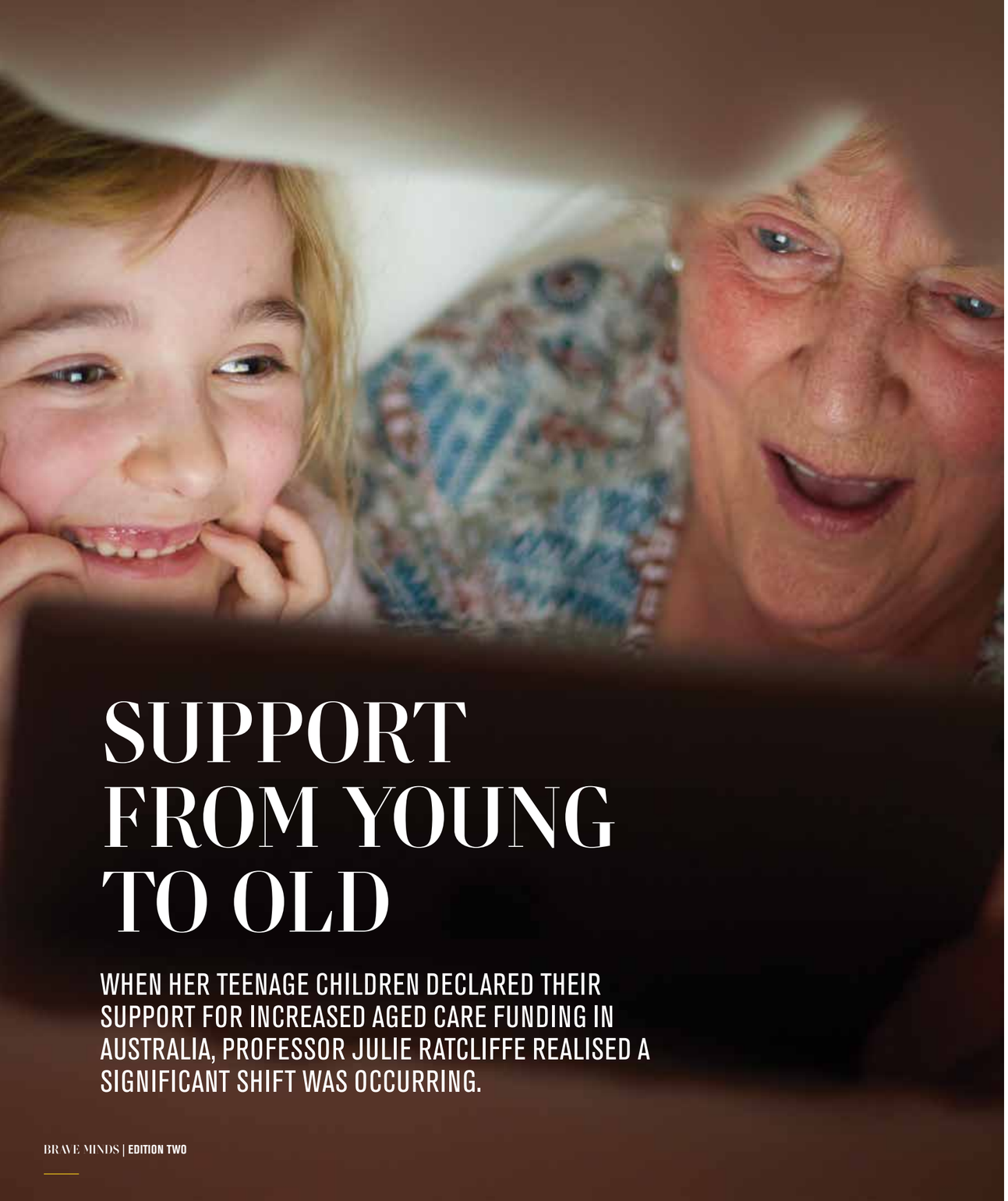
As a result, Professor Roberts and her team have been following the health journeys of mothers and their children through large studies: SCOPE, a pregnancy cohort of 1,200 women recruited between 2005 and 2008, then the STOP cohort involving 1,300 women recruited between 2015 and 2018, and new large collaborating cohort studies at Flinders Medical Centre and around Australia are currently being planned.

The researchers hope to build multi-generational pictures of health in families and identify genetic and lifestyle factors at play, with a focus on the early origins of chronic disease. Professor Roberts says these long-term studies can become a large resource for medical researchers. "We know research informs clinical practice but a multi-generational study can bring scientists, clinicians and the community together, people with apparently different interests but actually with a common goal. With the right design, a pregnancy study can be used to foreshadow future health in women. By reflecting back on the previous generation and forward into the next we can develop a powerful resource to study health across the lifespan."

Answers to the questions being asked will provide better health outcomes for pregnant women and their children. "When women are pregnant, they listen and are more likely to take on health advice than at any other time in their lives," says Professor Roberts. "We aim to provide the necessary information to pregnant women, to empower them to best help themselves."

"IF WE CAN IDENTIFY RISKS FOR HEALTH PROBLEMS IN PREGNANT WOMEN, IT MAY MEAN WE CAN INTERVENE EARLY AND PREVENT OR DELAY THE ONSET OF CHRONIC DISEASES FOR THESE WOMEN IN THE FUTURE. PREVENTION IS FAR BETTER THAN CURE."





SUPPORT FROM YOUNG TO OLD

WHEN HER TEENAGE CHILDREN DECLARED THEIR SUPPORT FOR INCREASED AGED CARE FUNDING IN AUSTRALIA, PROFESSOR JULIE RATCLIFFE REALISED A SIGNIFICANT SHIFT WAS OCCURRING.

As the leader of aged care research by the Caring Futures Institute team at Flinders University, Professor Julie Ratcliffe knew that ignorance and indifference had long shaped young people's opinions on aged care.

However, the team's most recent report, triggered by the ongoing Royal Commission into Aged Care Quality and Safety, signalled that a majority of Australians of all ages are prepared to do the unthinkable and pay more tax to ensure universal access to high-quality aged care services.

"When my 18 and 20-year-old children answered our survey, their answers reinforced a change in views and preferences about the quality of aged care and future funding," says Professor Ratcliffe. "Previously, I'd seen a real lack of attention given to older people and aged care by younger people. Now a whole new conversation is happening."

The closer Professor Ratcliffe looked at the survey data, the more apparent this became. Nearly 90% of people who participated in the research agreed that the government should provide higher funding for aged care services, with a majority believing it should be doubled. Almost 60% agreed there should be a reallocation of public expenditure to aged care.

More than half of current income taxpayers say they would be willing to pay an additional 1.4% income tax per year to ensure satisfactory quality aged care is delivered, and a further 1.7% per year to achieve high quality aged care.

It's breakthrough research that can help steer the future of aged care in Australia – a task that the Royal Commission is determined to address – and reveals a decisive change in thinking from younger Australians. "Young people tend to only think about aged care as involving older people residing in nursing homes, yet a growing proportion of older people receive services in their own homes," says Professor Ratcliffe. "However, there's a shortage of provision, with quite a long waiting list of older people wanting to access home care packages. People are dying who are eligible to receive home care services that they never end up receiving. Most young Australians are not generally aware of this, or the need for more investment and greater transparency about how aged care funds are allocated. The survey helped to inform younger people about what is actually happening in aged care."

As a consequence, more than 70% of survey respondents indicated that they would be willing to pay a larger co-contribution to receive the support they would need to remain living at home rather than entering a residential aged care facility.

Striving to improve care for aged people has been the focus of Professor Ratcliffe's work since she emigrated from the United Kingdom in 2007, to commence research at Flinders University evaluating the transition care program for older people. Now, the aims of the current Royal Commission has provided Professor Ratcliffe with an opportunity to pull together the many threads of her aged care research. Much of it has involved talking with older people about their own needs and preferences rather than just taking the advice of clinicians.

However, it struck Professor Ratcliffe that the recent survey represented the first time many older Australians have been asked about how they want to be cared for. They expressed great relief at finally being included in the conversation. During interviews, some people burst into tears. "They were quite emotional when they told me that no-one had ever asked them before about their opinions – and it has a great effect on what we found."

It took patience and considerable time to extract these answers, but Professor Ratcliffe has long valued the wisdom of older people. As a young girl growing up in Stoke-on-Trent, she loved spending time with her grandparents. While her grandmother baked, Professor Ratcliffe listened. When grandfather was tending his garden, she hung on his every word.

"I've always found older people to be very, very interesting to talk to. Over time, I became aware of how much we were really neglecting older people, not taking the time to talk to them and not prioritising health economics research which focused specifically on older people, or on the aged care services that they receive."

PROFESSOR
JULIE RATCLIFFE

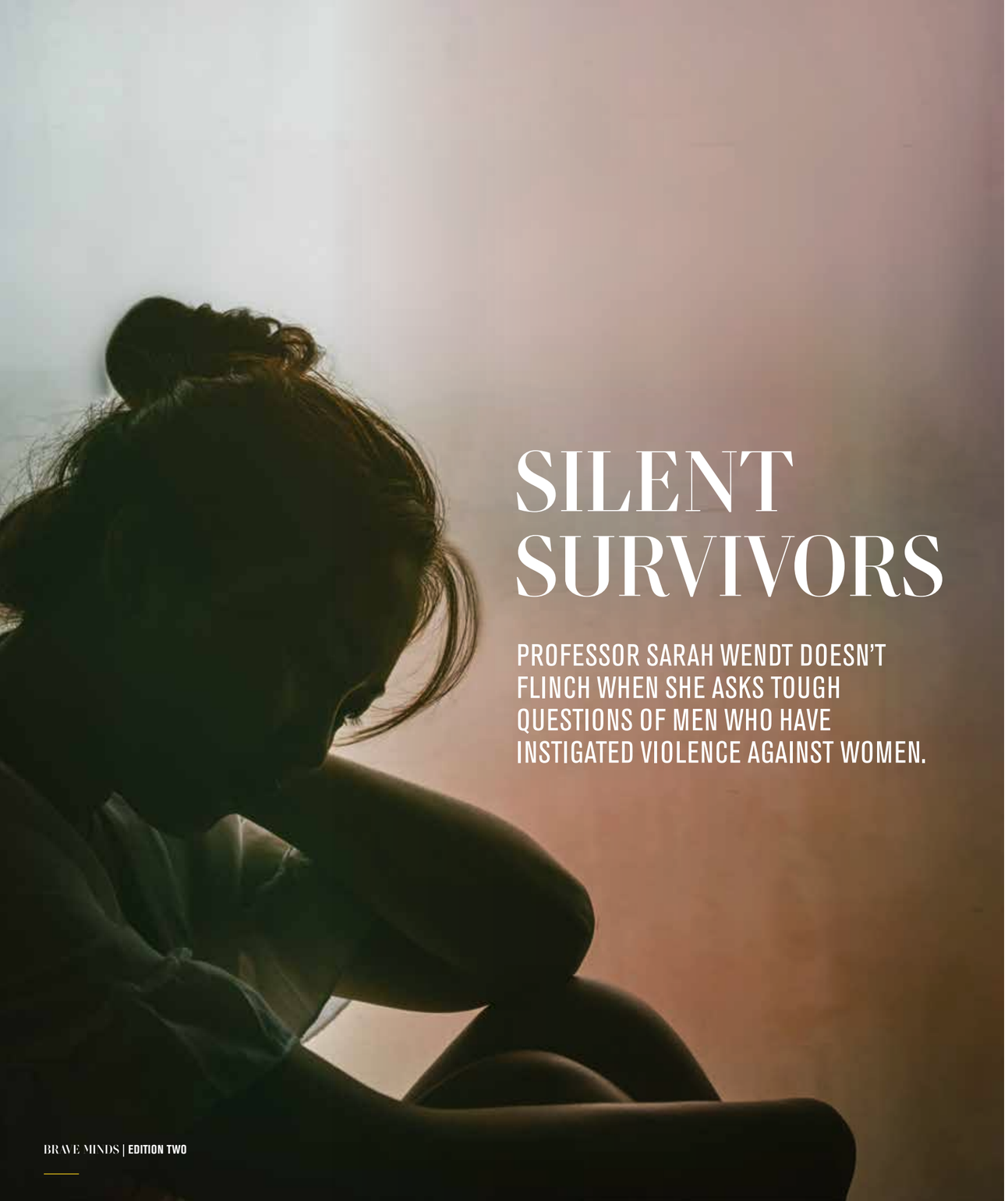
Professor Ratcliffe is confident the current research will make a difference, but like pulling a loose thread that just keeps unravelling, she has found more areas that need attention with every question she asks. "There is not just one aspect, but a big series of issues that are not being addressed properly."

The Caring Futures Institute at Flinders University illustrates the strength of a multidisciplinary approach to provide solutions for such complex public health issues. Drawing on the research expertise of health science, medical, nursing and social welfare experts, Professor Ratcliffe and her Health and Social Care Economics team is engaging with each limb of Australia's aged care industry to drive necessary reform – informing government policy, advising industry best practice and workforce improvements, and delivering stronger models for the care of all older people.

This includes new tools to measure quality of care and quality of life indicators. Application of this research is already having a positive effect. The Caring Futures Institute is working closely with five aged care industry partners, operating across five Australian states, to test the reliability, practicality and validity of these new tools. Aged care industry partners and clients involved in the tests say they are happy with the results, and the quality of life assessment tool will be ready for a sector-wide rollout towards the end of 2021.

Professor Ratcliffe is confident the Royal Commission's final recommendations will include routine assessment of quality of life and quality of care across Australia's aged care system, and she's thrilled the outcomes of long-term research look set to have wide-reaching ramifications. "Yes, I'm wanting to give something back, which hopefully will have a lasting impact. If there is going to be significant reform in the aged care sector, everyone in society – older people, their families and the wider population – really needs to be involved in that process, and to own the transformation of this sector."

"I'VE ALWAYS FOUND OLDER PEOPLE TO BE VERY, VERY INTERESTING TO TALK TO. OVER TIME, I BECAME AWARE OF HOW MUCH WE WERE REALLY NEGLECTING OLDER PEOPLE, NOT TAKING THE TIME TO TALK TO THEM AND NOT PRIORITISING HEALTH ECONOMICS RESEARCH WHICH FOCUSED SPECIFICALLY ON OLDER PEOPLE, OR ON THE AGED CARE SERVICES THAT THEY RECEIVE."



SILENT SURVIVORS

PROFESSOR SARAH WENDT DOESN'T FLINCH WHEN SHE ASKS TOUGH QUESTIONS OF MEN WHO HAVE INSTIGATED VIOLENCE AGAINST WOMEN.

If the Flinders University expert in social work is going to produce the type of pragmatic solutions that introduce real change to both victims and perpetrators of domestic violence, she knows that she must endure uncomfortable situations. She's not daunted by the prospect.

"Actions speak louder than words, and I'm an action orientated person," says Professor Sarah Wendt, a Matthew Flinders Fellow and leader of SWIRLS (the Social Work Innovation Research Living Space) at Flinders. "I want to confront the hard topics."

Professor Wendt has focused her attention on many difficult issues that crisis agencies must find answers to and solving problems that don't resolve themselves. Smart interventions to issues such as domestic violence need to be designed on evidence-based research. "Social work must continue to grow its evidence base to bring theory, practice and teaching together," says Professor Wendt. "Evidence leads to improving social work practice, and that improves people's lives."

Professor Wendt has led the team of SWIRLS researchers to embark on a different type of engagement with both clients and support agencies. A crucial signpost was the pivotal report identifying why men use violence in their relationships, constructed with the support of ANROWS (Australia's National Research Organisation for Women's Safety) and Uniting Communities.

This report – Engaging with men who use violence, released publicly at the end of 2019 – showed that domestic violence against women in Australia is a crisis that is not in decline. One in four women will experience domestic violence in this country during their lifetime, and an average of one woman a week is murdered by their intimate partner.

Professor Wendt's team investigated the effectiveness of the invitational narrative approach to therapy for men who use violence against women and children. The researchers found that using narratives and storytelling to engage with men on a rehabilitation journey was a useful and effective tool, even though it was a challenging and risky process for the researchers to ask pointed questions about the origins of violent behaviour by its perpetrators.

"All the interviewees volunteered to be a part of this research, so they had time to digest the purpose of the study and how to answer the questions, but it was still a difficult task for them to address the shame of what they had done, and for them to articulate the hurt and damage they had inflicted," says Professor Wendt. "It gave us piercing insights into violent behaviour."

The research interviews were very different to usual counselling or therapy interviews. "We aren't there to challenge the men or their accounts," explains Professor Wendt. "We ask questions to generate a narrative that enables men to think about their behavioural change and reflect on the therapy they have received.

Left to right - back row standing up: Natalie Greenland, Heather Nancarrow, Dr Fiona Buchanan, Chris Dolman, Michele Robinson. Left to right – seated: Regina Newchurch, Professor Sarah Wendt, Dr Kate Seymour.

PROFESSOR SARAH WENDT

"SOCIAL WORK MUST CONTINUE TO GROW ITS EVIDENCE BASE TO BRING THEORY, PRACTICE AND TEACHING TOGETHER," SAYS PROFESSOR WENDT. "EVIDENCE LEADS TO IMPROVING SOCIAL WORK PRACTICE, AND THAT IMPROVES PEOPLE'S LIVES."

"We later analyse the transcript with a therapist, and found interesting moments of change occurring along a violent man's journey. The process builds a foundation for men to start articulating who they would like to be and how they would like to change – but stopping the use of violence is a long journey that takes a very long time."

Due to the indeterminate length of time of each man's journey of change, Professor Wendt emphasises that trying to qualify "success" is a very contentious term in this space. Is it success if a man stops using physical violence against his partner, but continues to threaten and belittle her, controlling her every move? Is it success if a partner's fear never goes away? Even challenging the notion of how to define success in rehabilitation programs is a significant step forward in reassessing social work outcomes.

The influence of this report led to Professor Wendt and SWIRLS being engaged to work with other agencies, including a project with Anglicare to help children and young people leaving state care reconnect with their families and prepare for successful futures.

It points to the SWIRLS team building a reputation for resolving tough problems that keep troubling social equality agencies and clients. "We are open to having the difficult conversations," says Professor Wendt. "We listen closely to people working in the sector and they are hungry for change, and that drives us forward."

Professor Wendt applauds the SWIRLS team's willingness to enter difficult terrain and push beyond existing boundaries, realising that ingrained social problems run deeper than most people expect.

"We know that we are probably underestimating the extent of domestic and family violence, because so many women survivors are not prepared to report incidents," says Professor Wendt. "With the statistics so high, I can't understand why there isn't a panic about this in our society. It is a significant community problem that must be addressed – and we have to keep asking very difficult questions about men's use of violence if this is ever going to change."

HEALTHY COUNTRY, HEALTHY PEOPLE, HEALTH LEADERS

EFFECTIVE HEALTH DELIVERY FOR ABORIGINAL AND TORRES STRAIT ISLANDER COMMUNITIES REQUIRES TWO-WAY KNOWLEDGE AND MUTUAL COMMUNICATION.

DR MAREE MEREDITH

"WE'RE ADVOCATING FOR A SOCIAL MODEL OF HEALTH. FOR INDIGENOUS AUSTRALIANS, YOU CANNOT HAVE AN EFFECTIVE CONVERSATION ABOUT HEALTH UNLESS IT IS ALSO ABOUT LANGUAGE, CULTURE, COUNTRY AND FAMILY. THESE FOUR ASPECTS CANNOT BE SEPARATED FROM WHAT IT MEANS TO BE HEALTHY. IT MUST BE A HOLISTIC CONVERSATION."

An old Aboriginal man from a remote community rests motionless in bed 7A and stares at the wall, disengaged from the comings and goings in the ward, the television programs and the conversations in the beds around him.

He's bored, but because English is his third language, he doesn't understand a lot of the fast talking on the TV. He's lonely and misses his family, who are only allowed for an hour or two during visiting times. He's sick, and trying to hide the anxiety about whether the translator they got in to help him talk to the doctor was getting the right words across. He's also hungry, because although the hospital provides good food, the menus are indecipherable because he can't read English.

He could be an Elder who has been holding his community together for years, or simply a man who has lived a good life and wants to keep doing so. But his capacity to get back to full health is compromised by a narrow focus on the selection and delivery of medical care, without addressing his overall needs.

It's with the needs of individuals and their communities foremost that Flinders University's Poche Centre for Indigenous Health (Poche SA+NT) has developed a lofty ambition, with a grounded premise: to deliver measurable improvements in the current and future health of Aboriginal and Torres Strait Islander people through two-way knowledge transfer, research translation and holistic health leadership.

One of the daily challenges for the Centre's Acting Director, Dr Maree Meredith, is to find a new way of mutual communication, one that truly engages the many different communities she's striving to support and empower, and which delivers tangible outcomes – not just nice words.

Dr Meredith and her colleagues are striving to introduce change. Their research shows that Aboriginal and Torres Strait Islander communities experience health and talk about it very differently to mainstream health workers. She contends that the mainstream community needs to listen. "We need to shape the health conversation in the community's terms. It shifts power to the people who need to benefit from our medical research. If not, we won't make progress.

"We're advocating for a social model of health. For Indigenous Australians, you cannot have an effective conversation about health unless it is also about language, culture, country and family. These four aspects cannot be separated from what it means to be healthy. It must be a holistic conversation."

Dr Meredith says that the biomedical model and relationships with doctors will not improve unless broad relationships are improved with Aboriginal communities. It's not only about reframing the health conversation, but also the model of how health institutions operate. The wealth of research currently conducted to improve the health of Aboriginal and/or Torres Strait Islander people is rarely prioritised or even contemplated by communities. Equally, the localised priorities of communities are often not considered when shaping research programs.

"This is about privileging the voices of Aboriginal and Torres Strait Islander people. They are not going to talk unless we create the right space."

This requires a big shift from how the medical sector currently operates, with Dr Meredith saying greater empathy needs to be employed. "The biomedical model is only one way of dealing with health. There are customary healers who have been practising for millennia, and Indigenous knowledge also needs to be at that interface; if Aboriginal and/or Torres Strait Islander people choose to visit a healer before they visit the doctor, that may change the timing and nature of medical interventions," Dr Meredith says. "Equally, if patients feel uncomfortable, hungry, anxious or lonely in hospital because of cultural issues, that can have a significant impact on their willingness to undergo medical procedures and their recovery.

"Medical people come with their expertise, but Aboriginal people bring their lived experience, along with their experience as customary healers. It all has to come together."

Dr Meredith, a Bidjara woman from southern Queensland, worries that the capacity for ill Aboriginal and Torres Strait Islander people to get back to full health is compromised by a narrow focus on the selection and delivery of medical care, without addressing people's overall needs. "The recent news that federal, state and territory governments are set to hand back some of the control over health programs to empower communities is a watershed moment for the nation, but it also requires a new model of research translation and two-way knowledge exchange."

Dr Meredith based her PhD research on how Aboriginal art centres are critical to maintain and improve health and happiness in remote communities. "My first-hand experiences helped me to understand what the priorities of individual people were before any research agenda could kick in. Going into community, you have to listen very deeply to conversations. While the art centres were beneficial, the people I met there were very sick. They weren't just the subjects of my research. Their lives were at stake."

Now, as the first PhD graduate of the Flinders Poche Centre for Indigenous Health, Dr Meredith is in a strong position to drive change through improved Indigenous health programs. "The great opportunity right now is how we train the current generation of students to be the next practitioners. It's a transformative time; the University is implementing its first Reconciliation Action Plan, it has increased the numbers of Aboriginal and Torres Strait Islander staff, and it's why we have Indigenous Elders on campus, so that when a non-Indigenous person comes into our program, the first thing they see is an Aboriginal face.

"This is where the new journey starts, and it broadcasts a bigger message about our reconciliation. We can start to unpack what this really means in our research and our teaching."

Dr Meredith hopes it will serve as a beacon to other institutions. "If it can start with a university, then why can't the same type of inclusion extend into other institutions, like health and hospitals? Commitment has to come from everyone if there is a genuine desire to change. Without that aspect of working together, it's never going to work."

Dr Meredith believes effective health delivery can be an important signal of how Australia reconciles in the future, and a significant part is a health system that respects Indigenous community approaches. "We don't go into a community unless we are invited. We don't impose our ideas. Instead, we accept their invitation, either from individuals or from communities. That's the first step of respect." Due to this, invitations for the Poche Centre to work with communities are coming thick and fast.

Her focus is on turning research into policy changes. "It's so important that this research doesn't sit still." Where will the wins come? "Well, I'm meeting the health minister this week," Dr Meredith says, explaining her advocacy for an Indigenous arts and health framework in the NT that will sit separate to the national framework and clearly articulate the priorities for people in the NT.

Change is in motion.

Left to right: Uncle Richard Fejo (Larrakia Senior Elder on campus), Dr Maree Meredith.

SHIFTING THE FOCUS ON ABORIGINAL NUTRITION

DENIAL OF ACCESS TO TRADITIONAL FOODS, RATIONING AND USING FOOD AS SOCIAL CONTROL. RECOGNISING THE IMPACT OF COLONISATION ON ABORIGINAL PEOPLE'S NUTRITION IS A STEP WE NEED TO TAKE TO CHANGE THE NARRATIVE.

As a young dietitian, Dr Annabelle Wilson was thrown in the deep end when she was sent to work with Port Augusta, Oodnadatta and Coober Pedy Aboriginal communities, but her experiences there have led to revolutionary changes in the way non-Aboriginal health workers engage with Indigenous patients.

"I just felt totally ill-equipped to work with Aboriginal people," Dr Wilson says of her first experiences there. "And I felt like the health service had a set of different priorities to those of the Aboriginal people I was working with."

So strongly did she feel about how the health services were not meeting the needs of Aboriginal people that she did her PhD investigating how health professionals could work more effectively with Aboriginal communities, in order to contribute to better health outcomes for Aboriginal people.

Now as an Advanced Accredited Practising Dietitian and a Senior Research Fellow, Dr Wilson is working to make those outcomes a reality.

As part of her effort to support healthcare providers, with colleagues Dr Wilson established a peer-mentoring scheme for dietitians working with Aboriginal people.

The dietitians, who came from all over Australia, came together for an initial face-to-face meeting and then, over a year, had six-weekly catch-up sessions to talk about people, challenges and enablers, and just to provide peer-to-peer support.

Now, with seed funding from the Flinders Foundation, she is working with a team to scale that up to a national intervention study, bringing Aboriginal voices into the mentoring process as a first step.

"We're using the Knowledge Interface Approach, designed by Maori Elder and Scholar Sir Mason Durie, which is about bringing together Aboriginal and non-Aboriginal knowledges – not privileging one type of knowledge over the other, but saying that both are valid and both are important, and we need to include them both," Wilson says.

"IT NEVER TAKES INTO ACCOUNT THE DENIAL OF ACCESS TO TRADITIONAL FOODS, THE WAY FOOD HAS BEEN USED AS A FORM OF SOCIAL CONTROL, RATIONING, EVEN GENOCIDE, WHERE FOOD AND WATER HAVE BEEN USED TO POISON ABORIGINAL PEOPLE."

DR ANNABELLE WILSON

The other part of the seeding grant is to use something called "critical realist evaluation".

"We know that peer mentoring has a benefit to the practice of dietitians working in Aboriginal health, but we don't know the exact pathway or mechanisms that lead to that benefit. So a critical realist evaluation allows you to actually work out what works for whom and under what conditions," Dr Wilson says.

Her ultimate goal is to change the current narrative in Australian Aboriginal and Torres Strait Islander nutrition research, and peer mentoring, along with changing the way we speak about Aboriginal food and nutrition, is one way in which that can be achieved.

"Currently the discourse around Aboriginal people's nutrition is very deficit based – it's focused on what people perceive is wrong. It doesn't recognise the impact of colonisation on nutrition," Dr Wilson says.

"It never takes into account the denial of access to traditional foods, the way food has been used as a form of social control, rationing, even genocide, where food and water have been used to poison Aboriginal people."

Then there are the more contemporary challenges such as lack of availability of fresh, affordable food in remote communities. So that ongoing colonial impact on food is not recognised widely.

"So we argue in our work that we need to shift that narrative, that it needs to be strengths-based," says Dr Wilson.

Dr Wilson points to the understanding that before colonisation, Aboriginal people were not living a simplistic 'hunter-gatherer' existence as often portrayed, but a very complex ecological lifestyle involving sophisticated agricultural practices.

"That is just not acknowledged when we consider food and nutrition in the context of Aboriginal people."

Dr Wilson says she knows of no other program like it in Australia, but given the nature of the topic, which is not widely understood, there are challenges in obtaining funding.

"Often in public health, we have this set idea of what we see as the problem, but I am advocating that we need to shift the lens or see the issue from another perspective," Dr Wilson says.

"And in relation to this work, instead of always focusing on problematising Aboriginal people's health, it's about shifting the lens back onto the white health professional and their own attitudes, biases and values, and how that affects how they work."

Dr Wilson's earlier work involved interviewing many non-Aboriginal health professionals working in Aboriginal health. As a result, she developed a continuum based on how effectively they were practising.

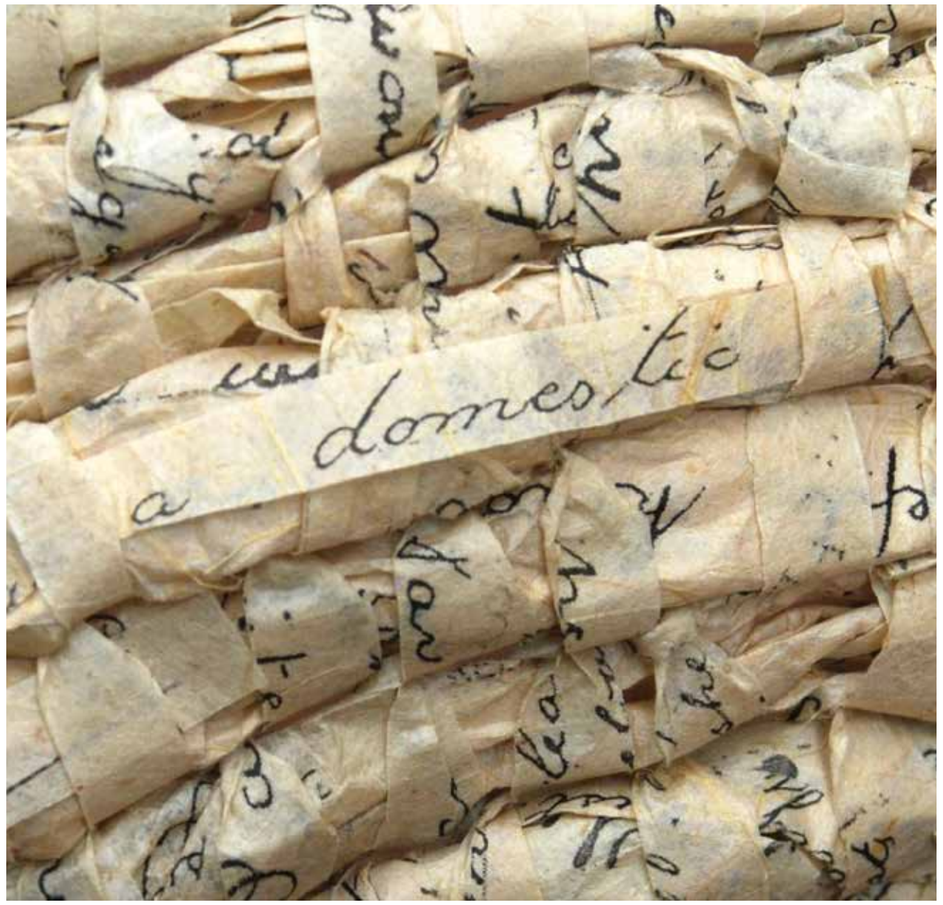
"This continuum started with those who felt totally at a loss to those who were really scared of, for example, being perceived as being racist," Dr Wilson says.

"There were those who thought it was too hard and just disengaged, but there were those who I called barrier-breakers who, regardless of all of those challenges, just went ahead and did it anyway. They had the most effective practice and were most aware of their own position as non-Aboriginal people."

Dr Wilson admits that the changes in approach and attitude she is proposing can be hard for some people.

"It requires a whole lot of skills that people don't necessarily have intuitively. And that's things like valuing multiple perspectives and knowledge, being able to be reflexive, having a willingness to sit with discomfort and being okay in feeling uncomfortable and then having the courage to challenge and change that."

RECKONING



WITH HISTORY

NARUNGGA WOMAN DR NATALIE HARKIN COMES FROM A "THREE MISSION HISTORY" – THAT'S THE NUMBER OF TIMES HER FAMILY WERE UPROOTED AND SHUNTED FROM ONE STATE-RUN ABORIGINAL SETTLEMENT TO ANOTHER.

"Our family, like many Aboriginal people from across the state, were herded on to Poonindie Mission, on Barngarla Country north of Port Lincoln," Dr Harkin says.

From there the family were shipped more than 400 km to Raukkan on the shores of Lake Alexandrina, then known as the Point McLeay Mission.

"Then they were taken from Point McLeay on Ngarrindjeri Country over to Point Pearce [on the West Coast of the Yorke Peninsula] on Narungga Country.

"That is where my Nanna was raised. So we identify mostly with Point Pearce and Narungga because that's where she connected with mostly, where many in our Chester family were born, buried and identify."

Throughout all the forced movements, the family, as with all Aboriginal people in South Australia, were under close surveillance by the authorities who recorded every aspect of their lives in a detail that would put the East German Stasi secret police to shame.

"If you were born Aboriginal, you were automatically under the Aboriginal Protection Act and it meant that you were controlled, surveilled, documented and archived in very particular, racialised ways," says Harkin.

Dr Harkin is an activist poet who is widely published and acknowledged, including winning the 2020 Adelaide Festival's John Bray Poetry Award. Her first poetry book, Dirty Words, was published by Cordite Books in 2015, and Archival-Poetics was published by Vagabond Press in 2019.

Now, as a DECRA Research Fellow at Flinders University, Dr Harkin is using archival-poetic methods to research and unlock those colonial-era surveillance records to document Aboriginal women's domestic service and labour histories in SA.

"When you enter colonial archives they can be violent spaces for Aboriginal people to navigate, but it's really important that we get access to our family records," Dr Harkin says.

"And when we do get access to them, we find trauma, but also the incredible strength and resistance of our families represented in the archives. We see them writing letters and petitions, lobbying for legislative change, illegally 'consorting' and breaching their 'Exemption Certificates', or running away and 'absconding' from placements and institutions, and attempting to return home and be with family."

Aboriginal lives were documented in minute detail even down to what was in their kitchen cupboards – what Dr Harkin calls "the mundane intimacy of the everyday" – as authorities sought to scrub those lives of their culture and history.

"The Inspectors, or 'State Ladies' as my family called them, recorded everything: what the children were wearing, where they were sleeping, who was visiting, and the state of the home. Being poor and Aboriginal was the basis then for children being charged as destitute or neglected, and grounds for child removal."

The other theme that runs through the archives is the grand narrative of the time – "the Aboriginal Problem" – escalating from the point of first contact.

"By the early 1900s, everything about our lives was couched in terms of the Aboriginal Problem," says Dr Harkin. "In 1913 there was even a Royal Commission about what to do with the 'problem' of the growing number of so-called half-caste children. The people who gave evidence to that Royal Commission mostly represented Adelaide establishment – they were from the museum, the medical profession, government, the mission superintendents, the Aborigines Protection Board, and many more who were in positions of power and privilege."

The Commission decided the answer to the "problem" was assimilation – forced if necessary – into white society.

"There was a quite deliberate dovetailing of policies between the Children's Welfare Department and the Aborigines Protection Board," says Dr Harkin.

"And they were all pretty much the same people, working in perfect harmony targeting Aboriginal children to be trained for domestic duties, particularly the girls as a key assimilation measure."

Unfortunately for Aboriginal girls and women, this policy solution coincided with an urgent need for domestic help in white homes across the colony. Dr Harkin says that most Aboriginal people she knows have a domestic service story but it is not part of the larger narrative of history in South Australia. She believed this gap in knowledge deserved considered archival research along with community stories documented for the future record.

In addition to poetry, Dr Harkin has exhibited her words in multiple ways, including a woven Ngarrindjeri basket from her nanna and great-grandmother's handwritten letters in the archives.

"These letters written by our families prove that our children were not destitute and neglected but were hard fought for, and deeply loved.

"Parents were often distressed about what was happening to their children – writing letters to access them, or advocate for them, or request holiday visits with them, or to influence where they were placed and worked. Parents were not passive or silent."

From the 1920s to the 1950s, the assimilation program proceeded at full pace, guided by the "Chief Protector of Aborigines" William Penhall.

DR NATALIE HARKIN

No one knows exactly how many girls were torn from their families and sent to work as virtual slaves in far flung corners of the state, so transparency and access to state archives is critical.

"The domestic service records that I've had access to show how punitive the Protector was, and how badly many girls were treated, which is gut-wrenching," says Dr Harkin. "There's evidence of abuse and being worked to the bone. Some girls weren't getting paid, or disputed wages, or their money was put into trust accounts which they had to apply to access. Some weren't clothed properly. Some were isolated and vulnerable, often sent to country farms because there was such specific demand for them."

Dr Harkin's response instinctively lies in poetry and creative arts as a way to repatriate love back to family, and as a personal and communal "reckoning with history". She also does this work with the Unbound Collective, close creative collaborators at Flinders University: Dr Ali Gumillya Baker, Associate Professor Simone Ulalka Tur and Senior Lecturer Faye Rosas Blanch.

"I guess archival-poetics feels the best way for me to deal with all the emotion in relation to colonial history, and to educate and make sense of our collective-collected lives.

"These policies severely impacted all our families. Many of us can't speak our languages or didn't grow up on country.

"We have generations of removal, and generations of indentured labour – our women were the market solution to the Aboriginal problem."

"I'm interested in decolonising archives and issues of access and transparency, questions of self-determination and representation, and ways to repatriate records to community. I'm interested in counter-narratives, truth-telling and active transformation. We know our histories of deep love, resistance and refusal. For me, archival-poetics shifts the emphasis from Aboriginal bodies, and puts the 'problem' spotlight back on the state where it belongs. This is everyone's story."

SUBMERGED WORLD BENEATH THE WAVES: ARCHAEOLOGY'S FINAL FRONTIER

SUDDENLY, THE BOUNDARIES OF HOW WE STUDY AUSTRALIAN HISTORY DRAMATICALLY CHANGED WITH THE DISCOVERY OF ABORIGINAL STONE TOOLS LOCATED ON THE PILBARA SEABED.

Flinders maritime archaeologist Associate Professor Jonathan Benjamin led an international team who confirmed what scientists and Aboriginal communities had long believed: that ancient poeple historically occupied a far greater Australia than exists today. This is evidenced by underwater archaeological sites on the continental shelf where hundreds of artefacts were found settled on the seabed at two sites in Murujuga (Dampier Archipelago), which is renowned for its ancient rock engravings.

It represents an important first step towards unlocking the secrets of ancient coastal habitation. This is especially important, as 21% of Australia's original land mass is now under water – an area larger than the state of Queensland. These submerged landscapes represent what is known as Sea Country by many Indigenous Australians, and Associate Professor Benjamin acknowledges the importance of working in collaboration with Indigenous communities.

The research published in scientific journal PLOS One, by The Deep History of Sea Country project team, confirms that archaeology can survive under water. Many Aboriginal Australians have oral traditions of the sea encroaching on ancient communities. "With a respectful approach and time to establish a trust, we have operated a two-way knowledge exchange between the archaeologists and the local communities," says Associate Professor Benjamin, who was the lead investigator of the DHSC Project. "We draw on and value local expertise. Providing the tangible links to Sea Country can help empower those communities in terms of land and sea rights."

The idea behind this major underwater archaeological discovery has burned within Californian-born Associate Professor Benjamin since he was a student. He was fascinated by the dramatic image of a diver emerging from the sea, holding an ancient antler. It featured on the cover of Danish research published by Anders Fischer, Man and Sea in the Mesolithic, and it inspired him to further investigate what the pioneer underwater archaeologists found in their own local areas. Associate Professor Benjamin realised the phenomenon of sea-level rise is global, so submerged archaeological evidence should be found in coastal and nearshore environments worldwide. This has major ramifications for studying human history and world archaeology.

There are only a few places in the world that have a well-known tradition for studying coastal prehistory below the current sea level, including Denmark, Israel and Florida. However, Associate Professor Benjamin's PhD studies focused on the Adriatic Sea, and his subsequent work focused on the submerged prehistory of Europe, while based in Scotland.

In 2014, Associate Professor Benjamin came to Australia with an ambition to make a mark on maritime archaeology. "An enormous amount of the world's earliest human history took place on land that is now under water," Benjamin says. "It's especially important to be studying this in Australia."

The Deep History of Sea Country was a complex project, which occurred thanks to cooperative and cohesive teams. Flinders archaeologists worked closely with colleagues at University of Western Australia, James Cook University, Airborne Research Australia, the Moesgaard Museum in Denmark and University of York in the United Kingdom. The project was done in collaboration and with permission from the Murujuga Aboriginal Corporation. Due to the challenges of planning and fieldwork in the marine environment, Associate Professor Benjamin says it was mix of excitement and relief when the two Flinders PhD students Chelsea Wiseman and John McCarthy made the initial dive where submerged artefacts were discovered.

"It is a life-changing experience for them and a positive disruption for Australian archaeology, because it confirms that there is so much more to be explored."

The door has swung open wide for future underwater archaeology opportunities in Australia and the Asia-Pacific region. Associate Professor Benjamin is confident more remarkable sites exist in the sea.

"We've gone from 'potential' to 'proven'. This is timely because people increasingly recognise the significance and care about the remarkable Indigenous history of Australia. The first Australians came from southeast Asia at least 65,000 years ago and arrived on land that is now submerged. Those first landing sites are all under water. Future discoveries and increased attention to underwater archaeology could tell us much more about the history of how and when people first arrived in Australia. The lives of millions of people took place on these now-submerged lands."

Photo credit: Sam Wright.

ASSOCIATE PROFESSOR JONATHAN BENJAMIN

Australia's Underwater Cultural Heritage Act currently provides automatic protection for shipwrecks older than 75 years in coastal and commonwealth waters, but does not automatically protect ancient Aboriginal sites, which can be protected by individual states or by the UCH Act with special ministerial approval. Associate Professor Benjamin believes the Murujuga discoveries will usher in significant change. "There is a real opportunity to review the policies and how we manage and protect cultural heritage, around the whole of Australia, both above and below the waterline."

Associate Professor Benjamin is thrilled that future generations of maritime archaeologists are now poised to make more remarkable discoveries. "We stand on the shoulders of those who pioneered the discipline of examining the ancient past through scientific diving. Now archaeologists and earth scientists make up an interdisciplinary, technologically advanced version of submerged landscape studies that will make significant new contributions to what we know about the human past."

Left to right: Associate Professor Jonathan Benjamin and Dr Maddy Fowler. Photo credit: Sam Wright.

FISH FINGERS TELL A WHOLE NEW EVOLUTIONARY STORY

A 375-MILLION-YEAR-OLD FISH FOSSIL IS CASTING NEW LIGHT ON OUR OWN EVOLUTION, AND ON THE COMPLEX HISTORY OF THE EARLIEST VERTEBRATES.

Professor John Long always thought he was simply examining fish when he looked at fossils. Now, thanks to his latest discovery that has radically changed evolutionary knowledge, he realises that he has spent 40 years investigating the genesis of human evolution – and it's all down to finding evidence of an ancient fish with fingers.

The startling discovery underlines Professor Long's belief that evolution is quite different from what he calls the "Hollywood version" that is fixated on the transition from monkey to man. Professor Long takes a much longer view – that all of us are connected with all living things, and that bony fish, the earliest vertebrates from 400 million years ago, represent a great unexplored mine of information about the longer evolutionary process.

"In science, knowledge is not written in stone. It is subject to change in the light of fresh evidence," says Professor Long. "This is a remarkable fossil because it reveals that the digits in our hands evolved before vertebrates left the water to colonise land.

"The big question is what does a fossil tell us about the overall narrative of evolution. To shine a light on that and to challenge existing knowledge changes the model of how we look at evolution."

As Strategic Professor in Palaeontology at Flinders University, Professor Long has been working with an international team over five years to examine an extraordinary 1.57 metre long *Elpistostege* fish fossil found in Miguasha, Canada: the perfect example of a complete skeleton from the Devonian period, 375 million years ago. It has revealed startling new insights into how the human hand evolved from fish fins. This has required slow, methodical and careful analysis before results were published in the prestigious *Nature* journal in early 2020, but its influence on evolutionary thinking has been profound.

New analysis of fossils that were discovered many years ago can rewrite evolution thanks to the advances of technologically advanced analysis tools available in the modern laboratory.

Flinders University's Palaeontology laboratory has a glowing international reputation, having an experienced team and the most modern apparatus to tease out new information – which is exactly why Professor Richard Cloutier from Universite du Quebec a Rimouski in Canada started a conversation with Professor Long over a beer at an international conference, mentioning that more scanning and investigation needed to be done on his exceptional *Elpistostege* fossil.

It began as a fishing expedition by the palaeontologists for new answers, and after five years of collaborative work, their published results signify a new definite marker in the evolutionary tree. "We knew we had the world's best fossil specimen of its type, but we didn't know what the story was," says Professor Long.

Elpistostege has slowly revealed many secrets since a small part of its skull roof was first found in Quebec in 1938, then another part of the skull found and described in 1985, demonstrating it was an advanced lobe-finned fish. The remarkable new complete specimen was discovered in 2010, but it took collaboration with Professor Long and the Flinders University team from 2014 to take its analysis a step further. The first paper was completed in 2019 when Professor Cloutier spent six months working with Professor Long at the Bedford Park laboratory as a Flinders University Visiting International Fellow.

CT scan data examined by Flinders Palaeontology Group colleague Dr Alice Clement revealed the hidden mystery, that this fish had digits in its fin. From this astonishing realisation, work progressed quickly. Sifting through 17,000 possible decisions in a data matrix, she was able to identify where this fish sits in the evolutionary timescale.

Professor Mike Lee analysed phylogenetic data to demonstrate that *Elpistostege* is now the most evolutionary advanced fish known, and that its unexpected pattern of skeletal development places it one node down on the evolutionary tree to all tetrapods – adding a missing link in evolutionary history.

PROFESSOR JOHN LONG

"IN SCIENCE, KNOWLEDGE IS NOT WRITTEN IN STONE. IT IS SUBJECT TO CHANGE IN THE LIGHT OF FRESH EVIDENCE," SAYS PROFESSOR LONG. "THIS IS A REMARKABLE FOSSIL BECAUSE IT REVEALS THAT THE DIGITS IN OUR HANDS EVOLVED BEFORE VERTEBRATES LEFT THE WATER TO COLONISE LAND."

"This has led us to propose a different theory of how fingers evolved and gave rise to the vertebrate hand structure that persists in the more than 33,800 species of tetrapods alive today, including humans," says Professor Long.

Great patience is needed in the laboratory to tease out all the relevant information concealed in a fossil, and what it means in the broader evolutionary discussion. Indeed, Professor Long is currently grafting at many fossil analysis projects, in some instances waiting for an advanced technological application to reveal the whole story.

Where to next? More 390-million-year-old tetrapod trackways of the Devonian age are being studied, with significant sites in Ireland and rural Victoria showing the earliest evidence of tetrapods walking on the world. More secrets in unfound fossils abound. More evolutionary answers beckon.

Cover image: West McDonnell Ranges, Northern Territory with Flinders researchers (2016).

Image left: A 3-D preserved 380 million year old fossil fish from Gogo, Western Australia, a site Professor Long has been working on for the past 34 years.

WHAT MOBSTERS TEACH ABOUT MASS TERRORISM

DECADES OF WORK TRYING TO UNDERSTAND THE SOCIAL STRUCTURES AND DYNAMICS OF ORGANISED CRIME IS NOW PROVIDING INVALUABLE INSIGHTS INTO THE TERRORIST NETWORKS THAT HAVE COME TO DOMINATE SECURITY CONCERNS IN THE 21ST CENTURY.

ASSOCIATE PROFESSOR DAVID BRIGHT

While there are similarities in the way the two function, there are also crucial differences that highlight the challenges of fighting them effectively.

Associate Professor David Bright is Director of the Flinders Illicit Networks Lab which conducts groundbreaking research using social network analysis to study organised criminal groups and terrorist groups. He is also Deputy Director of the Centre for Crime Policy and Research at Flinders University and Research Section Head for Criminology.

Associate Professor Bright began his career as a forensic psychologist before turning his attention to law enforcement interventions in the methamphetamine trade. What he found there piqued his interest in the structure of organised crime in general – specifically the networks that sustain it – and that has been his focus ever since.

“Social network analysis has been a key conceptual framework and an important methodology and analytical approach in my research,” he says. “It’s about the way people collaborate with each other in some type of an illicit activity, whether that’s drug trafficking or terrorism.”

Crime networks share many of the attributes of big business in their drive for profits.

“These networks are focused on the efficiency of their operations – how well they can do what they do and how quickly they can make money,” Associate Professor Bright says. “But they need to balance the efficiency of their operation against the overall need for security, because they’re operating in the dark, shadowy world of illicit trade. They need to make sure they make their money, but at the same time they don’t want to be detected and exposed.”

This keeps the networks much smaller than their multimillion dollar turnovers would suggest.

“Questions of trust are difficult and fraught,” Associate Professor Bright says. “The more they try to expand their networks, the more that they risk allowing someone into their organisation who is either going to inform on them, or who might be an undercover operative, or part of some rival operation. So the networks tend to be pretty small – in the dozens rather than the hundreds.”

In terrorist organisations priorities are slightly different.

Even with their desire to remain undetected, the profit motive means criminals will sacrifice some security for efficiency. Their networks need to work as ongoing concerns – importing drugs over and over again, for example – whereas a terrorist network only needs to do what they do once in order to achieve their aim.

“They only need to step into the light and engage in operations once. For example, planting a bomb or highjacking a plane,” says Associate Professor Bright. “So they prioritise security over efficiency and tend to operate in networks with a chain-like structure. It is not as efficient, but if they move slowly that’s not a major problem to them.”

That is not to say that organised crime networks don’t provide clues on how to tackle terrorism.

“In some of the work that we've done here in Australia mapping the neo-jihadist network across the past 20 years, we found that many of the groups who've engaged in either terrorist activity or planning for terrorist activity are all connected in one way or another.”

“So it’s actually one big network, connected across the country, but connected asynchronously – in other words, some of the groups were operating and planning at different times, but there are still interconnections between these groups across time. And these links facilitate the transmission of ideas and strategies.”

Associate Professor Bright's work has focused on the best way to disrupt these networks.

His research has questioned whether it is a better strategy to take the most highly connected individuals out of the network, or to target so-called “brokers” – individuals who connect other people together.

“These brokers might not be really well-connected,” says Associate Professor Bright, “but they’re in a very strategic position in the network. And what we found using computer modelling is that targeting those brokers is the most effective, and produces the most disruption to the network over time.”

Targeting brokers also, to some extent, overcomes attempts by organisations to adapt by replacing members who had been removed.

“We were able to show that even taking into account network adaptation – for example replacing actors who are arrested – that this brokerage targeting strategy was the most effective in dismantling and disrupting the network.”

One of the greatest obstacles to this sort of research is access to relevant and timely data. The most helpful is in the hands of law enforcement but is, for many reasons, usually very sensitive.

“Most of the work that I have done has been on historical data that's been through the courts, for example, and is no longer considered sensitive,” says Associate Professor Bright. “So often the snapshot of what you’re looking at is a little old.”

"And there are obviously questions as to what extent we can generalise from a study of a network that operated in the 1990s to more contemporary contexts?”

Slowly, there are signs that law enforcement is beginning to see the benefits of working more collaboratively with researchers such as Associate Professor Bright, a lesson that comes the long way around from the September 11 attacks on the US.

“One of the things I think the world learned from 9/11 is that when law enforcement agencies both within and across countries are not sharing information and cooperating with each other, important information slips through cracks and can lead to pretty bad outcomes.”

“Law enforcement cooperation within a federalism like Australia is vital, and we do have good cooperation and collaboration between agencies. And Australian law enforcement is also doing a good job of building collaborations with key international agencies, like Europol, for example, and Interpol.”

Building trust between criminologists and law enforcement is, however, a work in progress.

“My career over the last 15 years has been primarily aimed at trying to do just that. It's about building relationships and that’s incremental because law enforcement agencies are, and justifiably so, suspicious of outsiders.”

“But I think the collaboration between law enforcement agencies and researchers in this space is key. The Canadians and the Dutch do it really well. Australia is a little bit behind. But when I see work that comes out from researchers who have developed deeper cooperation and collaboration with agencies and can get access to sensitive data, the quality of the work is extremely compelling.”

“ONE OF THE THINGS I THINK THE WORLD LEARNED FROM 9/11 IS THAT WHEN LAW ENFORCEMENT AGENCIES BOTH WITHIN AND ACROSS COUNTRIES ARE NOT SHARING INFORMATION AND COOPERATING WITH EACH OTHER, IMPORTANT INFORMATION SLIPS THROUGH CRACKS AND CAN LEAD TO PRETTY BAD OUTCOMES."

RED ALERT ON THE CYBER BATTLEFRONT

THE DAYS WHEN THE THREAT TO OUR DEMOCRACY CAME SOLELY FROM TANKS, SHIPS AND FIGHTER AIRCRAFT HAVE LONG GONE. DIGITAL TECHNOLOGIES THESE DAYS HAVE THE ABILITY TO DESTROY TRUST IN OUR INSTITUTIONS WITHOUT A PHYSICAL SHOT BEING FIRED.

"THERE'S A TECHNO-POLITICAL SCRIPT WE'RE ALL READING FROM," DR ROGERS SAYS. "AND LARGELY IN THE DIGITAL AGE, THAT SCRIPT HAS BEEN WRITTEN FOR, BY, AND ABOUT SILICON VALLEY, EVEN AS THE ONE BEFORE THAT WAS WRITTEN BY, FOR, AND ABOUT THE MILITARY INDUSTRIAL COMPLEX."

DR ZAC ROGERS

The Jeff Bleich Centre (JBC) is positioning itself on the frontline of this new battleground with a mission of research, education and communication on emerging digital technologies and their impact on our social and political institutions.

"Digital technology is not a discrete technological artefact," says Research Fellow Dr Zac Rogers. "It is a techno-social and techno-political construct that includes everything from the way digital technologies play out in the defence and national security context, to the way people engage with these technologies, commercially or through social media.

"There are implications for the whole gamut of these emerging technologies. We include examination of 5G, blockchain and AI. We're really about understanding the social and political implications of these technologies."

The JBC is named for the former US Ambassador to Australia. Now returned to the United States, he serves on many boards or advisory boards of international cyber-technology companies and think tanks including RAND, the US Studies Centre at Sydney University and Stanford University's Center on the Advanced Study of Behavioral Science.

Bleich's term in Australia was marked by the US "rebalance" to the Asia-Pacific, with Australia being the focal point for that shift. With a long history as military allies, it is not surprising the two countries are working together in this new battleground.

While the JBC has a strong research focus, it is also actively engaged with industry and government.

"We're putting together an education package for the Australian Cyber Collaboration Centre in South Australia. Known as A3C, the centre is based at Adelaide's new high-tech hub, Lot 14, and assists business in navigating the cyber ecosystem.

"It is aimed at executive level people in government," says Dr Rogers. "We're expanding the concept of cybersecurity in relation to computer network attacks and critical infrastructure vulnerabilities. We're very much focused on the social and political implications of even using the internet and digital devices when they're working normally, before getting to confront cyber attacks."

While the dangers are all too evident and seem to be coming at us from all directions, solutions are less well-defined. There are defensive postures we can, or should, be taking. Dr Rogers speaks of a need for governments to build "provable provenance" into the information they release so that it can be audited when misinformation based on it is weaponised.

One of these tools is blockchain, a distributed ledger technology in which details of transaction are held in many different nodes rather than centrally. This creates a system that's more difficult to attack.

While its most public use is powering the cryptocurrency Bitcoin, it offers solutions for all sorts of security challenges, from locking away data to assuring that "provable provenance".

Flinders is at the forefront of this research and has just signed an MoU with US-based SimbaChain to accelerate our understanding of how to harness blockchain to fight digital threats.

Dr Rogers says we need to change the way we think about everything from legislative and regulatory changes, all the way down to norms in industry, where we design these digital technologies in ways that do not leave consumers and citizens vulnerable to manipulation.

"The digital age and its ubiquitous digital devices and social media is all designed to keep us on these platforms. Rightly, there are big discussions around how these algorithms work and how they should be in fact regulated.

"All the insights from cognitive science have been deployed at the vanguard of commercialism and using digital technologies, and we've allowed that to just crash through the political economy. And now we're thinking about cleaning up the mess."

Dr Rogers is hopeful that the community, addicted to its devices though it may be, is coming to a realisation that we can't just let the technology out and run wild only to worry about the implications later.

"We have to think about the implications on society and our political institutions and our democracy beforehand," Dr Rogers says. "And so the shift is really in how we scale and deploy and develop technology per se, rather than the fairly laissez faire approach that we've had to date."

Dr Rogers acknowledges that individuals can feel powerless but says the JBC's work is aimed at research into ways to take back control, and to educate the public and governments in that.

"There's a techno-political script we're all reading from," Dr Rogers says. "And largely in the digital age, that script has been written for, by, and about Silicon Valley, even as the one before that was written by, for, and about the military industrial complex.

"What we're really trying to do is change the script, and instead become its authors as democratic citizens for, by, and about us as citizens, as families and communities and as a nation."

ADDRESSING A CLIMATE OF INSECURITY

BUSHFIRES, DROUGHTS, FAILING CROPS AND RISING SEA LEVELS – THE LITANY OF DISASTERS ARISING FROM CLIMATE CHANGE ARE ALL TOO FAMILIAR. BUT AS THE CONTOURS OF CHALLENGES AHEAD BECOME CLEARER, THE IMPLICATIONS FOR NATIONAL DEFENCE AND SECURITY ARE ALSO COMING INTO SHARPER FOCUS.

ASSOCIATE PROFESSOR CASSANDRA STAR

"There's literature on the challenges that climate change presents for national security going back to the 1980s, but that was much broader and speculative," says Associate Professor Cassandra Star. "Now it's much clearer what some of those challenges are likely to be."

Associate Professor Star leads the Climate and Sustainability Policy Research (CASPR) group at Flinders and, while she is a scientist by original training, in the multi-disciplinary world of climate change research her work is concentrated on the interface between politics and the policy process, and the subsequent impact of these dynamics on policy formulation.

Associate Professor Star is particularly interested in environment movements, what makes their advocacy less or more effective and how they attempt to influence the policy process.

The other side of her work advises policy makers on the best approaches to deal with a heating planet. Part of that is helping anticipate and understand the broader impact of the disruptions we can expect as the climate changes and the challenges of making good policy to respond to those impacts.

Associate Professor Star is currently working on a program of research with CASPR colleagues, funded by the Department of Defence, which she calls the Climate Resilience Project.

While climate-related defence challenges in the Northern Hemisphere centre on issues such as the potential for ice-free winter navigation of the Arctic Ocean, in the Australian neighbourhood they are more about the situation as nations in the Pacific face potential oblivion.

The project seeks to understand climate resilience in the Indo-Pacific, and what our neighbours might do to improve their climate resilience. It provides guidance to other institutional partners and players about how preparations can be strengthened ahead of a warmer future to minimise political and security impacts.

"Obviously the role for Defence in terms of national security isn't about prevention – that's someone else's job – it is about response. So one of the challenges is about how to prepare for problems while making the best of government's resources and institutional capacity."

One of Associate Professor Star's key concerns is what might flow from the destabilisation which follows environmental disasters in the Pacific Ocean. There are clear implications for both the human cost and the security ramifications for Australia and its interests.

"If you look at what might be the first five countries to disappear, those five are all in the Pacific," says Associate Professor Star. "But countries will become unviable before they physically disappear due to saltwater intrusion into their fresh water."

Those changes to the political status quo in the region will require our own government departments and agencies to be well coordinated and ready to co-operate with our regional neighbours.

Closer to home, the bushfires that burned across Australia at the end of last year have also focused attention on the expectations of Defence and its resources – demands that Associate Professor Star expects will only increase.

"The likelihood is that those defence resources won't necessarily increase even as the military is likely to be called on in a greater way, more often in our region, whether that's around border security, or natural disasters in countries in our region – or even just that more people will be travelling to Antarctica where the Australian Navy is the rescuer of last resort."

All this means an increasing need to lean on the Australian Defence Force.

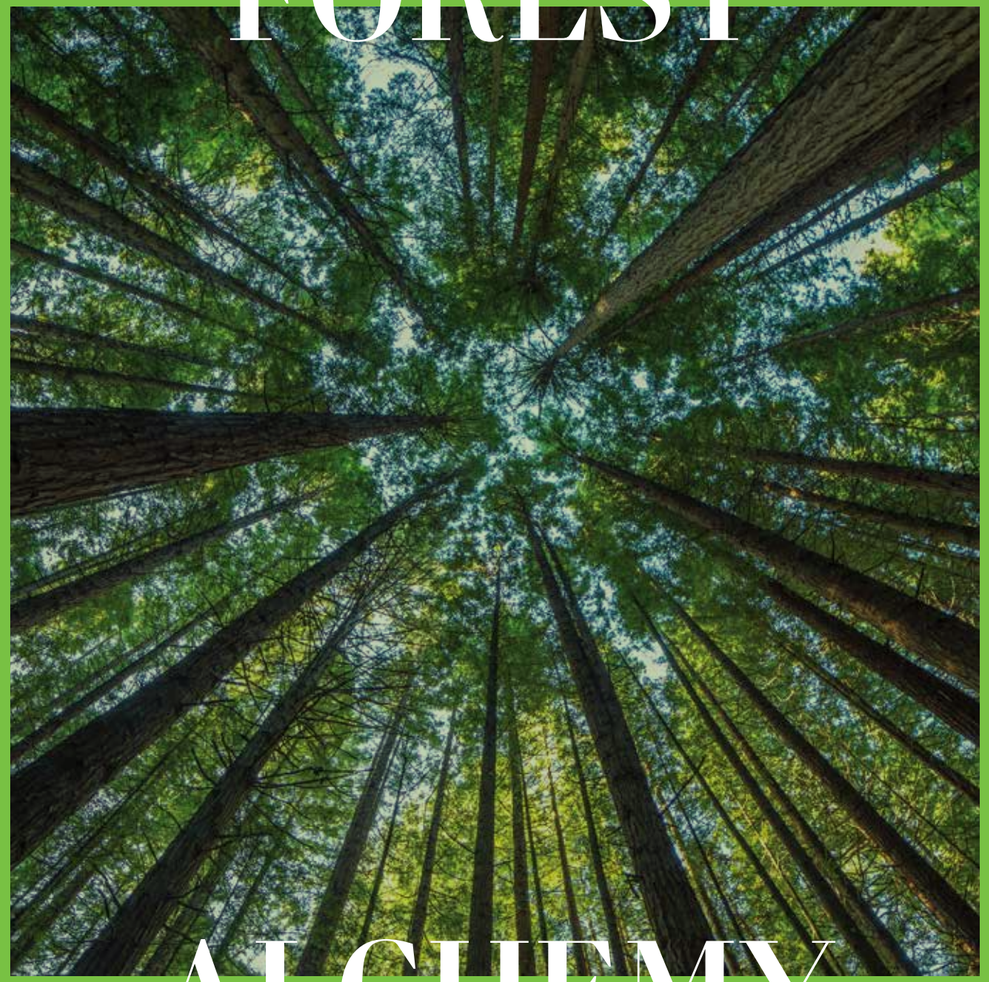
"We've seen that with COVID, as with the bushfires. These are the same kinds of events which the scientific evidence indicates that we need to expect more of."

Associate Professor Star says it is vital for our political leaders to start thinking about climate impacts in a strategic way through the lens of safety and security for Australia and our region.

"It's no longer really a theoretical 'this could happen in the future' kind of thing. It is a reality and it is now a question of what will be the implications for Australian national security and how can we be prepared? What can we do now to try and minimise some of these impacts?"

CLOSER TO HOME, THE BUSHFIRES THAT BURNED ACROSS AUSTRALIA AT THE END OF LAST YEAR HAVE ALSO FOCUSED ATTENTION ON THE EXPECTATIONS OF DEFENCE AND ITS RESOURCES – DEMANDS THAT ASSOCIATE PROFESSOR STAR EXPECTS WILL ONLY INCREASE.

FOREST



ALCHEMY

PROTECTING OLD GROWTH FORESTS AND CREATING HARDWOOD TIMBER BOARDS FROM WHAT WOULD PREVIOUSLY BE CONSIDERED WASTE ARE TWO BENEFITS OF A NEW PROCESS FOCUSED ON RECYCLING, REUSING AND REPURPOSING A VALUABLE RESOURCE.

A modern-day alchemy, which converts wood waste into timber boards indistinguishable from 100-year-old hardwood, has been turned into a business that is also protecting native forests in Australia, Indonesia and elsewhere in Southeast Asia.

Flinders University Professor David Lewis developed the process, which he has commercialised in partnership with Bosch Manufacturing Solutions through a company called 3RT. They are preparing to market the product around the world.

“The name comes from the three Rs, which stand for recycle, reuse, repurpose timber,” says Professor Lewis, a polymers expert.

The technology had its genesis in an earlier project of Professor Lewis’s creating strand-woven flooring – itself now a common material used around the world.

The current product, called Designer Hardwood, can be worked in the same way as natural hardwood but is made from logs that would otherwise be turned into wood chips.

The raw material comes from the first thinning of plantation forests, when the trees are about 10 centimetres in diameter and every second one is removed to let the remainder grow.

“You can't get useful boards out of the smaller diameter trees,” says Professor Lewis. “Typically they are chipped and turned into pulp and paper. Sometimes they are chipped and put into particle board, or even just burned.”

While this doesn’t matter so much with pine, which is fast-growing and plentiful, they represent very low value applications for hardwood timber.

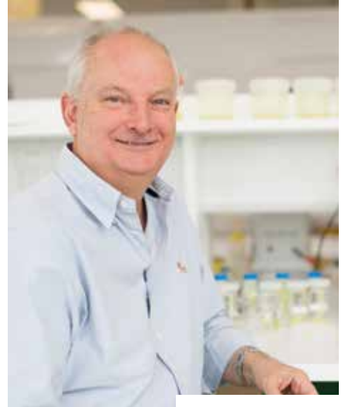
“So instead of chipping them, we peel these logs like an apple to get the veneer. Then we glue these veneers back together and apply pressure and temperature to get a big block of consolidated timber.

“We can then cut that into boards and panels and whatever other configuration that you’d like.”

The whole process takes no more than 30 minutes and the finished product behaves just like the real thing.

“It's very similar to conventional hardwood, so it machines the same way, cuts the same way, gives splinters the same way,” says Professor Lewis. “If you saw a piece of normal hardwood and you don’t tape up the back, you end up with micro fibres at the back of the cut. And the 3RT wood does exactly the same thing, so it machines and processes almost identically to traditional hardwoods.”

So far Professor Lewis and his team have applied the process to more than 50 different species of tree including blackbutt, jarrah, birch, maple, oak and a wide range of eucalyptus, as well as increasingly scarce tropical hardwoods such as teak and mahogany. This ability to create sizeable boards out of small trees is a game changer for the industry – and the environment.



PROFESSOR DAVID LEWIS

“To get a decent sized board out of a tree, depending on the species, it has to be 100 to 200 years old. There are no plantations that are that old anywhere in the world,” says Professor Lewis. “So this product allows us to use much younger trees and protect the native forests.”

While the key part to the technology is the adhesive that is used to recreate solid timber from veneers, Professor Lewis’s says the combination with the pressure and temperature is all part of the invention.

“We can get certain properties that we've got from adhesives that you wouldn't normally expect to get it from, so it's a different way of looking at some of the adhesives as well.”

He becomes tight-lipped, however, about the exact nature of the adhesive given its sensitive commercial nature.

“I can tell you it's a water-based emulsion, so it's very environmentally friendly.

THIS ABILITY TO CREATE SIZEABLE BOARDS OUT OF SMALL TREES IS A GAME CHANGER FOR THE INDUSTRY – AND THE ENVIRONMENT.

And it’s relatively straightforward, apart from a couple of tweaks that we’ve done to it. There are no solvents or anything like that, which makes the manufacturing line a lot simpler than it would otherwise be.”

Professor Lewis initially worked with local companies in Adelaide and Melbourne on the prototype equipment, then turned to a partnership with German manufacturing giant Bosch to make generation two.

The firm’s global reach was important for 3RT’s business plan.

“Part of the model is to place these production units close to the timber in various countries, wherever it happens to be,” Professor Lewis says. “And to do that, we need a global company, like a Bosch, who can supply, install, and support.”

REUSE IT OR LOSE IT

WASTE CAN BE VALUABLE IN WAYS THAT WE DON'T YET REALISE. IT JUST TAKES A VISIONARY TO SEE IT.

ASSOCIATE PROFESSOR JUSTIN CHALKER

Associate Professor Justin Chalker looks at waste items through the prism of green chemistry to consider what valuable new materials they can become.

Transformations that he has performed in the Chalker Research Lab at Flinders University have been dramatic: a new class of rubber can be repurposed into incredibly strong building bricks; waste cooking oil becomes an absorbent polymer that can clean oil spills from ocean water. It signals a brave new era of environmentally friendly chemical application.

"This is the ambition of green chemistry, to make materials, molecules and compounds that are useful – and to make sure they are sustainable," says Associate Professor Chalker, recipient of the Prize for New Innovators in the 2020 Prime Minister's Prizes for Science.

His idea is to establish new, valuable and generally recyclable rubber, plastics and ceramics. Too many materials are used once and then discarded, but Associate Professor Chalker believes functional alternative uses must be investigated by chemists.

"We have to think about how we can recycle them, or repurpose them, or break them down into their fundamental building blocks so they can be used in different ways, to fully inform a circular economy. Right now, we do a pretty poor job of designing materials with the consideration of a full life cycle."

Many common plastics – polyethylene, polypropylene and polystyrene – are made up of very strong carbon-carbon bonds that limit the ways in which these materials can be recycled. But what if the chemical bonding process was done differently?

Associate Professor Chalker embarked on this new research journey by examining sulphur, an abundant and cheap waste product. "Sulphur is so readily available, with tens of millions of tonnes produced each year as a by-product from petroleum refineries." However, sulphur is not very soluble, and chemists have a habit of wanting everything they use to be in solution for easy mixing. Tiny proportions of sulphur have long been used in vulcanising techniques to produce rubber, but Associate Professor Chalker tested what happens when much higher proportions of sulphur are used to activate reactions.

He started by combining used canola oil with sulphur to provide an absorbent polymer that has been found to clean up waste mercury (a common toxic by-product of crude gold mining techniques used in third-world countries) and absorb crude oil spillages (ideal for oceanic clean-ups). "One door opens to another. A lot of our research is application driven, and we've seized on the unique properties of reactions we've discovered to explore their application further."

Recently, the researchers discovered that a new kind of rubber can be made from waste sulphur, canola oil and dicyclopentadiene from petroleum refining, and can be used together with an amine catalyst to make flexible, repairable, sustainable objects, such as car tyres. This new type of rubber can be seamlessly repaired if damaged and returned to its original strength in minutes, in a low-energy process that can be conducted at room temperature. The new rubber can also be used as a latent adhesive, because the rubber bonds to itself when the amine catalyst is applied to the surface. The adhesion is stronger than many commercial glues and is also resistant to water and corrosion.

It's a significant waste solution breakthrough. At present, about 48 million rubber tyres reach the end of their life in Australia each year, with each passenger car tyre containing approximately 1.5kg of steel and 7kg of rubber, yet only 16% are domestically recycled. Around two-thirds end up in landfill, are stockpiled or illegally dumped.

Regarding the conversion of the new class of rubber to new construction materials, Associate Professor Chalker notes that "what we have come up with is a next-generation building material that could be used to replace concrete, and created with much lower rates of energy consumption".

Breaking and reforming the bonds of compounds in a radically different way provides a foundation stone for much green chemistry possibility. It results in a whole new class of recyclable, reprocessed materials, and industry is quite eager to engage with the scientists. Three major patents for the new compounds have been sold to international firm Clean Earth Technologies, with one of its staff now working within the Chalker Research Lab to develop their commercial application.

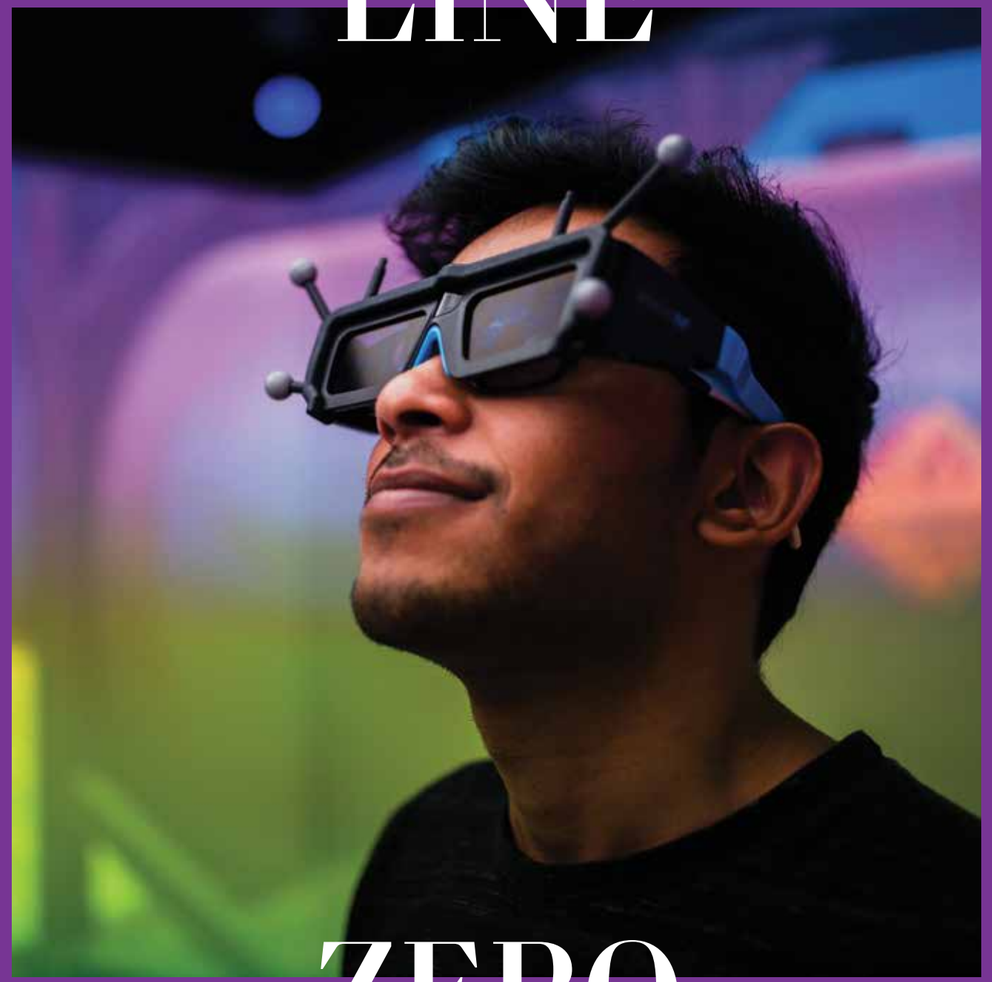
The curiosity within Associate Professor Chalker to find these chemical solutions came from the most unlikely origins. Born in a small Kansas farming community – "located right in the middle of nowhere," quips Chalker – he earned a scholarship to the University of Pittsburgh, which is famed for its biological science and chemistry programs. Here, he learned how chemical bonds are broken and reformed to make valuable compounds, and it set him on a path to higher studies at Oxford University in England, stimulating grand ideas to be both innovative and creative with chemistry.

"It satisfied both parts of my brain: building something constructive with my hands, and the intellectual satisfaction of solving unanswered questions."

"WE HAVE TO THINK ABOUT HOW WE CAN RECYCLE THEM, OR REPURPOSE THEM, OR BREAK THEM DOWN INTO THEIR FUNDAMENTAL BUILDING BLOCKS SO THEY CAN BE USED IN DIFFERENT WAYS, TO FULLY INFORM A CIRCULAR ECONOMY. RIGHT NOW, WE DO A PRETTY POOR JOB OF DESIGNING MATERIALS WITH THE CONSIDERATION OF A FULL LIFE CYCLE."

Recipient of the Prize for New Innovators in the 2020 Prime Minister's Prizes for Science, Associate Professor Chalker is surrounded by like minds in his lab at Flinders University's Institute for Nanoscale Science and Technology. "It's an area of great opportunity for young researchers. We make a point of integrating our students early on into our high-impact projects, as a vital part of our mission in education."

LINE ZERO



AUSTRALIA'S FIRST LARGE SCALE ADVANCED MANUFACTURING ACCELERATOR IS BEING ESTABLISHED AT TONSLEY, ON A SITE THAT DEFINED A PREVIOUS GOLDEN ERA OF AUTOMOTIVE MANUFACTURING IN SOUTH AUSTRALIA.

It's Line Zero: Factory of the Future, located on the former stamping plant that was the birthplace of the Chrysler Valiant and ended its days producing Mitsubishi 380 sedans, employing a significant portion of the car maker's 1,500-strong workforce.

The space now houses the initial pods of the Line Zero pop-up test lab where potential applications of advanced manufacturing technologies in the maritime shipbuilding sector are being explored.

"It's an impressively large facility – one that is coming alive again, this time as a driver of advanced manufacturing," says Professor John Spoehr, Pro-Vice Chancellor, Research Impact, and Director of the Australian Industrial Transformation Institute at Flinders University. "This is an optimistic sign for the state. We are living in challenging economic times, but this is an opportunity to keep apace with global technological change – and for the sake of all South Australia, we must get it right."

Line Zero – a major research partnership with BAE Systems/ASC Shipbuilding and the Innovative Manufacturing CRC at the Tonsley Innovation District – will be the first industrial-scale Factory of the Future facility in Australia, demonstrating the potential and capabilities of advanced robotics, automation and the Industry 4.0 industrial transformation agenda.

Joint research is being undertaken on human factors that influence the uptake of advanced manufacturing technologies and processes. "The purpose of the research is to support the development of world-class digital shipbuilding in Australia as part of the $35 billion Hunter Class Future Frigate program," says Professor Spoehr. "The idea is that we build this into a very substantial capability in the next five years."

Such bold new facilities are necessary for Australia to remain in step with global industrial transformation – something that Professor Spoehr says can be the foundation for growth of advanced manufacturing businesses and jobs.

"How do we translate great ideas into commercially and socially beneficial outcomes? We've never lacked great ideas – the challenge has been to commercialise and realise public value from more of them. Facilities like the Factory of the Future will really accelerate our efforts in industrial transformation, in line with other world leaders such as Germany and the UK."

This research facility's broad engagement with supply chains and suppliers is likely to attract the attention of a range of industries – especially food and wine production, medical technologies, energy and mining interests. Professor Spoehr says all these significant sectors of South Australia's economy and employment landscape are hungry to exploit the benefits of advanced manufacturing and digital technologies.

"It's exciting that the Line Zero facility will combine a research and development facility with training. Laboratory-based projects will move quickly into a facility where industrial-scale tests and trials can be undertaken to help de-risk and accelerate technology adoption in the workplace."

Professor Spoehr has been researching industrial transformation strategies for more than three decades and says it now requires a range of disciplines to come together for required solutions to be developed.

"So many of the barriers that we face are human and organisational, but we can overcome them if we assemble new teams from very different backgrounds.

JOINT RESEARCH IS BEING UNDERTAKEN ON HUMAN FACTORS THAT INFLUENCE THE UPTAKE OF ADVANCED MANUFACTURING TECHNOLOGIES AND PROCESSES. "THE PURPOSE OF THE RESEARCH IS TO SUPPORT THE DEVELOPMENT OF WORLD-CLASS DIGITAL SHIPBUILDING IN AUSTRALIA AS PART OF THE $35 BILLION HUNTER CLASS FUTURE FRIGATE PROGRAM," SAYS PROFESSOR SPOEHR. "THE IDEA IS THAT WE BUILD THIS INTO A VERY SUBSTANTIAL CAPABILITY IN THE NEXT FIVE YEARS."

Cover image: Flinders student Justin Thomas currently studying a Bachelor of Information Technology (Digital Media) (Honours), pictured in the Digital Transformation Lab.

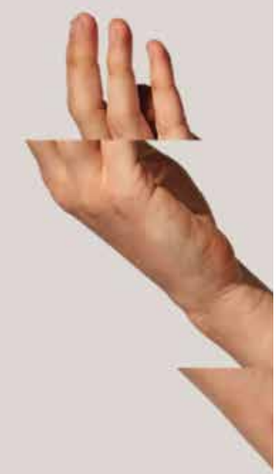
Photo credit: Nat Rogers

PROFESSOR JOHN SPOEHR

We need to bring together engineers and social scientists, computer technicians, psychologists and business experts to work in collaborative teams. It's something quite unique that we are doing at Flinders, and it puts us at the cutting edge of industrial transformation efforts internationally. It's what we need to do more in Australia."

Aware that industrial transformation is a fundamental challenge facing Australia's economy and society, Flinders' research expertise is providing substantial benefits for companies embracing industrial transformation. To ensure Australia rides at the cutting edge of advancement, Flinders is working with best-of-breed research and development facilities including the Advanced Manufacturing Research Centre in Sheffield, UK – the world's leading advanced manufacturing accelerator funded by the UK Government's Industry Catapult Program – and the University of Strathclyde's Advanced Forming Research Centre to support the application of new manufacturing technologies for shipbuilding. These collaborations with world-leaders are now of the greatest importance.

"No country without a strong manufacturing sector will enjoy high standards of living in the 21st century," says Professor Spoehr, "but if we do this well, it will help to underpin high living standards in Australia for decades to come."



CREATIVITY UNLIMITED: THE SCIENCE OF ART

ARTISTIC EXPRESSION HAS NEVER HAD LIMITING BOUNDARIES FOR PROFESSOR GARRY STEWART.

Through his 21-year role as artistic director of Australian Dance Theatre, Professor Stewart has fused his daring choreography with elements drawn from neuroscience, physics, architecture and robotics.

Now he is expanding the possibilities of innovative artistic research collaboration as the new Professor of Creative Arts and the first director of Assemblage: the Centre for Creative Arts, at Flinders University.

"I've always been fascinated in science and other arenas of knowledge outside of the choreographic domain," he says. "I'm exhilarated by alternate ways of thinking and collaborations that can assert new influences upon my own artistic processes."

Assemblage is a new research centre designed to draw together myriad artistic and academic disciplines at Flinders University, while also encouraging external artists, researchers, industries and communities to join as partners in novel artistic ventures. It aims to forge bright ideas for research that can stimulate, measure and qualify the impact of Arts endeavours, resulting in complex, transdisciplinary knowledge creation.

"The word assemblage is fitting as it describes a space that facilitates disparate thinkers and practitioners to come together in order to try and answer complicated questions about an increasingly complex world," says Professor Stewart.

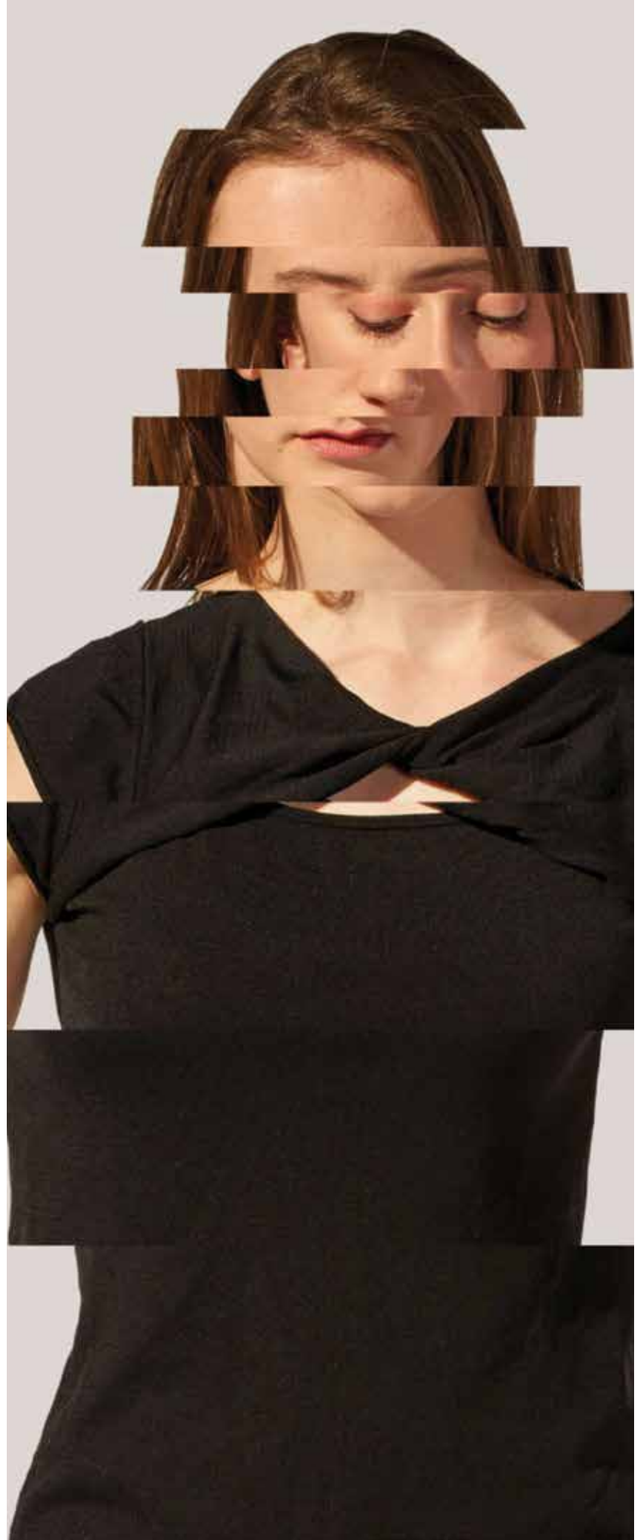
"It's a facility which recognises that artists take concepts, data, philosophies and experience, metamorphosing them into transformative encounters that radically alter our perception and understanding of the world and our place in it.

"While we're not creating a new physical centre, Assemblage will be drawing together the significant resources we already possess across the University. It pulls focus within the University and externally to generate interest from artists, industries, communities and supporters."

Key project examples are taking shape in The Void, one of the largest virtual reality and motion capture labs in South Australia. Attached to the Flinders University drama unit and run by Dan Thorsland, The Void brings together filmmakers, choreographers, actors, dancers, gamers, archaeologists, medical researchers and technicians in collaborative projects. "It's an environment where everyone is experimenting and exploring, and that brings much possibility," says Mr Thorsland.

Such a daring embrace of uncharted artistic pursuits points to fresh possibilities about how the Arts can engage in innovative research that makes strong connection to industries, investors, practitioners and audiences.

As another example of how Flinders' cross-disciplinary assistance can help shape new artistic endeavour, Professor Stewart points to the newly co-designed Arts in Health initiative, an inventive collaboration between the College of Humanities, Arts and Social Sciences and the College of Nursing and Health Sciences. Given the significant health problems facing our society, Professor Stewart says creative arts have a profound role to play in all areas of health and wellbeing through contemporary research.



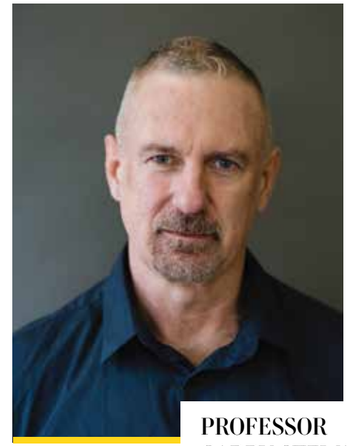
"ASSEMBLAGE FACILITATES COLLABORATIONS AND UNIQUE PARTNERSHIPS. IT CONFRONTS THE CONVENTIONAL, SILO-BASED TRADITION OF LEARNING..."

Assemblage aims to position Flinders at the centre of national and international activity in digital cultural heritage – especially presenting the rich histories of Indigenous Nations, building on foundations laid at Flinders University by the Tjilbruke Indigenous Studies and Research Group and the high-profile creative work of Unbound Collective. Flinders also hosts AusStage, the nation's most comprehensive online performing arts database, holding data on over 120,000 Australian performances.

Professor Stewart is excited that Flinders University is breaking new ground by fostering such bold new ventures. "Assemblage facilitates collaborations and unique partnerships. It confronts the conventional, silo-based tradition of learning and encourages extending the boundaries of how artists work to achieve new methodologies and unanticipated outcomes. It is a space for unexpected collaborations and partnerships across a panoply of disciplines."

Professor Stewart's route to academia has been similarly unconventional. Coming from rural New South Wales where his father was a stockman on a cattle station, he began studying social work at university in Sydney before committing himself to professional dance training at the Australian Ballet School. Through the 21 years he has spent at the helm of the Australian Dance Theatre (ADT), he has choreographed more than 25 major productions and dozens of smaller projects. Much of his work has been notable for novel collaborations, exploring dance in confluence with ingenious approaches to staging and design, expressing ideas drawn from neuroscience, biology and physics, incorporating digital technologies such as 3D stereoscopic graphics, live interactive video, virtual reality, prosthetics and robotics.

"The desire to incorporate science and technology into dance originated in a number of my early works prior to my directorship of ADT, and at ADT this pursuit has been amplified. My production Devolution, made in 2006, involved 30 robotic machines including robotic prosthetics along with 10 dancers on stage. At that time, it was probably the world's largest dance and robotics production."



PROFESSOR GARRY STEWART

Professor Stewart has meshed this heavy artistic workload with academic roles. In 2014, Professor Stewart was Artist-in-Residence at the National Institute for Dramatic Art (NIDA) in Sydney, and was Thinker-in-Residence at Deakin University in 2012–2013, attached to its Motion Lab and exploring motion capture, virtual reality and 3D stereoscopic graphics.

"I see research and acquiring knowledge as the essential building blocks of any innovative artistic pursuit; however all projects necessarily commence as fragile and uncharted and take time to disclose themselves. At Assemblage we are committed to supporting creative arts researchers through this process of discovery."

Through his work as director of Assemblage, Professor Stewart says he will remain inexorably linked to artistic practice and is exploring the possibility of a new video installation that will utilise the facilities of The Void involving ADT during 2021. A more recent film project titled *Microfilms* - a collaboration between ADT, AC Arts and Flinders University Screen Studies - resulted in 24 new short dance films made in isolation conditions.

Professor Stewart believes the rigour and discipline of academic research is integral to the progress of performing arts. "We live in an era when traditional boundaries are collapsing between different areas of thinking, knowledge bases and artistic forms. Artists have access to wider platforms of knowledge, which they absorb into the prism of their creativity. This permits unique and unanticipated discourses that are imperative for how artists try to comprehend our position in a rapidly changing world."

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