



Australian Government
National Health and Medical Research Council

**BUILDING
A HEALTHY
AUSTRALIA**

10

OF THE BEST

**NHMRC
RESEARCH
PROJECTS**

FIFTEENTH EDITION

NHMRC



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10 of the Best Fifteenth Edition

Welcome

10 of the Best celebrates success stories from Australia's health and medical researchers whose work has been funded by the Australian Government through NHMRC. NHMRC-funded projects are evidence of the deliberative and collaborative scientific method which underpins our nation's reputation for research quality and integrity.

Funding research to improve the lives of millions of people.

FOREWORD



It is a pleasure to introduce NHMRC's *10 of the Best – Fifteenth Edition*, celebrating the calibre of talent and achievements of Australia's health and medical researchers.

Health and medical research benefits all Australians. It helps us prevent disease and injuries, find treatments and cures for debilitating conditions, and improve our understanding of the human body and the health issues that can affect it.

As Australia's lead agency supporting health and medical research, we invest in people and projects that support our health and medical research sector to respond to existing and emerging threats to human health. As demonstrated in the research highlighted herein, NHMRC-funded research is generating innovative ideas and leading to health policies, programs and practices that lead to real improvements in individual and population health.

As NHMRC's Chief Executive Officer, it is my privilege to reflect on the breadth of extraordinary research undertaken across Australia – 10 of the Best is an example of this and I am honoured to showcase the outcomes of our national research effort.

Here we showcase research projects completed in 2021 that demonstrate the quality and diversity of projects funded by NHMRC through its grant program, and which have significantly contributed to improving human health.

This edition documents ground-breaking discoveries across a broad spectrum of topics from tackling the physical health outcome gaps for adolescents, preventing ear disease among Indigenous children, early diagnosis of glaucoma and implementing trials to reduce the number of open surgeries during a hysterectomy procedure.

Congratulations to the researchers celebrated in *10 of the Best – Fifteenth Edition*. On behalf of NHMRC, I hope you, the reader, enjoy learning about some of the life-changing research projects led by Australia's brightest researchers.

Professor Steve Wesselingh
Chief Executive Officer

GETTING ADOLESCENTS ACTIVE FOR HEALTH BENEFITS

Dr Rachel Sutherland



Administering Institution: University of Newcastle

Grant: Translating Research into Practice Fellowship

Funding: \$179,118

Year: 2018–2020

Team: Professor John Wiggers, Prof Luke Wolfenden, Prof David Lubans, Prof Philip Morgan, A/Prof Nicole Nathan, Dr Libby Campbell and Dr Matthew Tepi McLaughlin

Less than 10% of adolescents globally, including in Australia, do enough physical activity to align with the amount required for young people to be healthy.

Knowing the potential impact from this—including diabetes, heart disease and some cancers—Dr Rachel Sutherland could not sit still. She transitioned from being a clinician to a full-time researcher to focus on childhood obesity prevention and the teenager group, in particular.

'After working for 15 years as a dietitian it seemed to me that the adolescent age group misses out on a lot, but needs a lot of support,' said Dr Sutherland, who now works for the University of Newcastle as a research fellow.

'I saw a great need to integrate research into practice to fill the important gap in health service delivery.'

Through her NHMRC Translating Research into Practice Fellowship, Dr Sutherland aimed to find evidence-based methods that would embed physical activity programs in schools, particularly in low socioeconomic status (Low SES) areas.

'I was pretty confident that if the research findings and knowledge were put into practice, on school ovals and in the gym, we'd see results,' said Dr Sutherland.

'So, you could best describe me as "dogged" about identifying the right kind of implementation methods for schools,' she quipped.

Dr Sutherland worked closely with 49 secondary schools; not always an easy feat as school staff are incredibly busy. The COVID-19 pandemic also presented a significant challenge, but this didn't deter Dr Sutherland.

'We engaged with school executives and teachers to ensure we could gather as much data as possible and make the project a success,' said Dr Sutherland.

'Highlights included bringing teachers together and the substantial increase in the implementation of evidence-based physical activity practices. The project also had unintended positive consequences where passionate teachers were uplifted and secured leadership opportunities in their schools,' she said.

'People learning from each other, and the resulting Community of Practice translated to tangible results. There is very little research evaluating effective strategies to support schools to implement evidence into practice. Our strategies resulted in over 7 in 10 schools fully implementing the program. That's something I'm really proud of,' said Dr Sutherland.

The Fellowship work achieved substantial impact in New South Wales (NSW) including:

- Best-practice physical activity practices in schools improving from 0% to 72% within 12 months and maintained at 2 years.
- The exposure of ~50,000 adolescents to best practice physical activity environments.
- Internationally significant findings as the first and only program internationally to increase low SES adolescent physical activity by 49 minutes/week (equivalent to a 10% increase) and limit unhealthy weight gain (2kg difference between groups), in low SES adolescents.

The evidence generated from the research has now been used in a NSW government modelling study, is being scaled up across the region and Dr Sutherland's expertise is being used to design future education and health policies.

'I saw a great need to integrate research into practice to fill the important gap in health service delivery.'





Caption: Physical Activity
4 Everyone in action in
NSW secondary schools
Image supplied by:
Hunter Medical
Research Institute

Next steps

The Fellowship inspired Dr Sutherland to embrace her research career. She secured another Medical Research Future Fund Fellowship to conduct school-based research on nutrition and physical activity.

'It's been lovely to be able to pursue various interests focused on implementation and scale up research. The NHMRC Fellowship really cemented that I wanted the academic research career path but with a research translation focus,' said Dr Sutherland.

Dr Sutherland is now conducting national scale-up trials to support parents to pack healthy school lunchboxes via embedding the program into existing school communication apps.

'I'm sure that the transferable nature of implementation science to other priority health issues will provide big benefits into the future.'

'People learning from each other, and the resulting Community of Practice translated to tangible results. There is very little research evaluating effective strategies to support schools to implement evidence into practice. Our strategies resulted in over 7 in 10 schools implementing the program. That's something I'm really proud of.'



CLEAR LINE OF SIGHT TO SOLVING IRREVERSIBLE VISION LOSS

Associate Professor Zhichao Wu



Administering Institution: Centre for Eye Research Australia
Grant: Early Career Fellowship
Funding: \$366,252
Year: 2016–2020

As a practising optometrist, Associate Professor Zhichao Wu realised there was a big problem diagnosing glaucoma. Glaucoma is a leading cause of irreversible vision loss that is projected to cost Australia \$4.3 billion per annum by 2025.

One in 2 people with glaucoma doesn't know they have it. And, shockingly, half of these people have had an eye test in the past year. Yet good 3-dimensional scanning technology, already used by many optometrists today, can show the initial warning signs of damage to the neurons in the retina.

The dire statistics didn't make sense to Associate Professor Wu. 'I kept thinking: How is it possible, in the 21st century, when we're living with such incredible technology, that we still can't stop people from going blind? Why can't we diagnose glaucoma early?'

After completing his PhD tackling another leading cause of irreversible vision loss—age-related macular degeneration—Associate Professor Wu received an NHMRC Early Career Fellowship to pursue his project: 'Novel Clinical Biomarkers of Glaucoma Management'.

As part of this Fellowship, he travelled to the University of California San Diego and Columbia University in the USA in 2016–17. He set out to overcome the major challenges in preventing vision loss from glaucoma, including early diagnosis and detection of disease progression.

'How do we take the shocking diagnosis problem from half of people being missed to nearly no one being missed? Then how do we shorten the timeframe of detecting the worsening of the disease from 6 years to 6 months, before significant vision loss has occurred?' he questioned.

'I want to substantially reduce the health and economic impact of this condition. Early diagnosis, rapid detection of disease worsening, and better treatment options means we won't miss the window of opportunity to intervene more aggressively before vision is irreversibly lost,' he said.

Associate Professor Wu and his colleagues have already developed an approach to near-perfectly detect glaucoma through expert evaluation of 3-dimensional eye imaging.

Buoyed by the wonderful mentorship gained through the Fellowship and his ongoing research, Associate Professor Wu and his team at the Centre for Eye Research Australia are now creating technology to make detecting glaucoma and its progression faster and more accurate.

'We've taken human expertise, novel computational methods, superb eye imaging and put them all together. We're developing artificial intelligence models to replicate that approach so it can be applied widely in the clinic with patients,' said Associate Professor Wu.

'The patients involved in our research are excited because most of them, being older, tend to think of future generations. They're incredibly generous people who are eager to participate so that they can make a global impact on those with glaucoma,' he said.

Next steps

Associate Professor Wu had developed new clinical trial approaches to improve the scalability and reduce costs. This has included changing how to analyse results, optimise timelines of study visits, and leverage new imaging technology.

'We can reduce the sample size needed for trials by about 20 times,' said Associate Professor Wu.

The medical and pharmaceutical industry are now taking advantage of this knowledge when exploring new treatments such as gene therapies.

Associate Professor Wu's team is also developing new imaging technologies to better identify individuals with glaucoma at high risk of vision loss to target for trials and to better evaluate new treatments.



'I want to substantially reduce the health and economic impact of this condition. Early diagnosis, rapid detection of disease worsening, and better treatment options means we won't miss the window of opportunity to intervene more aggressively before vision is irreversibly lost.'



UPSKILLING GYNAECOLOGY SURGEONS FOR BETTER, LESS INVASIVE SURGICAL PROCEDURES AND HAPPIER PATIENTS

Professor Andreas Obermair



Administering Institution: University of Queensland

Grant: Partnership Project

Funding: \$656,854

Year: 2017-2020

Team: Professor George B Hanna, Prof Val Gebski, Prof Nicholas Graves, Prof Monika Janda, Dr Saira Sanjida, Ms Caitlin Horsham and Dr Archana Rao

Hysterectomy is the most common major gynaecological procedure Australian women will require in their lifetimes. Yet, up to 2 in 10 patients have developed severe complications following outdated open surgery.

According to Professor Andreas Obermair, from the Queensland Centre for Gynaecological Cancer at the University of Queensland, too many women still receive open abdominal surgery in Australia.

'I realised that women who could have a minimally invasive, laparoscopic hysterectomy weren't receiving them because the workforce was not up to the new surgical and technical skills standard. That's why patients were still receiving old-fashioned, outdated surgical procedures,' said Professor Obermair.

'Unfortunately, there's no systematic upskilling after Obstetricians and Gynaecologists complete their formative training.'

Professor Obermair set a goal for his NHMRC Partnerships Project: To replace open abdominal surgery by minimally invasive, laparoscopic hysterectomy for better patient outcomes and less complications. Laparoscopic hysterectomies also save the Australian public \$3,000 per case.

The Implementation of Minimally Invasive hysterectomy (IMAGINE) trial included developing a surgical teaching program involving a multidisciplinary team, from hospitals and health care services, charitable organisations, medical device companies and universities.

'When I started out in my career, I said that when I retire, I want to see more minimally invasive surgery than abdominal surgery. We've achieved that already.'

As a result of the project, Professor Obermair estimates that now about half of OBGYN surgeons are undertaking laparoscopy hysterectomies, up from about 1 in 10 only 7 years ago.

'The number of people I talk to who are taking on more complex procedures is rapidly increasing, which is amazing. It's fantastic.'

Professor Obermair points out that this isn't just because of his trial, saying that hospitals, other surgeons and the Australian Gynaecological Endoscopy Society have also taken up training.

Professor Obermair was driven to improve the OBGYN field because he is acutely aware of the heartbreak that can occur as a result of poor surgical outcomes.

'Ultimately, we want to save patients from life-altering complications. As a surgeon, you're not just "fixing up" patients, you're seeing them when they get diagnosed, you try to help them navigate the maze of decisions that they need to make. It can be a very stressful time for them because there is, for many women, a lot at stake,' he said.

'I think about my wife or my daughters going to hospital somewhere. They should have the confidence that the procedure recommended to them is an up-to-date procedure,' he said.

'I'm a fierce advocate of surgical investigator-initiated clinical trials, because that's the only way as surgeons we can actually know which procedures we should recommend to patients under what circumstances.'

'When I started out in my career, I said that when I retire, I want to see more minimally invasive surgery than abdominal surgery. We've achieved that already.'

Next steps

Professor Obermair is working on expanding the training program for hysterectomies but also making the teaching framework available to other specialties.

'I'm very excited that the framework we've developed can be adapted for implementing new surgical techniques in other specialties. If you wanted, for example, to implement a new way of brain surgery, liver surgery or lung surgery, then you can take this framework, adapt it to your needs and roll it out.'



UNCOVERING THE DEEP, DARK SECRETS OF PATHOGEN GENOMES TO SAVE LIVES

Professor Ben Howden



Administering Institution: University of Melbourne
Grant: Practitioner Fellowship
Funding: \$467,960
Year: 2016–2020
Team: Associate Professor Torsten Seemann, Assoc. Prof Norelle Sherry, Dr Stefano Giuliani, Dr Claire Gorrie, Dr Romain Guerillot, Dr Glen Carter and Dr Patiyan Andersson

Professor Ben Howden, from the University of Melbourne at the Doherty Institute, is a renowned clinician researcher who's dedicated focus on public health microbiology, genomics and antimicrobial resistance (AMR) has impacted thousands of lives.

Genomics—technology to sequence the whole genome of an organism—has been Professor Howden's forte. During his PhD in the early 2000s, he was the first to sequence *Staphylococcus aureus* genomes in Australia.

His work since has not only revolutionised the way we understand and combat bacterial pathogens but has also played a pivotal role in shaping public health surveillance and response strategies around the world.

'We're seeing significantly increased antibiotic resistance around the world and in Australia. Genomic technologies allow us to deeply understand how bacteria are becoming resistant to antibiotics and how those resistant bacteria are spreading, for example, in hospital settings,' said Professor Howden.

In 2016, he began a NHMRC Practitioner Fellowship to improve prevention, tracking and treatment of major human bacterial pathogens. He pioneered the use of genomics in public health microbiology to address crucial knowledge gaps and drive innovation in disease surveillance and outbreak management.

As a result of the work conducted in the Fellowship, Professor Howden helped change public health microbiology practice in Australia, enabling the country to be much better prepared for the COVID-19 pandemic.

'I think what we've seen now through the pandemic is that the use of genomic technologies has become mainstream,' said Professor Howden.

'We've really revolutionised the use of pathogen genomic technologies in Australia now. We've helped government agencies build national systems for integrating genomic data from all the public health laboratories around the country to better spot and understand outbreaks for key public health pathogens, including COVID-19.'

'We also supported 8 countries in the Pacific region with their COVID-19 response through analysing their samples and I'm proud of that,' he said.

What's the impact? Fewer infections, fewer people having their lives affected (or lost) and saved taxpayer money as health management costs have been reduced.

Achieving success wasn't a straightforward process, according to Professor Howden who said he's fundamentally changed the way he does research.

'I had to change my mindset around the way I did my research from just being in a lab and thinking about things at the laboratory level to implementation, partnerships, data governance and evaluation. So, it's been a big transition,' he said.

'The fact that we had a strong foundation of this research on genomics allowed us to take a leadership role on the COVID-19 genomics for Victoria and Australia. The timing meant we were "ready to go" in Australia. We had one of the best responses to COVID-19, from a genomic point of view, in the world because of that,' he said.

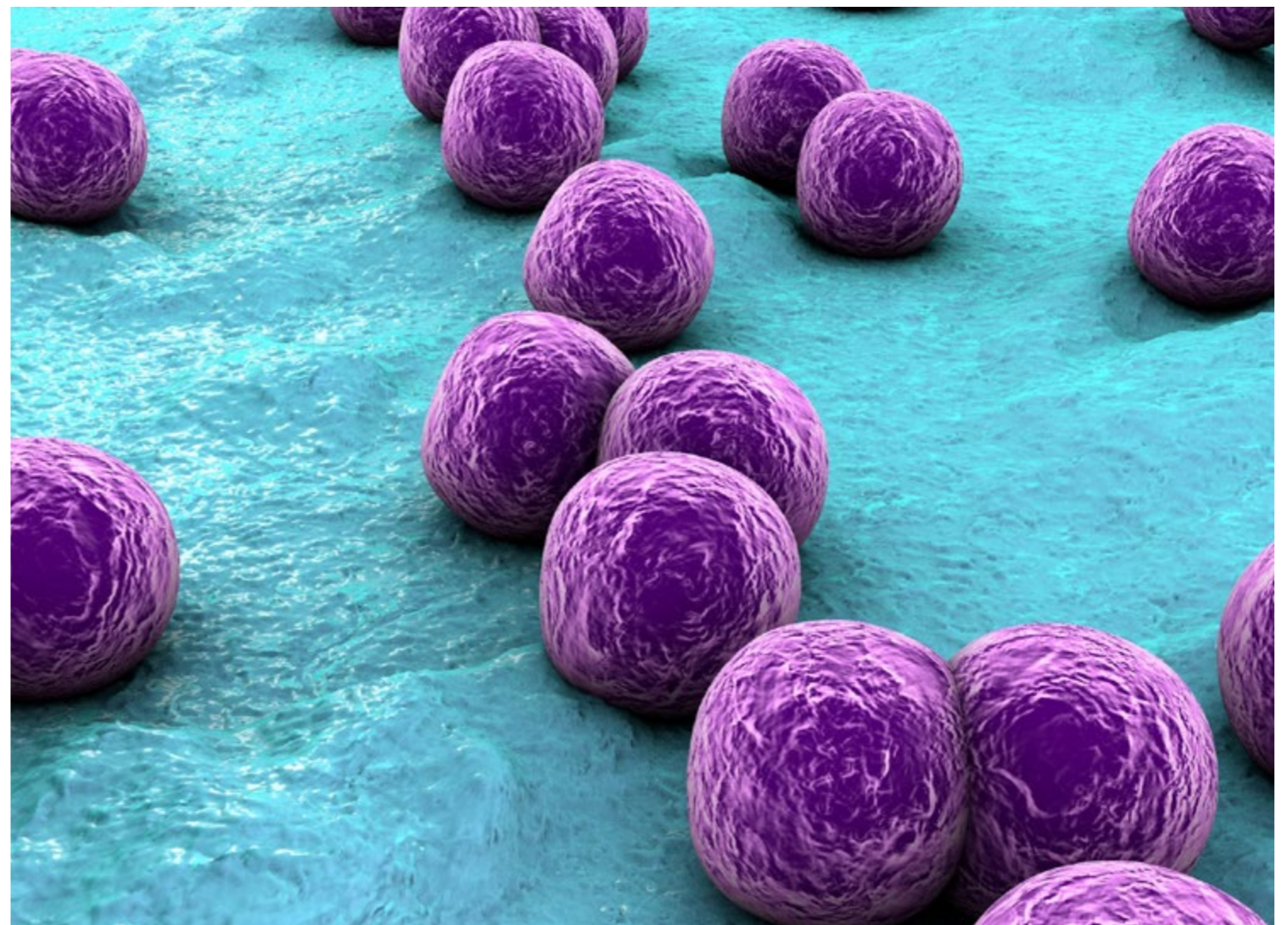
'This type of research is only possible when you've got great partnerships locally, nationally, internationally, and also with end users, like our public health units, particularly the Victorian Department of Health.'

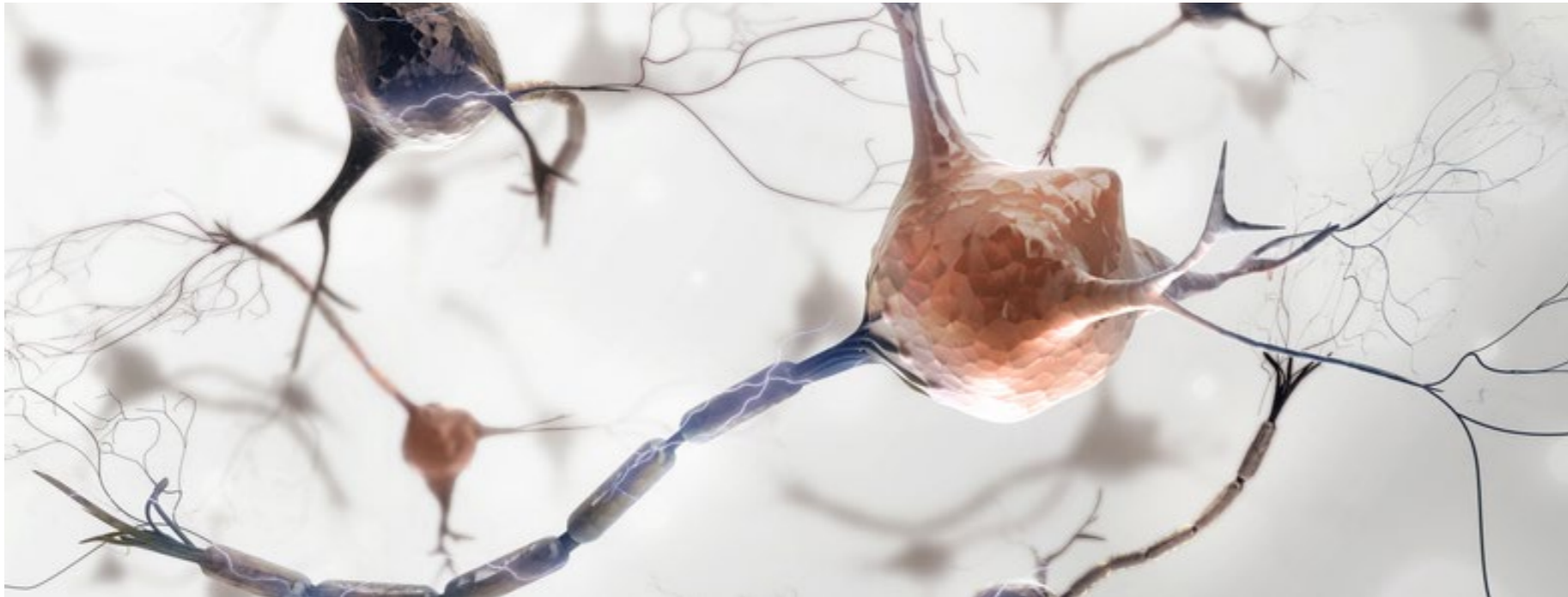
Next steps

Professor Howden and his collaborators have established the Centre for Pathogen Genomics at the University of Melbourne (Doherty Institute) with a focus on international partnerships. Appropriate sharing of data and the implementation of cutting-edge technologies will play a crucial role in disease surveillance and response in the future.

'We're taking that next step of working internationally to foster relationships with other labs in the public health environment to implement genomic technologies and understand how we use it in a meaningful and cost-effective way.'

'We've really revolutionised the use of pathogen genomic technologies in Australia now. We've helped government agencies build national systems for integrating genomic data from all the public health laboratories around the country to better spot and understand outbreaks for key public health pathogens around the country, including COVID-19.'





‘Ensuring that they have the healthiest future possible is really important for all our futures, not just their futures.’

UNIFIED RESPONSES TO YOUTH SUBSTANCE USE AND MENTAL DISORDERS

Professor Maree Teesson



Administering Institution: University of Sydney
Grant: Research Fellowship
Funding: \$739,980
Year: 2015–2020
Team: Professor Katherine Mills, Professor Cath Chapman, Professor Nicola Newton and Professor Tim Slade

Australia, like many other countries, is facing increasing rates of mental disorders and substance use. Globally, substance use, depression and anxiety disorders are among the leading causes of disease burden in young people. Yet they are treated in isolation, stalling discovery, prevention and treatment.

Closer to home, there is a stark Australian statistic that troubles Professor Maree Teesson, from the University of Sydney, who has dedicated her career to improving the outlook for young people.

‘Over the last 20 years, the rates of mental health problems in young people have doubled, from 1 in 5 people to 2 in 5 people suffering.’

The peak onset of these disorders occurs in those aged between 15 and 24 years of age. Unfortunately, 1 in 2 people with a substance use or mental disorder will develop it before leaving school.

‘Young people are 30% of the population but 100% of our future. They’re also 100% of the future workforce. So, if you’re thinking about who are the next innovators and who are the next people to support the Australian economy, they’re it,’ said Professor Teesson.

‘Ensuring that they have the healthiest future possible is really important for all our futures, not just their futures.’

Professor Teesson secured a 5-year NHMRC Research Fellowship in 2015. She used this to develop innovative ways to prevent and proactively address substance use and mental disorders.

‘Effective prevention is critical, yet until recently, single disorder models, barriers to implementation and poor understanding of risk have hampered prevention efforts. The aim of the Fellowship was to bring the 2 areas of research together so that we could accelerate the

knowledge gains in both areas and create immediate change,’ she said.

Professor Teesson says that the support of NHMRC was critical for building a passionate team around her.

‘The incredible team successfully bridged the gap between mental health and substance use research and paved the way by creating evidence-based responses,’ she said.

As a result of their work, millions of people around the world now access their digital resources.

In 2015, Professor Teesson and colleagues set up a joint venture not-for-profit company and attracted over \$12 million in philanthropic funding.

And Professor Teesson isn’t finished yet.

‘It’s been really important to address knowledge gaps through bringing together diverse researchers in Australia and internationally. People wanting to make a difference has allowed us to capitalise on opportunities for intervening early. So, this work has saved lives, and I’m incredibly excited by that,’ she said.

Next steps

The Fellowship contributed significantly to the options for intervening and treating substance use and mental disorders. It also advanced psychology research and showcased Australia’s innovative and impactful medical research on a global scale. Professor Teesson is continuing to share her work and promote the outcomes globally through research projects, collaborations and active community engagement.

In 2018–2019 Professor Teesson established the Matilda Centre, at the University of Sydney, the largest research centre in the world focussing on comorbidity prevention and treatment. The research centre is dedicated to addressing mental health challenges and creating a brighter future for young people.



LIFE-GIVING OILS: LOW OMEGA-3 FATTY ACID LINKED TO EARLY PRETERM BIRTH AND LOWER BRAIN DEVELOPMENT

Professor Robert Gibson and Professor Maria Makrides



Administering Institution: University of Adelaide

Grant: Research Fellowship

Funding: \$652,765

Year: 2013–2019

Team: Dr Andrew McPhee, A/Prof Carmel Collins, Dr Karen Best, A/Prof Lisa Yelland, Dr Thomas Sullivan and Dr Jacqueline Gould

Preterm birth occurs in approximately 1 in 10 infants globally. It causes about three-quarters of near-birth deaths and more than half of newborn deaths.

According to Professor Robert Gibson from the University of Adelaide and Professor Maria Makrides from the South Australian Health and Medical Research Institute (SAHMRI), the cost of direct initial hospital care for infants born before 34 weeks is estimated to be between \$100,000 to \$200,000 per infant.

'But the costs associated with long-term care of these children are vastly underestimated, if at all truly measurable,' said Professor Makrides, who's worked for over 30 years to improve the lives of babies and mothers.

With the aim of redefining the nutritional requirements for a range of nutrients, including omega-3 long chain polyunsaturated fatty acids, the professors secured funding for an NHMRC Centre of Research Excellence (CRE) called 'Foods for Future Australians' and NHMRC Fellowships.

From 2013 to 2019 they conducted large-scale clinical trials with pregnant women, developed new technology to gather and assess blood samples more cheaply and produced findings that have already had a profound impact. Critically, the funding from the NHMRC enabled them to establish clinical networks around Australia and internationally to conduct research on a large enough group of babies.

They discovered that low intakes or blood status of omega-3 fatty acids (fish oil) are associated with increased risk of preterm birth and that low-cost supplements lower this risk. They also proved that babies who are born very premature, who are given omega-3 fatty acids, will experience better cognitive function.

Before their CRE, the role of nutrition in preventing preterm birth and in brain development after birth wasn't clearly established.

'We've demonstrated that by 5 years of age, supplements will have improved their IQ and recovered about 30% of what they've lost by being born very preterm,' said Professor Gibson, who's dedicated his 40-year career to science.

'The realisation that you've found clear evidence, when you see it for the first time, it literally causes the hairs on the back of your neck to stand up. Honestly, it's the most incredible feeling,' he said.

Now, as a direct consequence of their research, the Pregnancy Care Guidelines of the Australian Government have been updated and manufacturers of nutritional products for preterm babies are improving their products.

'The likely impact of our work will be that health systems around the world will have a 'screen and treat' approach for all pregnant women. This will reduce the short-, medium- and long-term costs associated with preterm birth,' said Professor Makrides.

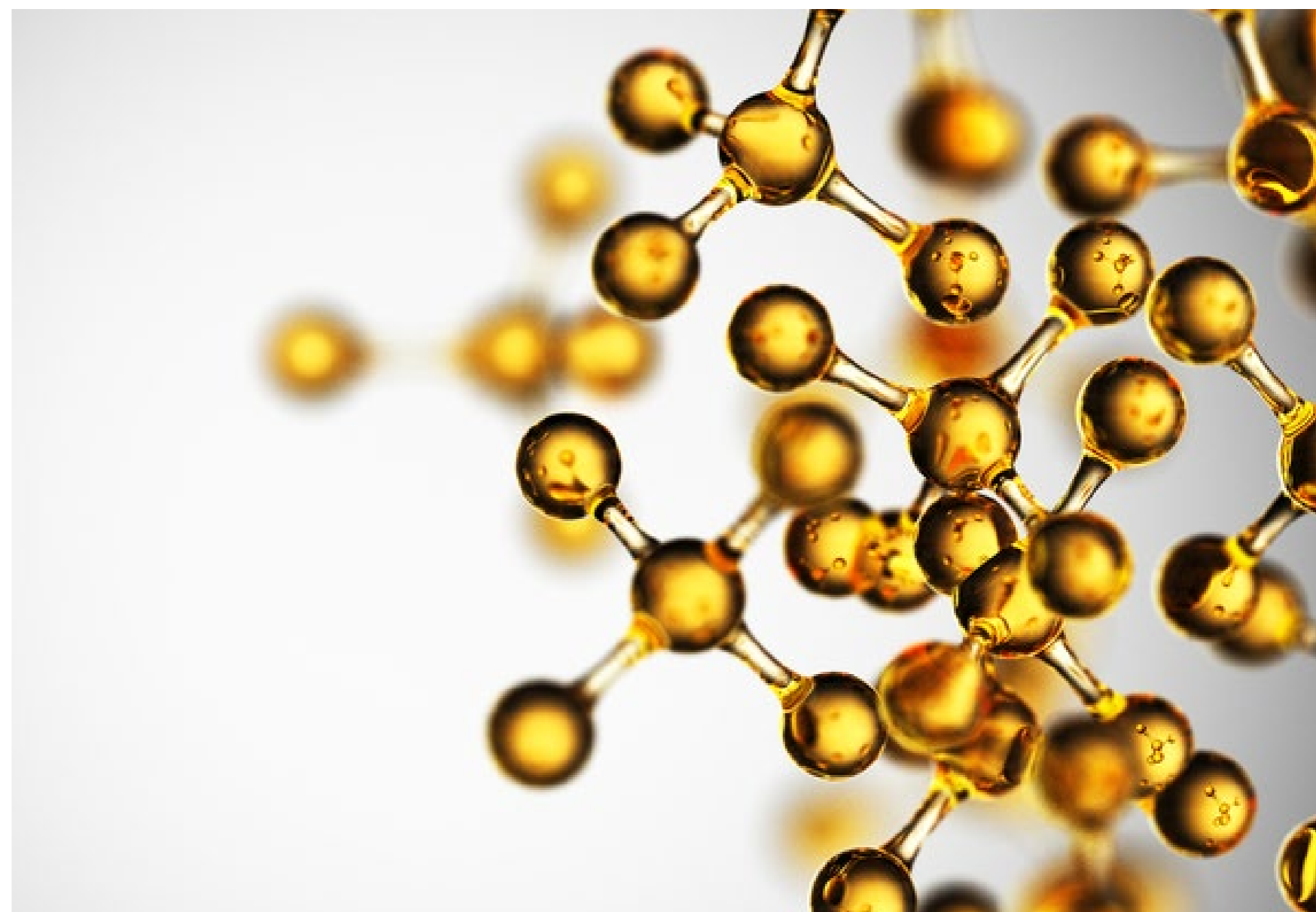
Both professors are extremely excited about what the findings mean to babies and their families. But the story doesn't end here as they need to do more work.

'In order to prove that supplements are effective in the Australian population we need to demonstrate effectiveness in a large community,' they said.

Next steps

In partnership with the South Australian Pathology service, Professor Robert Gibson and Professor Maria Makrides aim to measure the omega-3 status of every pregnant woman in the state over the next 2 years. Their goal is to prove that assessing omega-3 fatty acids plus supplementing, if needed, will reduce the rate of preterm birth by 10-15%.

'This means working with around 15,000 women per year! We are well on the way but it's an enormous task. But we will keep on our mission because, if successful, this program will likely expand nationally, and this is important to save and improve more lives.'



'The realisation that you've found clear evidence, when you see it for the first time, it literally causes the hairs on the back of your neck to stand up. Honestly, it's the most incredible feeling.'

Lack of **knowledge** concerning the **nutritional needs** of **pregnant** women and ways to **prolong gestation** and thus avoid the daunting consequences of **preterm birth** had largely **eluded medical researchers**, thus highlighting our **limited understanding** of the processes involved.

The rate of **preterm birth** was **highest** in **disadvantaged groups** and **indigenous populations**. The role of **nutrition** in **preventing preterm birth** was **unknown**.



'The likely impact of our work will be that health systems around the world will have a 'screen and treat' approach for all pregnant women. This will reduce the short-, medium- and long-term costs associated with preterm birth.'

REDEFINING RESILIENCE RESEARCH FOR ABORIGINAL AND TORRES STRAIT ISLANDER ADOLESCENTS

Professor Roxanne Bainbridge



Administering Institution: Central Queensland University

Grant: Career Development Fellowship

Funding: \$419,180

Year: 2016–2019

Acknowledgement: Professor Komla Tsey (mentor)

It is well known that Aboriginal and Torres Strait Islander peoples' conceptions of health and wellbeing and life experiences differ vastly from mainstream populations.

The strengths of Aboriginal and Torres Strait Islander cultures carry forward enduring resilience and adaptation in the face of complex trauma stemming from colonisation, dispossession and prejudiced policies and climate change. Despite statistical disparities, Indigenous young people possess immense potential and talents often overlooked. With proper support and opportunities, they exhibit remarkable determination, paving the way for a brighter future and increased engagement with health determinants.

Realising these potentials requires research reform.

According to Professor Roxanne Bainbridge, Deputy Director of the University of Queensland Poche Centre for Indigenous Health, the techniques widely used to monitor and measure changes in Aboriginal and Torres Strait Islander populations are wrongly built off the understandings and experiences of the general population.

In 2017, Professor Bainbridge received an NHMRC Career Development Fellowship and pursued a range of projects about resilience. One of the projects focused on improving the environment for boarding schools in North Queensland. It involved a multidisciplinary team including experts in youth mental health and resilience. The project led to training for staff, knowledge sharing forums, and the implementation of resilient strategies in schools.

'We need to develop more culturally sensitive tools to measure Aboriginal and Torres Strait Islander peoples' health and wellbeing,' said Professor Bainbridge.

'Standard instruments should only be used with Aboriginal and Torres Strait Islander populations if they have been subjected to a rigorous cross-cultural adaptation process and psychometric evaluation in the target population to ensure their validity,' she said.

For Professor Bainbridge, conducting research to align with the views and experiences of Aboriginal and Torres Strait

Islander people, have been key pillars of her career. Professor Bainbridge credits mentors in her early career for paving her way into science. These include Professor Yvonne Cadet-James and Dr Felecia Watkin Lui, both very well-known leaders in national Indigenous research reform.

'They helped map out my career, shared their research experiences and told me I should do something about it,' she laughs.

'I was always curious as to why some people could flourish in life and others couldn't. So I did my PhD on Aboriginal women's agency and documented what people need to flourish in life and make things work,' said Professor Bainbridge.

'I've been really keen ever since to develop constructive critiques and alternate narratives so that Aboriginal biomedical science can align with the views and experiences of Aboriginal and Torres Strait Islander people,' said Professor Bainbridge.

'It's so important to bring the community together for research and to overcome the challenges in interpreting data. But often, due to a lack of investment, this doesn't happen. I want to change that.'

Professor Bainbridge's findings have contributed to several policy updates and new initiatives, including Queensland's Aboriginal and Torres Strait Islander Health Equity Framework, Making Tracks Together.

Next steps

Professor Bainbridge and her team are currently developing a patient reported experience measure for Aboriginal and Torres Strait Islander populations; a need noted at the highest levels through the Royal Australian College of General Practice (RACGP) and Australian Commission on Safety and Quality in Health Care (ACSQHC). She is also continuing her focus on research impact, developing tools to plan, monitor and measure Aboriginal and Torres Strait Islander research impact for a number of agencies and organisations.

'It's so important to bring the community together for research and to overcome the challenges in interpreting data. But often, due to a lack of investment, this doesn't happen. I want to change that.'





'On my first trip to the Tiwi Islands I saw that half the school children were wearing hearing aids. It was a phenomenal and distressing thing to see. I was so moved by those early trips.'

NOVEL VACCINES TO PREVENT HEARING LOSS LEAD TO LEARNING AND LIFE OUTCOMES

Professor Amanda Leach



Administering Institution: Menzies School of Health Research

Grant: Project Grant

Funding: \$1,317,169

Year: 2017–2020

Team: Professor Kim Mulholland, Prof Mathuram Santosham, Prof Peter S Morris, Dr Jemima Beissbarth, Ms Nicole Wilson and Ms Beth Arrowsmith

Almost all Aboriginal and Torres Strait Islander children living in remote areas have ear problems that start from within weeks of birth. For many, otitis media ('glue ear') leads to hearing loss and devastating learning and life outcomes.

Professor Amanda Leach, from the Menzies School of Health Research in the Northern Territory, has changed the fundamental understanding of the cause of ear disease and hearing loss, as well as how to prevent it.

The current median age for hearing aid fitting in Aboriginal and Torres Strait Islander children is around 5 years, with delays of up to 3 years due to requirements for particular diagnostics and referrals but limited availability of specialists.³

Profoundly shocked by what she saw as an early career researcher on the Tiwi Islands, Professor Leach, dedicated her life to making a difference to young kids.

'On my first trip to the Tiwi Islands I saw that half the school children were wearing hearing aids. It was a phenomenal and distressing thing to see. I was so moved by those early trips,' said Professor Leach.

Professor Leach was the first to discover that two types of bacteria, pneumococcus and non-typeable H. influenzae (NTHi), were to blame. But with over 90 different pneumococcal strains, which strains were the culprits? Why were the rates of ear disease so different among Aboriginal children in the Northern Territory compared to other parts of the world? Which vaccines could make a difference? Would the vaccine that combined NTHi-protein D be effective?

Professor Leach has systematically answered many of these fundamental questions and pushed further into public health interventions, including creating a free app for ear health support in remote areas.

'The biggest challenge really is to wake Australia up to this issue. Ear disease is not a sexy disease so it keeps getting left behind,' said Professor Leach.

'But it can affect people through their whole life. Picture kids who can't talk, who can't communicate. There's poor bonding between mother and child. There's teasing at school. And in some cases, it leads to increased maltreatment because the kids can't hear properly, that exacerbates frustrations in families.'

Her most recent NHMRC-funded project was VOICES: Vaccines to prevent Otitis media In Children Entering School. She conducted 2 randomised controlled trials of novel schedules that mixed licenced vaccines, and led a team to develop national guidelines for prevention and treatment including antibiotic use.

'The approach we took has opened people's eyes somewhat. I think this was one of the very first projects globally to combine different vaccines into a schedule,' she said.

'I feel very privileged as a scientist to be able to find solutions to problems and work with incredible collaborators,' said Professor Leach.

'I see both the big picture of this whole issue and then I see an important gap and say, "Let's target that!". So, I work to design a project around it and get funding and communicate the results. That is the real beauty of being a researcher.'

Next steps

The next step for Professor Leach is influencing primary healthcare. She's training a specialised workforce of Aboriginal and Torres Strait Islander people in 20 communities. Importantly, by using their skills to identify likely hearing loss and sharing their knowledge in local language, the Ear Health Facilitators can immediately assist parents, teachers and the community to take action and better support children.

'... there are so many barriers to prevention, including social determinants, quality healthcare, and a massive churn of health service staff that don't understand this issue,' said Professor Leach.

'They're dealing with acute care and very often, stressed. So, I thought, "What can I do about that?" We didn't want to drain health services. We want to create new skills, new jobs, and also address ear disease.'



'But it can affect people through their whole life. Picture kids who can't talk, who can't communicate. There's poor bonding between mother and child.

There's teasing at school. And in some cases, it leads to increased maltreatment because the kids can't hear properly, that exacerbates frustrations in families.'



All children have the **right to ear and hearing health** and the **quality of life** that gives.

Middle **ear infection** (otitis media) is **common** in children but can cause **debilitating hearing loss** and **developmental problems** for some young children during their **formative early years**.

Research shows that **almost all Indigenous children** who live in remote areas have **ear problems** that persist from within **weeks of birth throughout early childhood**. The **inability to listen and learn** language can cause **communication problems** and misunderstanding at home and with friends, which can lead to a **trajectory of poor school readiness, attendance, and performance**.



Middle ear infections are caused by many different **germs** that live in the **nasopharynx**. When these "**otopathogens**" infect the middle ear, they cause a **build-up of fluid** (pus) that **prevents the eardrum from vibrating** in response to sound. **Sound is not passed** through the middle ear to the inner ear or the brain.



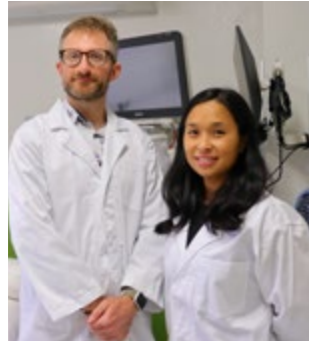
Pneumococcal conjugate vaccines (PCVs) could **prevent most ear infections**. Different formulations, PHiD-CV10 and PCV13, have **not been evaluated** in head-to-head or combination schedules.



The **World Health Organization** has also recognised globally that **too much has been left to audiologists and ENT surgeons**, whereas Otitis media (middle ear infection) is massively a **primary health care issue**, particularly for children.

AUSTRALIAN INNOVATORS CREATE SUPERIOR SURGICAL SCREWS FOR ORTHOPAEDIC SURGERIES

Dr Intan Oldakowska and Dr Matthew Oldakowski



Administering Institution: Curtin University

Grant: Development Grant

Funding: \$414,076

Year: 2017–2020

Team: Professor Markus Kuster, Prof Garry Allison, Prof Gabriel Lee, Prof Thomas Kirk and Mr Robert Day

Not all orthopaedic implants are created equal. Surgeons repair bone fractures using metal plates and screws but sometimes the screws loosen and the surgery needs to be repeated. Previous expandable screws increased screw fixation strength but were more difficult (or impossible) to remove and increased surgery time.

Dr Intan Oldakowska and Dr Matthew Oldakowski have worked for 10 years in biomedical engineering and first spotted an opportunity to improve surgery outcomes during their PhD studies at Curtin University.

As now-entrepreneurs and co-founders of REX Ortho, a spin-out from Curtin University, they received an NHMRC Development Grant to test a new expandable screw for orthopaedic surgery. Dr Oldakowska and Dr Oldakowski started with hip fractures because they are the most common fracture surgery and screw failures can lead to a loss of independence, disability and death.

About 1 in 3 adults aged 50 and over dies within 12 months of suffering a hip fracture and 40% never return to pre-fracture mobility.

They developed a screw that is stronger, more easily expandable and can also be easily removed at a later date, if required. The screw also fits with existing surgical workflows, without increasing surgery time.

'Better rehabilitation of hip fractures—which includes improving surgery results and reducing complications—presents a huge societal good and also savings to taxpayers funding the medical system,' said Dr Oldakowska.

'The funding from NHMRC was a real lifeline for us. To get to that commercial stage we used the grant to collaborate with surgeons and conduct biomechanical testing and animal studies. That made us attractive for external investment and commercial translation,' said Dr Oldakowska.

'The financial support for collaborative innovation, where surgeons are part of the development cycle, is crucial,' she said.

To create something ready for human clinical trials, the researchers have overcome challenges, in particular balancing commercial, manufacturing, and clinical requirements.

Inspired by the potential for improving patient outcomes, both researchers have undertaken PhDs in the field of biomedical research but have moved beyond academia.

'We went down this path, away from a traditional academic career, because we really wanted to have impact from our research and our technology. We weren't really happy to do research, publish a paper and have it possibly sit there and maybe not get used,' said Dr Oldakowski.

'Because we wanted to collaborate broadly with industry, surgeons, other researchers, and with all sorts of people doing manufacturing (for example, industrial designers) we realised we became less researchers and more innovators.'

'It's been brilliant that the NHMRC grant has enabled us to work with the best surgeons in the country and to conduct world-first lab and animal trials to move this technology so much closer to operating theatres.'

Next steps

Drs Oldakowska and Oldakowski have since attracted external investment and a partnership with the AO Foundation, the world's largest network of orthopaedic surgeons. REX Ortho is currently raising further investment to take the product to market.

'The technology could be used in a range of other orthopaedic surgeries, including spine fixation. We're really excited to see where we can take it. And we believe that successful commercialisation will also improve Australia's standing on the world stage for research translation and innovation and build the health and medical research ecosystem.'

'About 1 in 3 adults aged 50 and over dies within 12 months of suffering a hip fracture and 40% never return to pre-fracture mobility.'





'Because we wanted to collaborate broadly with industry, surgeons, other researchers, and with all sorts of people doing manufacturing (for example, industrial designers) we realised we became less researchers and more innovators'.

'It's been brilliant that the NHMRC grant has enabled us to work with the best surgeons in the country and to conduct world-first lab and animal trials to move this technology so much closer to operating theatres.'

ADDICTIVE BRAIN CHANGES LINKED TO OBESITY AND SIMPLE SUPPLEMENT SHOWS PROMISE

Dr Robyn Brown



Administering Institution: University of Melbourne

Grant: Project Grant

Funding: \$765,935

Year: 2016–2020

Team: Professor Andrew Lawrence, Professor Peter Kalivas and Dr Diana Sketrisiene

When exposed to highly palatable (yummy) foods, some people overeat and have trouble regulating their intake long-term.

Currently, 2 in 3 Australians are classified as being overweight or obese. This is about 12.5 million adults. Middle aged Australians have the worst statistics, with 8 in 10 men and 7 in 10 women between 45 and 54 years old being overweight or obese.

Dr Robyn Brown, from the University of Melbourne, works at the challenging intersection of addiction, obesity and eating disorders. A few years ago, Dr Brown observed similarities between substance and food addiction.

She secured an NHMRC Project Grant to explore how the brain is involved in overeating and potential new ways of treating obesity. As a result of the project, Dr Brown found the first direct evidence of brain impairments in obesity that parallel those observed in animal models of drug addiction.

In drug addiction, long-term potentiation—the process where synapses strengthen through repetition—is impaired in the nucleus accumbens part of the brain, which is associated with reward and motivation. Dr Brown found that obese rats showed these similar impairments.

‘Through my research, we have compelling preliminary data that show deficits in the brain associated with addiction are also found in diet-induced obesity. Therefore, strategies used to treat addiction, whether it’s drinking or gambling, can potentially be used to treat obesity,’ said Dr Brown.

The NHMRC grant also funded a preclinical trial of N-acetylcysteine (NAC), known to restore these specific ‘addiction-like’ brain deficits. Dr Brown tested NAC in a rat model and found it reduced compulsive eating of highly palatable foods.

Her experiences have led her to work with health practitioners and advocate for a change in treatment approach.

‘If you say to someone who has an addiction-like pathology, “just stop eating”, it’s like saying to someone who has alcohol use disorder, “just stop drinking”. Change is not as easy as that,’ said Dr Brown.

‘It’s important to me that health practitioners realise that there’s more than choice going on here. Many people can have all the knowledge in the world, but they can’t control their behaviour.’

‘Showing that this is applicable in the obesity field is big because some people have not wanted to believe that the brain is involved. And that’s my message: “Believe it; it’s real”,’ said Dr Brown.

Findings from the NHMRC project have been incorporated into training for clinicians. And the preclinical findings regarding NAC represent a potential adjunct therapy to assist people to control their eating behaviour when engaging in other weight loss therapies.

‘The idea that we can get pharmacotherapies or strategies informed by addiction neuroscience through to the clinic and test them? That’s exciting.’

Next steps

Dr Brown is currently conducting a pilot trial of NAC in humans for compulsive eating and has found some positive preliminary results. She is seeking to conduct a larger clinical trial of NAC in humans and to also test a derivative of NAC, with higher bioavailability, preclinically.

Dr Brown’s research laboratory is also conducting ongoing investigations to further understand:

- the neurobiology associated with eating behaviours
- how exposure to highly palatable food affects the brain and behaviour
- the relationship between stress, emotion and eating behaviour and how it differs between males and females.





'If you say to someone who has an addiction-like pathology, "Just stop eating", it's like saying to someone who has alcohol use disorder, "Just stop drinking". Change is not as easy as that.'



Worldwide
obesity has nearly
TRIPPLED
since 1975



In **2018**, obesity cost the Australian community **\$11.8 billion** and, on its current trajectory, is estimated to cost **\$87.7 billion** by **2032**



Higher BMI is a **major risk factor** for many **chronic diseases** such as **cardiovascular disease, type 2 diabetes** and some **cancers**. It can also impact **mental health**, as well as **social and economic** opportunities.

Endnotes

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Cover page image: 'Atomic jewellery' by Sarah Piper - Monash University, Monash Institute of Pharmaceutical Sciences and ARC Centre for Cryo-Electron Microscopy of Membrane Proteins

Description: Cryo-electron microscopy is a powerful technique to determine atomic structures of biomolecules. These atoms can be displayed using 'ball and stick' models. Here we see the structure of GLP-1 receptor (white), an important drug target for diabetes and obesity, with a small molecule bound (blue). The atoms and bonds are rendered using Blender3D to give it a shiny look similar to jewellery or pearls on a string.

Other images: iStock

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