Top 250 Australian researchers

RESEARCH 2026

A better world

Research for the greater good

The Aussie Nobel

Why it makes a difference

THE AUSTRALIAN

Only one university ranks highly in both education *and* research

From classrooms to cutting-edge labs, Deakin University delivers teaching that transforms minds and research that moves industries.

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Deakin's Food & Mood Centre is at the forefront of global research into the gut-brain connection and nutritional psychology, transforming how we understand and treat mental illness. Our world-first CALM clinical trial suggests that lifestyle therapy, delivered by dietitians and exercise physiologists works as well as traditional approaches in managing depression.

Through the *Deakin Recycling and Clean Energy Commercialisation Hub*, we're building a sustainable world through research, by transforming biosolids, food scraps and garden clippings into sustainable solutions. From enriching soils with carbon-rich biochar to exploring their potential as next-generation battery materials, our work is driving practical solutions for a greener future.

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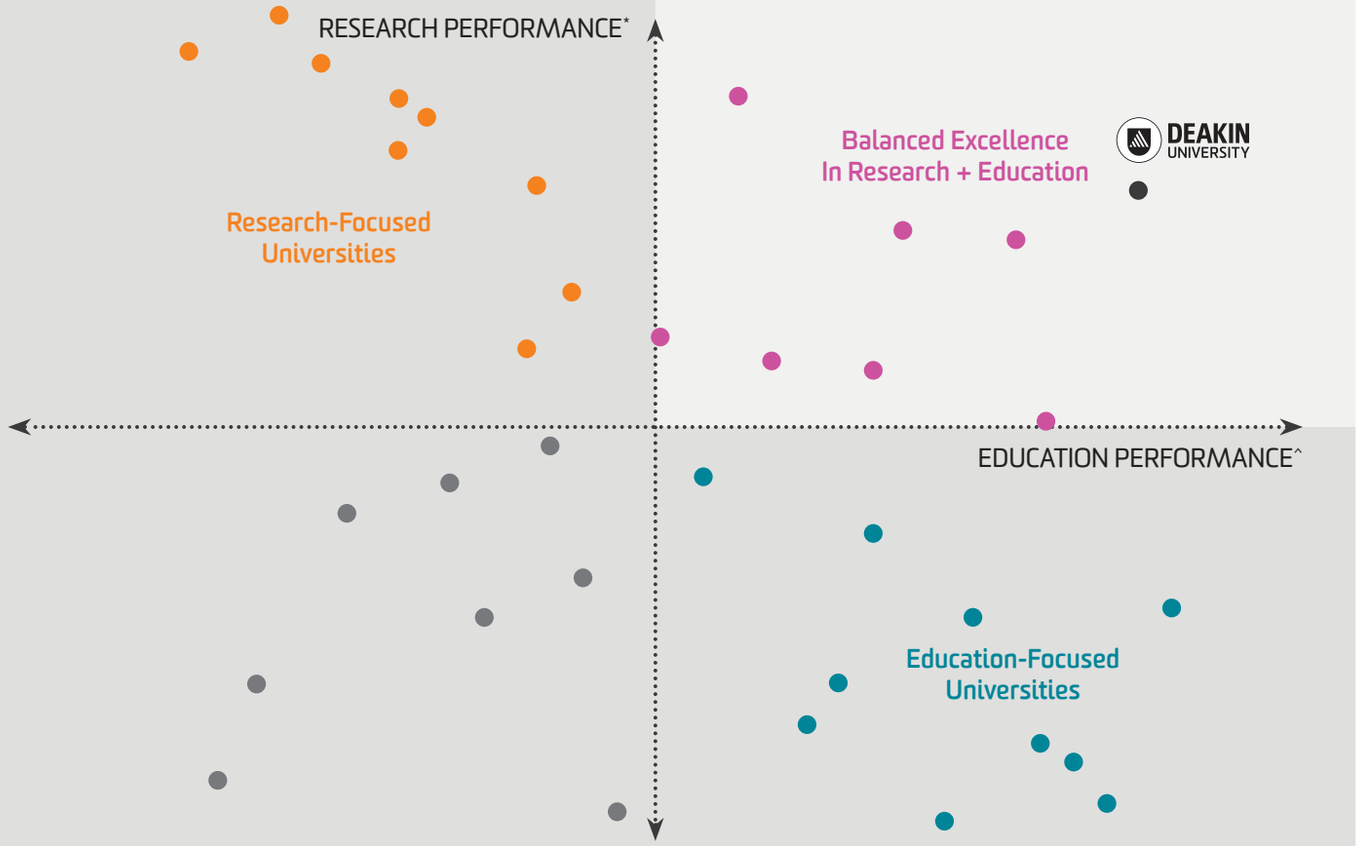
Performance in education and research – Australian universities



* **Research performance is by publication volume and proportion of publications in the top 10%** (number of citations per paper), CWTS Leiden Ranking Open Edition 2024 – Australian universities

^ **Education performance is the mean score for overall quality of educational experience** (undergraduate and postgraduate coursework), Student Experience Survey 2023, Australian Government Department of Education

When **knowledge** and **impact** move forward together, the possibilities are truly **powerful**.

#1 In Victoria for
course satisfaction~

#1 in Victoria for
teaching quality-

#2 in Victoria for
research quality+

~ 2024 Graduate Outcomes Survey, Quality Indicators for Learning and Teaching
- 2024 Student Experience Survey, Quality Indicators for Learning and Teaching
+ THE World University Rankings, 2025

Foreword

Jason Clare, Federal Minister for Education

Australian universities punch above their weight in research. Australia is only 0.3 per cent of the world's population, but we do 3 per cent of the world's research – and that includes Nobel-level research.

In October, Australian Professor Richard Robson was awarded the 2025 Nobel Prize in Chemistry alongside two other scientists. He joins twelve other Australian Nobel Prize winners. Professor Robson's work on metal-organic frameworks was described by the Nobel Committee as like Hermione's handbag in Harry Potter. Novel materials that can store huge amounts of gas in a tiny volume.

What drove Professor Robson wasn't accolades or outcomes – it was curiosity, and that curiosity has led to him receiving one of science's highest honours. This was homegrown research, undertaken at the University of Melbourne and supported by the Australian Research Council (ARC).

The ARC awarded Professor Robson with his first grant in 1987 and has continued to support his research journey. The government continues to invest over $1 billion annually through the ARC. These investments allow our world-class universities and researchers to work on big ideas and projects.

But not only does it deliver global scientific breakthroughs, it's also good for our economy and good for Australia. Across the government, total investment in research and development is expected to reach over $15 billion in the 2025-26 financial year.

It's a vital part of the Australian government's plan for a Future Made in Australia. That's why the Australian government is investing $2.2 billion over ten years to support researchers to commercialise research, with programs such as Australia's Economic Accelerator (AEA). The AEA is undertaking research in critical areas, including in defence and critical minerals.

In October, the Australian government signed a historic multibillion-dollar bilateral framework on critical minerals and rare earths with the United States of America. This is all part of the Australian government's plan to support Australia's economic growth and productivity.

Australians should be rightly proud to be home to some of the world's most brilliant researchers and the most-cutting edge research.

Australia's success in producing Nobel-level research outcomes is also a powerful example of how long-term investment in curiosity-driven research delivers global impact and scientific breakthroughs.

Congratulations to every researcher, scientist and institution featured in this year's publication. You are continuing this rich research tradition.

Your work is adding to knowledge and changing lives. Thank you.

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Abbreviations

ACU Australian Catholic University
AIMS Australian Institute of Marine Science
ANU Australian National University
Baker Baker Heart and Diabetes Institute
CQUni Central Queensland University
Ear Science Ear Science Institute Australia
NSW Health NSW Department of Health
George Institute George Institute for Global Health
Peter Mac Peter MacCallum Cancer Centre
QIMR Berghofer QIMR Berghofer Medical Research Institute
QUT Queensland University of Technology
RCPAQAP Royal College of Pathologists Australasia Quality Assurance Programs
RCH Melbourne Royal Children's Hospital Melbourne
UNE University of New England
UniSQ University of Southern Queensland
UTS University of Technology Sydney
UWA University of Western Australia
WA Health WA Department of Health

THE AUSTRALIAN
RESEARCH

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From **wonderful** ideas to real-world **breakthroughs**

Just like Dilendra's PhD research on silk as a next-gen biomedical material.

Dilendra Wijesekara, a graduate researcher at the *Deakin Institute for Frontier Materials*, is transforming silk into life-changing biomedical solutions.

By developing a silk-based packing material for ear surgery, she's combining material science, biology and biomaterials to support surgery and healing from chronic middle ear disease, a condition affecting 200 million individuals around the world.

Her breakthrough packing material for ear surgery will improve graft success and speed up recovery, bringing better outcomes to patients and pushing the future of medicine forward for a range of diseases and injuries.

When discovery is this purposeful, we bridge the gap between possibility and reality.

"I'm using my PhD to explore silk for ear surgery and beyond. I'm driven by a belief that nature holds the answers and I'm committed to turning those answers into real solutions that create change for a better, healthier and more sustainable world."

Dilendra Wijesekara,
GRADUATE RESEARCHER

DEAKIN UNIVERSITY

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Welcome to the 2026 Research magazine

Demonstrating the value of Australian research

This year's magazine offers a deep and detailed look at how our nation's valuable reservoir of knowledge is created

Welcome to The Australian's 2026 Research magazine, the latest edition of our annual publication which presents a comprehensive picture of Australia's best research, naming the top performers in 250 different fields of inquiry. It is the eighth year that we have made this major effort to curate the available public data about research, using a different lens to analyse the output of Australia's knowledge-creation industry.

Our purpose is to shine a light on Australia's best research and we delve down into the nitty gritty, highlighting praiseworthy pockets of excellence which might otherwise go unnoticed by the wider community.

This innovative approach was the brainchild of data scientist Paul McCarthy, head of research analytics firm League of Scholars, which is The Australian's partner in the Research magazine. As well as producing the top 250 lists of researchers and research institutions each year, Paul and his team – League of Scholars co-founder Rasika Amarasiri and data analyst Elaine Gong – look for innovative ways to analyse research data using traditional techniques and, increasingly, artificial intelligence.

Their innovative thinking has led to several new features this year. One is a deep analysis of which Australian universities are providing the most support, through their research, to achieving the United Nations Sustainability Development Goals. It takes into account every research paper produced by every Australian university in the past five years, utilising AI to determine whether each paper is aligned with one or more of the goals. Another is a 'heat map' of Australian research that uses machine learning to reveal global research frontiers and where Australia's strengths lie.

We have two main aims in the magazine. One is to offer the research community useful information to help them analyse, and improve, what they do. The second is to help showcase the achievements of Australian researchers to the wider public.

Each year, we're seeing growing engagement with the magazine from the research community and we look forward to even more with this edition. Please don't hesitate to offer us suggestions and feedback.

Tim Dodd (doddt@theaustralian.com.au)
Editor, 2026 Research magazine

Paul McCarthy (paul@leagueofscholars.com)
CEO and co-founder, League of Scholars

Your guide to the data

The **Research magazine** is information rich, using deeply analysed data to yield valuable insights into Australia's broad research endeavours.

Sustainability research (pages 10-16): We list the top five universities whose research has contributed to progressing each of the first 16 United Nations Sustainability Development Goals.

Research frontiers (pages 18-19): We reveal the 'hot spots' on Australia's research landscape, using innovative new techniques to discover areas of research where effort is being concentrated and which attract the attention of other researchers.

Global collaboration (page 22): We name the universities where researchers' collaboration with their peers in other countries is above the norm.

Top 250 (pages 25-57): This is the core of the magazine. For 250 individual fields of research, which are spread over eight broad research disciplines, we use our 'impact score' to name both the top research institution and the top individual researcher in each field.

What is the impact score?

To find the **Top 250** research leaders, we give every Australian researcher and every Australian university or research organisation an impact score based on their research output in each of 250 fields of research. The score is equal to the number of citations for papers published – by the individual and the institution – in the top 20 journals of each particular field over the past five years.

The score is designed to reward research quality (only papers published in the top journals of each field are considered), impact (we count the citations for each paper and thus measure how much the research is being used by other researchers), and volume (because higher output also leads to a higher impact score, provided quality and impact standards are being met). We use publicly available information from Google Scholar to identify researchers, to obtain data on their citations and to link their work with universities and research institutions.

Paul McCarthy

Rasika Amarasiri

Elaine Gong

Tim Dodd

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

CREATE CHANGE

Together, we build tomorrow

Tomorrow doesn't just happen.
It's something we shape. Together.

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The Aussie Nobel

Why it really makes a difference

Australia's first Nobel prize in 14 years has gone to a chemist who did research for the joy of it. But his discovery, made over 30 years ago, has led to a multitude of promising new technologies, writes **Tim Dodd**

Sometimes big things grow from small and inauspicious beginnings, and that's the story of the 2025 Nobel prize in Chemistry. In 1974, University of Melbourne chemist Richard Robson had an idea. He toyed with it for 10 years before trying it out in his lab. Then in the mid-1980s, working alone and without fanfare, he took the first steps in creating a new class of manufactured material – today known as metal-organic frameworks (or MOFs) – which have extraordinary properties.

They are crystals, but they are not solid. They are built like scaffolding, from a network of molecular rods, and they are mainly empty space. This means they are extremely porous but their cavities are nano-sized: so small they can be "tuned" to admit some types of molecules and refuse entry to others.

To build the first MOF, Robson decided to try to emulate a diamond crystal, which is structured as a series of tetrahedrons stacked together. Except that unlike diamond – made of solid tetrahedrons with strong bonds between carbon atoms – he would build it from molecular rods. The end result was a liquid that didn't look spectacular. But when Robson's colleague Bernard Hoskins X-rayed it, the diffraction image proved that floating in the liquid was the tetrahedral lattice that Robson was seeking.

He understood the significance of what he had achieved. Hoskins and he published a paper in 1989 describing their result and hence proposed "a new and potentially extensive class of solid polymeric materials with unprecedented and possibly useful properties". They said, prophetically, that the materials "may show some interesting molecular sieve and ion exchange properties". Their structure "would generate a regular array of cavities, interconnected by windows". Even rods of "modest length" would produce cavities and windows of "relatively large size", the paper said.

Although Robson correctly foresaw the potential of this new class of materials, the early examples he and others produced did not have practical applications. One problem was that they were not strong. If the solvent bath they were created in evaporated away, they were prone to disintegrate. But despite this, Robson was able to show in these early experiments that molecules could flow in and out of the lattices and they could be optimised to attract different chemicals to their interior "cavities". He also suggested that the lattices could be designed to catalyse chemical reactions.

He was proved to be correct. Today, more than 10,000 different types of MOFs have been built by chemists. They look commonplace. Some are powders and others are grains the size of rice. But what they have in common is immensely small, molecular-sized "cavities and windows" that do amazing things.

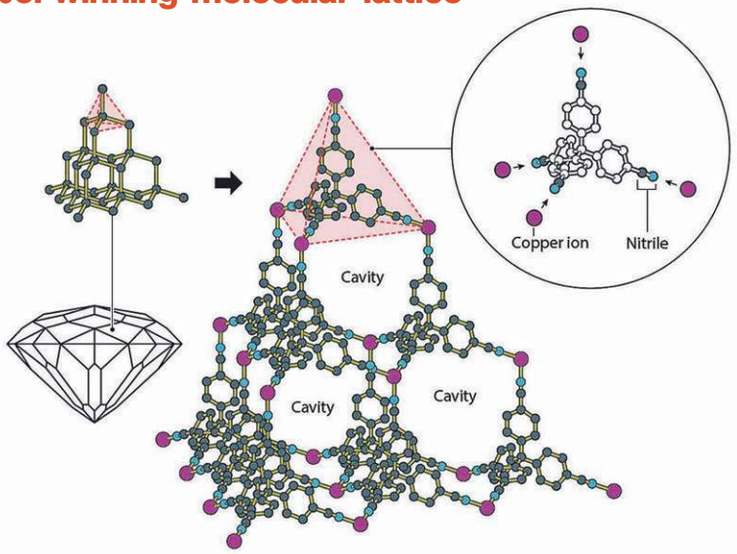
There are MOFs that are designed to admit only one type of molecule and to store them in their interior space. There are others that will remove carbon dioxide from the air. And some that will capture water vapour from the air, allowing it to be liquefied and provided as drinking water in arid areas. There are also MOFs that will store hydrogen gas, a fuel that is expensive to store or transport at the moment because of the need to keep it under high pressure at very low temperatures.

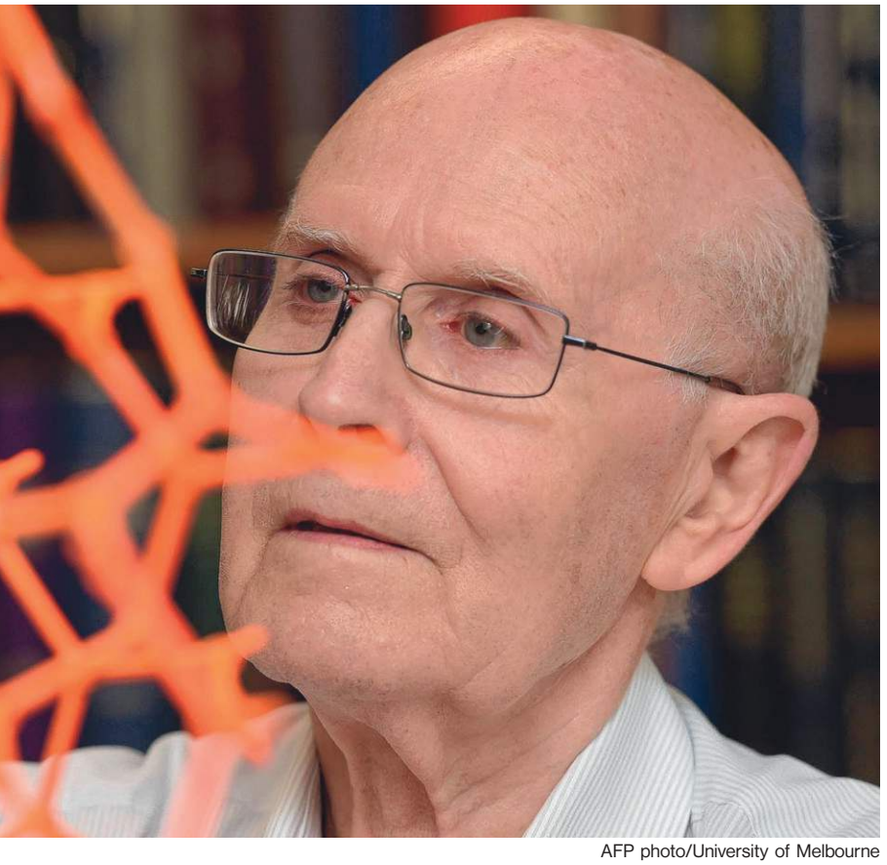
MOFs can also be designed to filter specific pollutants from both air and water, including the dangerous PFAS "forever chemicals". Related to this, a MOF can be used as a sensor. If "tuned" to admit only one particular substance into its lattice, it can trigger an alert when this occurs.

The possible uses for MOFs are countless and often not obvious. For example, MOFs that absorb ethylene – a gas released by fruit that hastens ripening – are being used to extend shelf life of perishable foods. And studies are under way to see if MOFs are an economic way to filter

Robson's Nobel-winning molecular lattice

Inspired by the structure of a diamond (bottom left), in the 1980s Robson succeeded in building a repeating tetrahedral lattice from molecular rods which had cavities inside that were very large on a molecular scale.





AFP photo/University of Melbourne

The University of Melbourne's Richard Robson, one of the winners of the 2025 Nobel prize in Chemistry

lithium – a key component of batteries – from briny underground water.

University of Sydney chemistry professor Deanna D'Alessandro, who has worked with Robson on MOFs and is the field leader in inorganic chemistry in this year's Research magazine, explains their ubiquity by noting that MOF designers have all the elements of the periodic table to work with. "You've got whatever your imagination can come up with," she says.

D'Alessandro says real advances were made by Robson's fellow Nobel prize winners, Susumu Kitagawa of Kyoto University in Japan, and Omar Yaghi of the University of California, Berkeley in the US. "They showed how to make these materials stable when you evacuated all the molecules out of the pores".

In the 1990s, Kitagawa made a famous breakthrough when he built a MOF which was flexible. It expands when it absorbs a gas or liquid and contracts when it is released. One of Yaghi's achievements was an immensely strong MOF called MOF-5. It has a huge interior storage capacity and is so stable it can be heated to 300 degrees C and remain intact.

What comes next? Will there be enormously successful commercial applications for MOFs in carbon reduction, pollution control, hydrogen storage or water harvesting. "We have to be careful not to say that MOFs will solve all the world's problems," says D'Alessandro. "If only they could." She says there is a leap to be made from a MOF that works in the lab to one that works, and is economic, when integrated into a large engineered system.

"But there's certainly many of us working hard because we recognise that there are going to be needs for this technology," she says.

Robson, although he still goes into the University of Melbourne most days, said in an interview just after his Nobel win that he's not in close touch with the latest developments. But the 88-year-old said he was still excited by one possibility, that a MOF could be designed to have high electrical conductivity. "including, very optimistically, super conductivity."

His University of Melbourne colleague Brendan Abrahams, who has worked closely with Robson in the lab for 35 years, says the path-breaking MOF research was enjoyable just for the sake of it. "It was fun, it really was. We'd often have an early morning coffee and he'd bring in this thick wad of paper. He'd written down all of these ideas that he'd come up with overnight."

Abrahams says Robson was never one to look for publicity or reward. "He's a very quiet person, a very humble and modest person." So quiet that for a long time he had a very low profile in the chemistry department, Abrahams says.

But in December, Robson will be in the spotlight when he goes to Stockholm to be presented with his Nobel prize by the Swedish king and be feted at a magnificent banquet. And he's invited his long-time colleague Abrahams to go with him.

Accolade for MOF researcher — page 25

How sustainability research can improve Australia's future

You won't find an Australian university which is not putting its research resources behind the quest for greater sustainability. But how are universities doing this and with what results? Sustainability is a broad and amorphous field but a United Nations initiative – the 17 UN Sustainable Development Goals (SDGs) announced in 2015 – do give it a structure. Sustainability is defined as far more than just the environment and clean energy. It covers a range of things including health, education, economic wellbeing, gender equality and good governance, as well as the partnerships needed to make the goals achievable.

In the 2026 Research magazine we have used the UN SDGs as a yardstick to measure the alignment of Australian university research to sustainability. On the following pages we list, for nearly every goal, the five universities whose research is most aligned. Our process for doing this is explained at right.

On this page we also give university leaders the opportunity to describe what their institutions are doing regarding sustainability research, and why.

There is a very high degree of commitment to it. "Research-intensive, comprehensive universities like Sydney have a really strong ethical obligation to ensure that Australia is making a decent and equitable contribution to the sustainable development goals," says University of Sydney provost Annamarie Jagose.

The single idea which university leaders express most is the need to gather researchers from many disciplines to tackle sustainability's toughest problems.

"No one single area is going to be able to genuinely shift the dial in relation to these big goals," says University of Queensland vice-chancellor Deborah Terry.

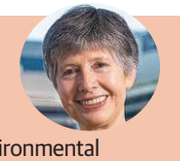
RMIT University deputy vice-chancellor (research and innovation) Calum Drummond agrees. "About 10 years ago we saw a lot of the wicked problems weren't going to be solved by single disciplines," he says.

Deakin University deputy vice-chancellor (research and innovation) Matthew Clarke says that, at his university, the necessary teamwork generates itself.

"We don't force the work to happen across disciplines, but it naturally happens. They come together and form teams and research groups to actually be able to achieve the outcomes that they want," he says.

Other universities purposefully create cross-disciplinary expertise. UNSW Sydney deputy vice-chancellor (research and enterprise) Bronwyn Fox said her university's Institute for Climate Risk and Response is headed by Ben Newell, a behavioural psychologist. "Ben's brought together scientists, business experts and law experts who are focused on a risk-based approach to climate response to support businesses to make those shifts," she says.

Griffith University vice-chancellor Carolyn Evans says her university has three "beacons" – interdisciplinary research teams –



PM's Prize for Science

Queensland University of Technology environmental scientist, **Lidia Morawska**, one of Australia's leading sustainability experts, is the winner of the 2025 Prime Minister's Prize for Science.

Professor Morawska has also been recognised by The Australian's Research magazine for her work. In 2020 and 2021 she was named a Lifetime Achiever in the environmental sciences and in 2023 she was named the field leader, for that year, in environmental sciences.

Professor Morawska has been highly praised for her early recognition that the Covid-19 virus was airborne, leading to major efforts to stop airborne spread.

Another of the 2025 PM's Prizes for Science was won by Adelaide University physicist **Yao Zheng**, who is noted for his work to produce clean hydrogen directly from sea water, a major step forward in the effort to reach net zero carbon emissions. He won the Malcolm McIntosh Prize for Physical Scientist of the Year.

Deborah Terry
University of Queensland

Anton Middelberg
Adelaide University

Virginia Kilborn
Swinburne Uni of Technology

Matthew Clarke
Deakin University

Emma Johnston
University of Melbourne

Annamarie Jagose
University of Sydney

Bronwyn Fox
UNSW Sydney

Carolyn Evans
Griffith University

Melinda Fitzgerald
Curtin University

Robyn Ward
Monash University

Margaret Sheil
Queensland Uni of Technology

Andrew Parfitt
Uni of Technology Sydney

climate action, disrupting violence and inclusive futures, all of which relate to UN SDGs.

University of Adelaide deputy vice-chancellor (research) Anton Middelberg says that both his university, and the University of South Australia (which will come together in January 2026 to form Adelaide University) have, in the last five or so years, "really started to take a more multidisciplinary approach to their research, become less siloed, and put that focus on things relevant to South Australia".

It's one thing to find a research solution to problem but then it must be implemented. Curtin University deputy vice-chancellor (research) Melinda Fitzgerald is proud that her university's alternative to using hazardous cyanide to extract minerals from ore is currently being commercialised in partnership with chemical company Draslovka.

UTS vice-chancellor Andrew Parfitt says that it's important that his institution moves beyond just creating the enabling technologies, and builds networks with the technology users to find solutions. It's important to knock on industry's doors, taking sustainability solutions to them, says Queensland University of Technology vice-chancellor Margaret Sheil, voicing a similar view.

Monash University deputy vice-chancellor (research and enterprise) Robyn Ward agrees. "We're looking at how we can scale up a lot of these (sustainability) solutions into commercial solutions," she said.

She points to the example of Monash spin-out company ElectraLith, which produces battery grade lithium hydroxide using no water or chemicals and minimal energy.

Swinburne University of Technology chief scientist Virginia Kilborn says it's important not only to produce sustainable solutions, but also economically viable ones. She points to Swinburne's energy research programs which, she says, are aimed at producing cheaper energy through energy efficiency as well as cleaner energy.

University of Melbourne vice-chancellor Emma Johnston, while not at all decrying the push for sustainability research that can be quickly implemented, offers a reminder not to neglect the importance of fundamental inquiry with no apparent applications. Scientist Richard Robson, from her university, just won the Nobel Prize in Chemistry for discovering a new type of material 40 years ago which then had no use. Today these metal-organic frameworks are leading candidates to capture carbon and store clean hydrogen fuel.

Finally a word from Kate Dundas, executive director of the UN Global Compact Network Australia, which works with business and the Australian community to advance the UN SDGs. Universities must not only do sustainability research, they must teach sustainability to students, she says."We need these institutions to show leadership and embed the SDGs, or at least that kind of holistic thinking, into the heart of tertiary education."

Tim Dodd

How we chose the leaders in sustainability

The credo of the Research magazine is that we use publicly available data in innovative ways to throw light on the performance of Australian research. Our investigation of sustainability and what universities have done to advance it through their research, is no different.

Our starting point to analyse this topic was the mass of data about research papers available from the not-for-profit platform OpenAlex — which was named in homage to the ancient Library of Alexandria.

Using AI, OpenAlex maps the world's published research papers to the UN Sustainable Development Goals. Our partner, research analytics firm League of Scholars, extracted data to yield a matrix which showed how many research papers were published in the past five years by each Australian university in relation to each of the 17 UN SDGs. (Note that a paper can map to more than one SDG.)

Then, to ensure that we took into account the quality and impact of research, not just the volume of papers, we counted the citations gathered by each paper.

For each of the SDGs, we ranked universities by the number of times their papers associated with that SDG had been cited. In this way we we identified the five leading universities for each goal.

Note that we have not linked research papers to the 17th SDG — Partnership for the Goals — because it is more about implementing the goals rather than research as such.

Scoring the goals

On the following pages we name the top 5 universities supporting each of the first 16 UN sustainable development goals through their research. For each goal, we profile the work of a researcher who has made a major contribution.

Research excellence strengthens education

Matthew Clarke

As Deputy Vice-Chancellor of Research and Innovation at Deakin University, I have the privilege of stewarding research that delivers an extraordinary impact for communities in Australia and around the world.

Universities have existed for about 1000 years because of this contribution to society. Their purpose is the accreditation of learning and the creation of new knowledge, both equally important to our advancement as a society.

Deakin excels in both education and research. We are Australia's largest university to rank highly in both, and one of the few institutions globally to do so.

We have embedded the synergy between research and education in our institutional DNA. We make it explicit through our goal of "balanced excellence" – setting us apart from other Australian universities. It's a deliberate choice we made, and it's what makes us special.

We apply this balance in how we address the major challenges facing our society – fostering technological advances in health, science, engineering, social policy, international relations and trade – for the betterment of all communities.

The true nexus of education and research – where they are both informed by and influence each other – creates a quality experience combining excellence in learning with the chance to make a difference in the world.

Yet, there is growing scepticism among the Australian public about the value universities deliver. Our Vice-Chancellor, Professor Iain Martin, has rightly identified this as a crisis of confidence – a challenge to our social licence that demands a considered response.

One of the most persistent concerns that I encounter is the idea that university-based research somehow detracts from the quality of education. I want to be unequivocal: research at Deakin is not here to compete with education. It strengthens it.

Our research is progressive, tackling complex challenges with a clear focus on creating positive change. From harnessing artificial intelligence to support medical teams working in trauma-response units, to advanced materials development to tackle our waste crisis, and humanitarian research to help people survive disasters. Our work at Deakin is grounded in achieving impact for the communities in which we operate.

Investment in research and innovation is crucial to Australia's long-term future if we want to keep improving our lives and create the jobs of the future.

At Deakin, we've built a world-class research ecosystem that's geared towards addressing major challenges for society and fostering technological advancement. Deakin's multiple campuses, our strong industry partnerships and our commitment to interdisciplinary collaboration give us a unique edge.

Deakin researchers are great collaborators, bringing diverse experience from a range of backgrounds, and we have a very real commitment to nurturing new generations of researchers to contribute fresh perspectives and bold ideas.

This commitment to research excellence creates a learning environment focused on curiosity and discovery, which our students get to be part of every day. Our students are learning from researchers who are experts in their fields and deeply committed to teaching and mentorship. They're exposed to cutting-edge thinking, encouraged to ask difficult questions, and empowered to contribute to solutions. This is how we shape minds, move industries and prepare graduates to thrive in a rapidly changing world.

We also recognise that the value of research extends far beyond the university walls. The Australian research sector punches well above its weight on a global scale, contributing to major discoveries that improve our daily lives, from medicine and ecology to social policy and technological innovation.

As we look to the future, we must continue to earn the public's trust. That means being transparent about our goals, accountable for our actions and deeply engaged with the communities we serve.

At Deakin our relationships are built on trust and they show that we are here to help advance society through quality education, positive student experience and research that makes a difference.

Only by achieving a true balance between education and research excellence will we unlock incredible possibilities. I believe, wholeheartedly, that our sector can – and must – lead Australia into a better future. At Deakin, we're ready to do just that.

Deakin Distinguished Professor Matthew Clarke is Deputy Vice-Chancellor Research and Innovation at Deakin University

A better world

Supported by Deakin University

Delivering on the United Nations Sustainable Development Goals

GOAL 1
No poverty

Top five universities
Monash
Uni of Melbourne
UNSW Sydney
Uni of Queensland
Uni of Sydney

Research case study

Economist Russell Smyth, from Monash University's Business School where he is deputy dean (research), is a prolific researcher on many topics including the links between "energy poverty" – the inability to afford the necessary fuel and other energy to meet basic needs – and other measures of wellbeing.

Among factors linked with a higher likelihood of energy poverty are high crime rates, low education achievement and childhood adversity. His work has also linked energy poverty with a greater likelihood of voting for right wing populist political parties.

Professor Smyth, who has also examined the affect of ethnic polarisation on poverty, has found that good economic policies alone are not sufficient to reduce poverty and that ethnic and linguistic fractionalisation can increase poverty. Policymakers must also pay attention to the social environment, he says.

Research case study

Adele Pavlidis is an associate professor in sociology at Griffith University who focuses her research on gender and power relations in sport and leisure. She sees sport as a key area of change

Research case study

Deakin University's Fiona McKay has a strong research record on hunger and food insecurity.

Associate Professor McKay, from the university's Institute for Health Transformation, has researched food-related issues for many groups in the community, including children, pregnant women and mothers.

Research case study

In her research Monica Barratt, an associate professor at RMIT University, studies emerging trends in drug use, particularly focusing on the use of psychoactive substances; the testing of drugs for harm reduction; cannabis cultivation;

Research case study

Professor Kok-Sing Tang of Curtin University is an education researcher with a particular specialty in the use of generative AI in education.

He recognises that the emergence of generative AI leads to new possibilities for

GOAL 2
Zero hunger

In her recent research she has investigated hunger in Australian families with children, the relationship between food insecurity and family violence, and the response of the Australian welfare system to those who need food assistance.

She has also reviewed commercially available meal kits

GOAL 3
Good health and wellbeing

and access to drugs online. She is committed to ensuring her research has an impact outside academia.

Associate Professor Barratt is also the Australian lead for the

GOAL 4
Quality education

personalised learning, digital tutoring and the generation of content, but teachers report limited use of the new technology because of policies restricting its use and a lack of training.

Professor Tang is the co-editor-in-chief of the journal Research in

GOAL 5
Gender equality

in Australian society, where attitudes towards women are changing and being challenged.

She aims to connect social, cultural and health concepts in sport with the goal of making

Top five universities
Deakin
Uni of Queensland
Monash
Uni of Melbourne
Uni of Sydney

and found that – while they are convenient, easy to prepare and reduce food waste – high levels of salt and fat make them unsuitable for being a regular part of a healthy diet.

Top five universities
RMIT
UNSW Sydney
Deakin
Adelaide
Monash

Global Drug Survey, and she is the executive director of Bluelight.org, a global drug harm reduction community.

Top five universities
Curtin
Monash
UWA
Uni of Queensland
UNSW Sydney

Science Education. In 2024, he received the Humanities Research Excellence Award for his work on the use of AI in education.

Top five universities
Griffith
UNSW Sydney
Uni of Melbourne
Monash
Uni of Sydney

as a drug and alcohol worker and a youth worker.

A better world

Supported by Deakin University

Delivering on the United Nations Sustainable Development Goals

GOAL 6
Clean water and sanitation

Top five universities
UNSW Sydney
RMIT
Uni of Queensland
Monash
Uni of Melbourne

Research case study

UNSW's David Waite, CEO of the university's Centre for Transformational Environmental Technologies, has made major contributions to environmental chemistry. He has been awarded more than $16 million in research funding for his work on water quality and treatment technologies.

He is a Scientia Professor and he also leads the UNSW Biogeochemical Engineering, Management and Systems research group, which aims to prevent environmental degradation and increase human health.

He says his goal is to undertake biogeochemical research to improve the understanding of natural aquatic systems for the purpose of preventing environmental degradation and finding solutions to the challenges in water supply and health.

Research case study

Griffith University's Brent Moyle has a passion for improving economic conditions in remote Australian communities through tourism. He says his long periods living and researching in remote regions has given him a deep understanding of the challenges faced by isolated communities.

"I have become successful in leveraging my academic knowledge of sustainable tourism to conceptualise, advocate and lead the development of major tourism attractions, which have positive impacts on the economy, society, and the natural environment of these remote Australian communities," he says.

"I proudly regard myself as a community-responsive academic who can traverse the delicate balance between generation of new theory and the implementation of practical outcomes designed to regenerate Australia's remote regions."

Volunteers key to big

Gretta Pecl: "We can do a lot of innovative projects"

The University of Tasmania is not a large institution and its very lack of scale is a key reason why it's a leader in the Life Below Water UN Sustainable Development Goal (See page 16).

"Because we're a small university, we can do a lot of innovative projects that would normally be quite difficult," says Gretta Pecl, a professor at the university's Institute for Marine and Antarctic Studies.

The institute has a successful record of involving the community in research that is critical to understanding the changes taking place in the oceans due to the warming earth.

One project Pecl started in 2009 – the Range Extension Database and Mapping project (or REDMAP) – invites fishers and divers to record sightings, preferably with a photo, of marine species that are not common in a particular location. It has extended nationally and its database is a hugely valuable scientific resource documenting the impact of the earth's warming. It has found manta rays, a warm water species, in waters off Tasmania, tropical coral trout off NSW and Victoria, and tiger sharks off northeast Tasmania.

Another IMAS project, the Reef Life Survey, uses trained volunteer divers to accurately survey marine life – the number and size of species and how it is changing over time. The Reef Life Project has expanded

Research case study

Adelaide University's Nataliia Sergiienko and her colleagues are at the forefront of developing ocean wave power as a source of renewable energy. Unlike solar or wind, it's almost 24/7, and it can reduce storm erosion of coastlines.

GOAL 7
Affordable and clean energy

"Wave energy converters work by removing energy from waves, which significantly decreases the height of waves that propagate towards the shore," Dr Sergiienko says.

Wave energy converters could also protect offshore infrastructure, such as floating wind farms, from wave damage.

Top five universities
Adelaide
Curtin
Swinburne
QUT
Deakin

GOAL 8
Decent work and economic growth

Top five universities
Griffith
Uni of Queensland
Monash
Uni of Melbourne
UNSW Sydney

ocean science push

internationally and now operates in almost 60 countries and has recorded about 27 million animals.

"It's an incredible data set and a wonderful initiative that emerged here from the University of Tasmania," Pecl says. "The data has been used in an extraordinary number of publications, including in Science and Nature."

The state is a natural laboratory for observing changes in the marine environment. The waters off Tasmania's east cost, where temperatures have risen by 2.3 degrees in the past century, about four times the global average, are among the fastest warming in the world, Pecl says.

In addition to general ocean warming, the Tasmanian waters receive extra heating from the East Australian Current, which sweeps southward. The arriving waters are nutrient poor. That, combined with the rising temperature and the appearance of more marine animals that eat kelp, is wiping out Tasmania's underwater forests of giant kelp.

Pecl says 95 per cent of the giant kelp has gone. Faced with warming waters, the kelp would naturally migrate south but, south of Tasmania, there is nowhere to go for this coastal water species.

What is being observed in Tasmania is part of what Pecl says is the "largest redistribution of life on earth for hundreds of thousands of years".

"As our climate changes on land and in the ocean, plants and animals in the northern hemisphere are moving north and plants and animals in the southern hemisphere are moving south," she says.

IMAS has a kelp restoration project under way. Researchers are looking for adaptations in kelp species which might be more tolerant of heat.

Now Pecl is launching another project, Sea Change Australia, to build more business and community awareness of the impact that warming is having on the oceans.

Sea Change, which started this year, works with the fishery and aquaculture industry to prepare for, and respond to, climate change.

It offers people across these industries the opportunity to ask questions and get the best answers possible to key questions like 'How will species X shift in the next 10 years?', 'What's happening to currents in my region?' or 'How is today's climate different from the past?'.

It's intended to help researchers understand what is important to the seafood industry and to communicate about climate science in a practical and relevant way.

More details are available at seachangeaustralia.org

Tim Dodd

Research case study

Deakin University's Jemal Abawajy is a leading researcher on cyber risk, the internet of things, cloud computing and its offshoot, fog computing, in which the processing takes place closer to the user, reducing the latency time.

GOAL 9
Industry, innovation and infrastructure

His research is being applied to improving transport systems, including self-drive cars, tele health and health apps, cybersecurity, block chain efficiency and reducing the risk posed to encryption systems by quantum computing.

Top five universities
Deakin
UTS
UNSW Sydney
RMIT
QUT

Research case study

Kirsten Thorpe, from the University of Technology Sydney, leads the university's Indigenous Archives and Data Stewardship Hub, which advocates for Indigenous rights in archive and data management. It also works with libraries and archives to support culturally appropriate ownership, management, and ongoing preservation of Indigenous knowledge.

During her career, she has been supported in many projects involving the return of historic collections to Indigenous people, and the revitalisation of Indigenous languages. Her doctorate within the information technology faculty at Monash University examined Indigenous self-determination and sovereignty over the management of Indigenous knowledge.

At UTS, she is also a Chancellor's Indigenous Research Fellow at Jumbunna Institute for Indigenous Education and Research.

GOAL 10
Reduced inequalities

Top five universities
UTS
Deakin
Monash
Uni of Sydney
Uni of Queensland

GOAL 11
Sustainable cities and communities

Top five universities
UTS
QUT
RMIT
UNSW Sydney
Uni of Queensland

Research case study

Chengqing Wu is a professor of structural engineering at the University of Technology Sydney who has made major contributions to building and structural safety.

He is recognised for his research on the effects of blast-induced ground vibrations, the structural response to blast loading, the mitigation of blast effects on structures, the blast resistance of ultra-high performance concrete, rock blasting and traffic barrier response to vehicle impact.

He has also conducted research into using 3D printing techniques to build concrete structures.

One of his recent papers evaluates the use of high-strength concrete to build structures on the Moon and on Mars, particularly looking at the material's ability to withstand the large variations in temperature experienced on those celestial bodies.

A better world

Supported by Deakin University

Delivering on the United Nations Sustainable Development Goals

GOAL 12
Responsible consumption and production

Top five universities
Adelaide
Curtin
UNSW Sydney
UTS
RMIT

Research case study
Adelaide University's Volker Hessel is a world leader in continuous flow chemistry, which allows the chemical industry to operate with improved efficiency, higher safety, less waste and reduced environmental impact.

In continuous flow chemistry, pumps move liquids through small tubes giving more control over the reaction, compared to traditional batch chemistry, where ingredients are mixed in a large vessel which is then emptied and cleaned before the next batch is mixed.

Professor Hessel's work includes using tiny, extremely hot streams of plasma to drive chemical reactions to make ammonia, a key ingredient of fertiliser, in a way that reduces energy consumption and emissions of carbon dioxide.

Research case study
Adelaide University legal academic Laura Grenfell focuses much of her research on human rights law, where she has three main interests.

One is to examine how parliament and executive

Research case study
The University of Melbourne's Andrew King is a highly recognised climate scientist investigating the effects of global warming and the changes needed to reach a net zero level of carbon dioxide emissions.

His work investigates global warming's impact on rainfall, the

Research case study
A key interest of UNSW oceanographer Moninya Roughan is modelling the East Australian Current, the ocean current that travels south on Australia's east coast carrying warm water from the tropics.

Her research around the current

Research case study
Monash University engineer Jeffrey Walker is an expert on using remote sensing to gather data on soil moisture. His doctoral thesis at the University of Newcastle was part of the pioneering research on estimating root zone soil moisture levels via

GOAL 16
Peace, justice and strong institutions

government engage with human rights issues when they are in the process of developing new law and policy.

GOAL 13
Climate action

prevalence of heatwaves and the time it will take for the climate to stabilise if net zero is achieved.

In a recent paper, he says that climate changes will take many centuries to play out after net zero is reached, particularly in the Southern Hemisphere.
In his work he has also says the

Top five universities
Uni of Melbourne
ANU
UNSW Sydney
Uni of Queensland
Monash

rate of warming is accelerating and that a large proportion of the world's poorest people could bear the brunt of a sudden rise in temperatures.

GOAL 14
Life below water

includes ocean circulation dynamics, the spread of nutrients and their biological impact and ocean warming trends.

She played a major role in the development of Australia's Integrated Marine Observing System, which collects

Top five universities
UNSW Sydney
Uni of Tasmania
James Cook
Uni of Queensland
Uni of Melbourne

comprehensive ocean data from many sources that can be accessed by researchers in Australia and overseas.

GOAL 15
Life on land

remote sensing. He contributes to soil moisture monitoring from space, working with both NASA and the European Space Agency. His work also includes using remote sensing to improve existing agricultural practices and to increase sustainability by

Top five universities
Monash
Uni of Queensland
UNSW Sydney
Uni of Sydney
Uni of Melbourne

providing data on crop and soil health to optimise irrigation and nutrient use, and to deal with weeds and diseases.

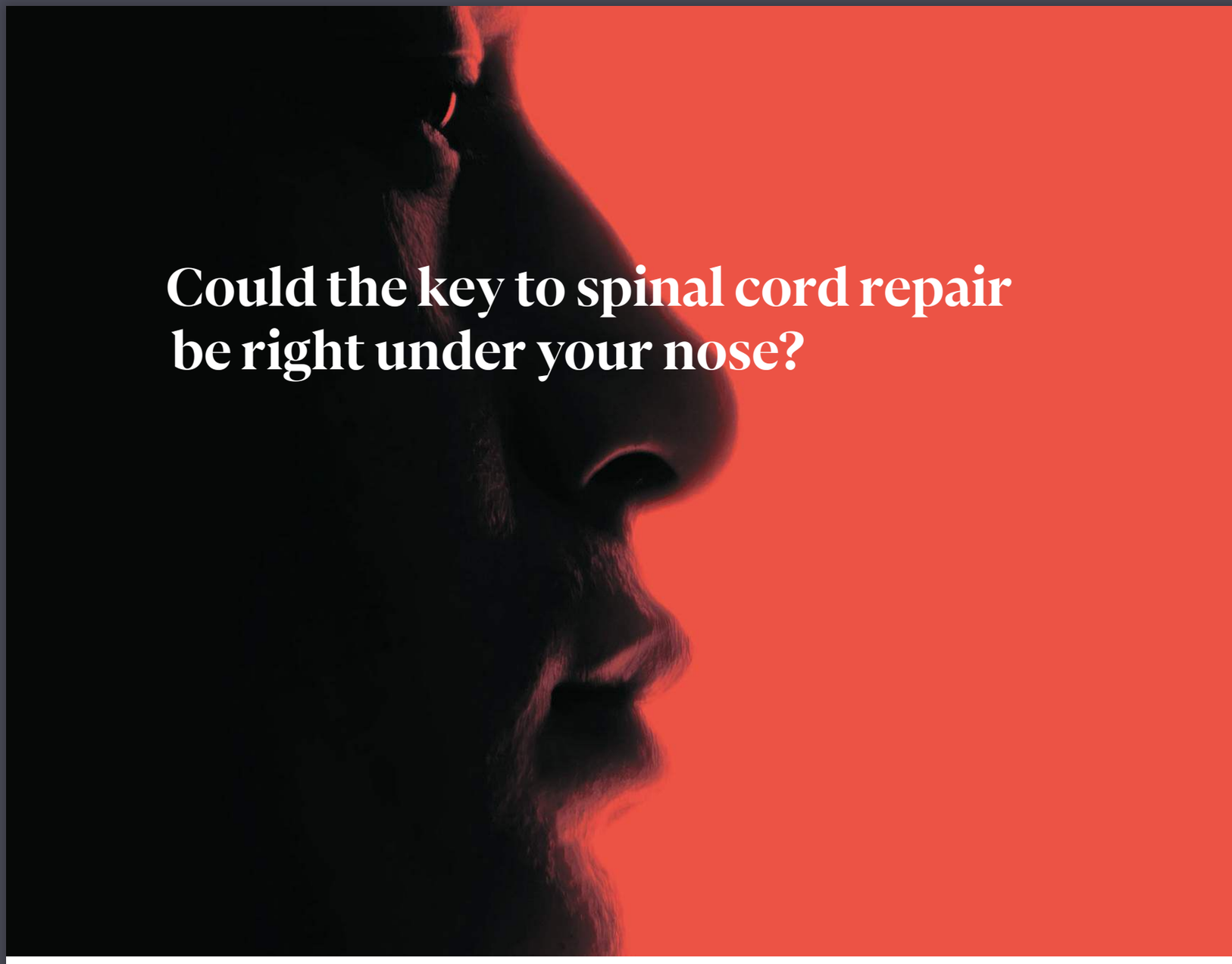
Another is to research issues of governance and human rights protection in post-conflict environments. She has specifically researched the situation in Timor Leste, South Africa and Afghanistan.

A third area of her expertise is anti-discrimination laws in Australia, North America and Europe. Here, she has particularly

Top five universities
Adelaide
UTS
Macquarie
Deakin
Uni of Queensland

focused on how the law deals with discrimination experienced by the trans community.

GRIFFITH UNIVERSITY | INSTITUTE FOR BIOMEDICINE AND GLYCOMICS



Could the key to spinal cord repair be right under your nose?

The Griffith Institute for Biomedicine and Glycomics is leading a world-first clinical trial that could see the humble nasal cell become the catalyst for spinal recovery, giving hope to over 15 million people worldwide.

Led by Professor James St John, this breakthrough study builds on Griffith's proud legacy of life-transforming research. From cell transplantation treatments for spinal injuries to landmark trials for malaria, Strep A and rheumatic heart disease, Griffith remains at the forefront of people-focused biomedical innovation with global impact.

Spanning discovery, clinical trials and therapy development, the Institute unites changemakers across the translational research spectrum to uncover life-changing discoveries in sometimes unexpected places.

griffith.edu.au/institute-biomedicine-glycomics

CRICOS: 00233E | TEQSA: PRV12076

Make it matter

Top ten Australian research frontiers
Mapped by artificial intelligence

What would we see if machines drew maps of our knowledge and identified our research frontiers? We let them have a go

Let your imagination roam for a minute. Imagine that the attributes of a research paper – its topics and its findings – can be summarised and represented by a point in a vast space. But we don't stop there. We summarise more research papers and populate this space with more points, countless numbers of them. Papers that are on similar topics are represented by points that are near each other while papers on dissimilar topics are further apart. The more different a pair of papers are, the greater the distance between them.

We end up with a huge array of points resembling the stars in the universe, and we find that many of them cluster into "galaxies" of papers that are on similar topics.

An example of what we end up with is the picture at the top of the opposite page, a universe of "stars" that actually represents more than 60,000 research papers published in the world in the past year. Clearly though, this picture was not assembled by hand. It was done with machine learning, which analysed the papers and classified them, using more than 100 different variables. (Obviously we can't show you on a page the full complexity of what this produced. What you are seeing is a two dimensional slice through a space of more than 100 dimensions, one for each variable.)

The interesting thing is that the machine learning process, without human intervention, naturally grouped the papers into the nine "galaxies" in the top picture. (Note that the labels were created by humans, not the AI.) Within those nine groups, but not visible at this scale, are 150 smaller clusters, each representing a "hot spot" – a research frontier where frenetic academic activity is taking place and many papers are being published.

Research analytics firm League of Scholars, which created the pictures opposite, is trying out this AI-driven approach, looking for new insights into the research landscape that are not evident when research papers are "pigeonholed" by traditional methods. "It's a way of picking up subtle emerging trends," says League of Scholars CEO Paul McCarthy. He believes it could be particularly useful in identifying cross-disciplinary research hot spots that fall between the cracks in old-school classification structures.

The approach is in its early days. But, as an experiment, McCarthy and his colleagues focused on Australian research papers to discover which of the 150 research frontiers Australia is doing best in.

They decided to select the 10 best performers based on the number of citations that Australian papers in each cluster had received from other researchers. On this page we list these top 10 Australian research frontiers, in which Australian researchers are enjoying the most success. For each frontier, we highlight one Australian paper (and name the first author of that paper), based on the paper's citation performance.

This is an early-stage analysis with limits. Because it spans only a single year, citation counts remain small. Even so, McCarthy believes it demonstrates a new way to read the literature and identify new frontiers, using machine learning to map papers at scale from the texts themselves. Analysing research with machine learning is still in its early days but we will keep refining the method and tracking where Australia leads, he says.

Tim Dodd

1 Large language models

Example paper: *Unifying large language models and knowledge graphs: A roadmap*, IEEE Trans. Knowl. Data Eng.
First author: Shirui Pan, Griffith University

2 Deep learning and time series

Example paper: *Autoencoders and their applications in machine learning: A survey*, Artificial Intelligence Review
First author: Kamal Berahmand, Queensland University of Technology

3 Climate change and ecosystems

Example paper: *300 years of sclerosponge thermometry shows global warming has exceeded 1.5 °C*, Nature Climate Change
First author: Malcolm McCulloch, University of Western Australia

4 Bibliometrics and publishing

Example paper: *Open access outputs receive more diverse citations*, Scientometrics
First author: Chun-kai Huang, Curtin University

5 Student well-being and resilience

Example paper: *Need support and need thwarting: A meta-analysis of autonomy, competence, and relatedness supportive and thwarting behaviors in student populations*, Personality and Social Psychology Bulletin
First author: Joshua Howard, Monash University

6 Higher education and skills

Example paper: *Work-integrated learning: opportunities and challenges in Australia*, High. Educ. Res. Dev.
First author: Denise Jackson, Edith Cowan University

7 Global health and social change

Example paper: *Unfair knowledge practices in global health: a realist synthesis*, Health Policy and Planning
First author: Seye Abimbola, University of Sydney

8 Education systems and pedagogy

Example paper: *Where has the joy gone? A qualitative exploration of academic university work during crisis and change*, Higher Education Research & Development
First author: Craig Whitsed, Curtin University

9 Religion, culture and identity

Example paper: *Religion and growth*, J. Econ. Lit.
First author: Sascha Becker, Monash University

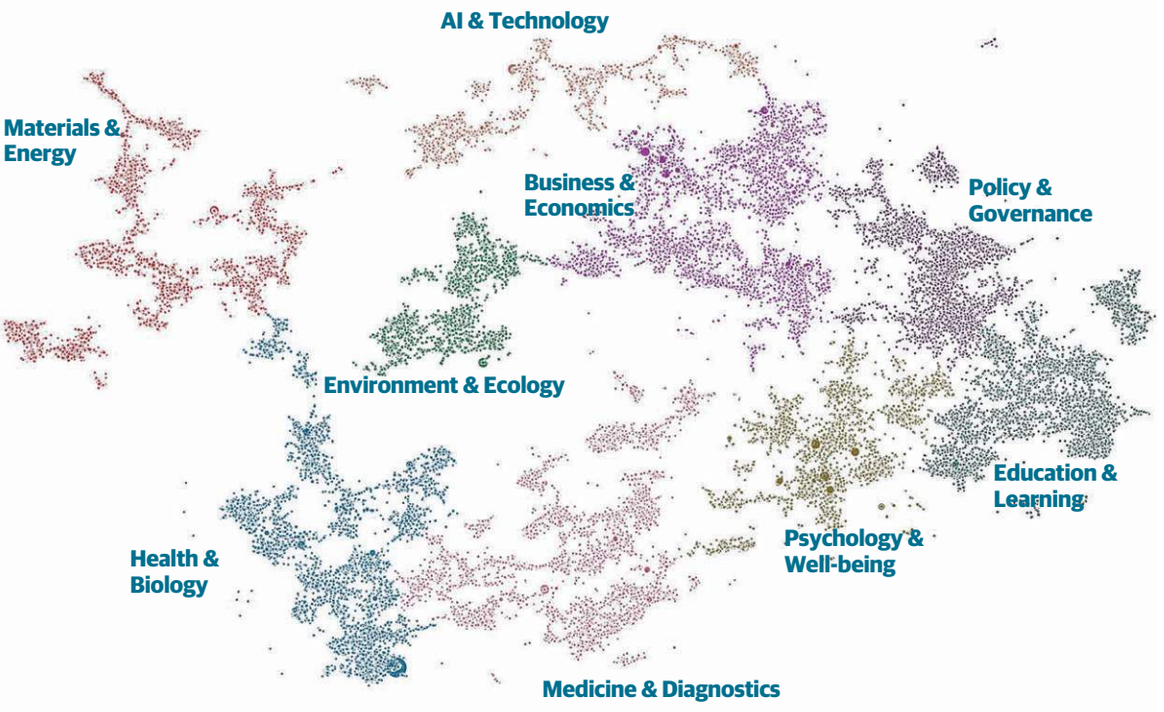
10 Digital Platforms & Society
Example paper: *Risky business: How food-delivery platform riders understand and manage safety at work*, Journal of Sociology
First author: Qingyu Wang, University of Melbourne

The galaxy of knowledge

The top map shows over 60,000 research papers published globally in the past year, which have been classified by machine learning into nine broad clusters of subject areas. The bottom map is the same picture with Australian papers highlighted. The large dots on the bottom map represent the top 10 Australian research frontiers, also listed opposite.

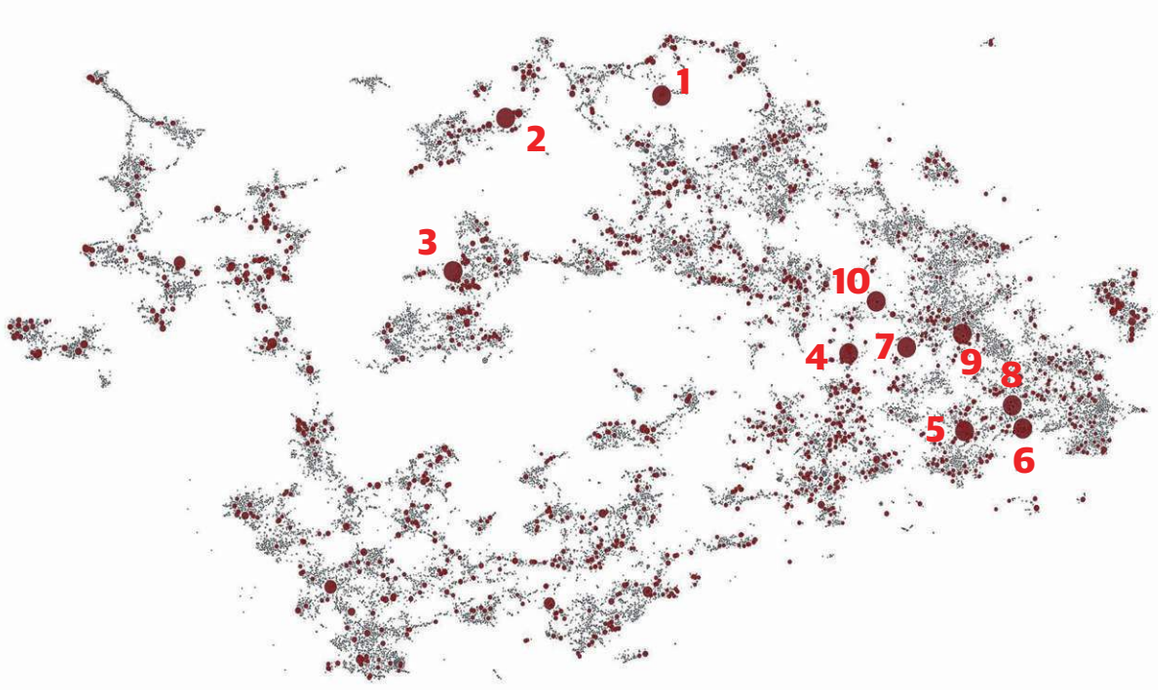
The global view

Each research paper's content is assessed by machine learning and placed as a dot on the map. The more similar two papers are in their subject matter, the nearer their dots are placed. Papers which are unlike each other have dots a long way apart. In this map, there are 150 significant dot clusters. Although they are too small to see at this scale, they are the top 150 global research frontiers, or 'hot spots', where research is progressing rapidly and many papers are being published.



The local view

This is the same map as above but Australian papers are highlighted in maroon while papers from the rest of the world are in grey. The 10 labelled spots correspond to the 10 top Australian research frontiers listed opposite. These are selected from the top 150 global research frontiers. They are the ones where Australian researchers have the highest percentage of global citations for their papers.



UniSQ

UniSQ is ranked #1 in Australia for the proportion of top 1% of papers in Physical Sciences and Engineering in the 2024 CWTS Leiden Rankings

Transforming quantum futures

UniSQ is driving Australia's quantum revolution through world-class research in materials engineering, cryogenics, quantum sensing and computing.

UniSQ is home to the National Cryogenics Electronics Measurement Facility – the nation's first industry-accessible cryogenic infrastructure hub, accelerating advances in next-generation technologies. From wearable quantum sensors to quantum computing skills, UniSQ researchers are turning complex science into practical solutions.

In partnership with CSIRO and Food Ladder, UniSQ computer scientist Professor Rajib Rana is applying quantum AI to improve food security and student wellbeing. These initiatives are driving national capability and real-world impact.

Regional innovation, reaching for the stars

Research at the University of Southern Queensland (UniSQ) is transforming the way we explore the universe and harness technology, connecting local expertise with global frontiers.

Pioneering space exploration

From discovering planets to developing advanced imaging for Australia's first sovereign low Earth orbit (LEO) satellite, UniSQ is helping shape the nation's future in space.

Through the iLAuNCH Trailblazer program and an Optus-led consortium, Professor Duncan Wright, Director of UniSQ's Centre for Astrophysics, and his team are building the technology to capture clearer images of deep space and uncover new planetary systems.

The national initiative unites government, industry and universities to push the boundaries of space science, demonstrating how regional expertise can power global innovation.

UniSQ is ranked in the 351-400 band in the 2026 Times Higher Education World University Rankings

Explore how UniSQ research is shaping Australia's future – from regional innovation to global impact: unisq.edu.au/research

CRICOS: QLD 00244B, NSW 02225m TEQSA: PRV12081

International link ups

Universities with global partnerships

Which institutions have the most diverse research partnerships, and which have the strongest ones with particular countries

There are many reasons why universities, and individual researchers, work hard to develop research collaboration with overseas institutions. Aside from the advantages of harnessing a variety of skills and expertise on a research project, if more funding is required, it's easier to find the money if overseas universities are involved and there's access to funding sources in their countries.

Australia's large research intensive universities are best known for their collaboration with overseas researchers. But a new study by research analytics firm League of Scholars shows that when it comes to sheer diversity of partner countries, there are many universities which are less research intensive which still rank highly.

To quantify diversity we adapted Simpson's Index, the tool used by biologists to measure diversity in the natural world. The results, when applied to universities and the diversity of their research partnerships, are shown in the top graph at right. This measure is independent of the size of a university's research output. Torrens University, despite its small research output, comes out on top.

League of Scholars also turned its attention to the strength of the research partnerships which individual universities have forged with particular countries. Here we measured, for each country, the ratio by which each university's research engagement with that country differs from the average for all Australian universities. The top 10 engagement pairs are shown in the bottom graph at right.

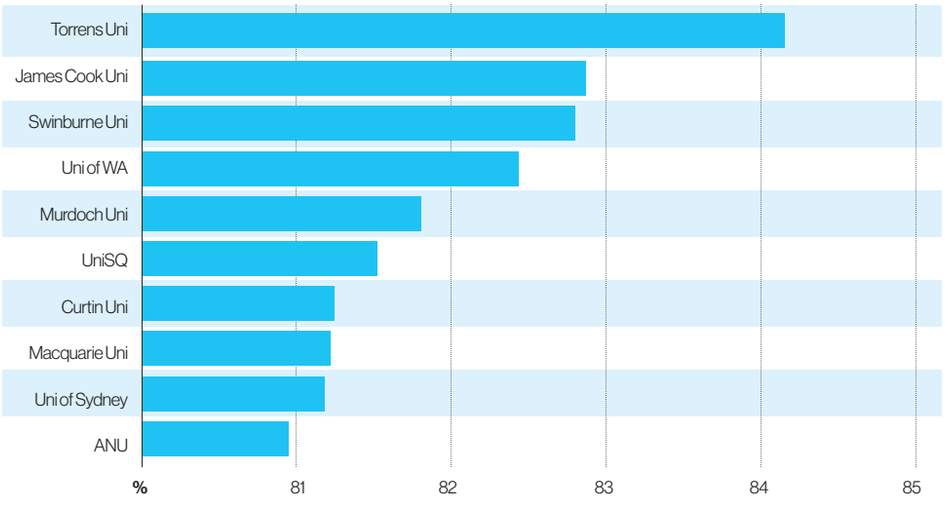
Some of these strong pair relationships are probably due to long-term links which some universities have built with countries overseas.

For example, Swinburne University has a campus in the Malaysian state of Sarawak, and RMIT has a campus in Vietnam. Their presence in the country is likely to drive stronger research partnerships.

Tim Dodd

International teamwork

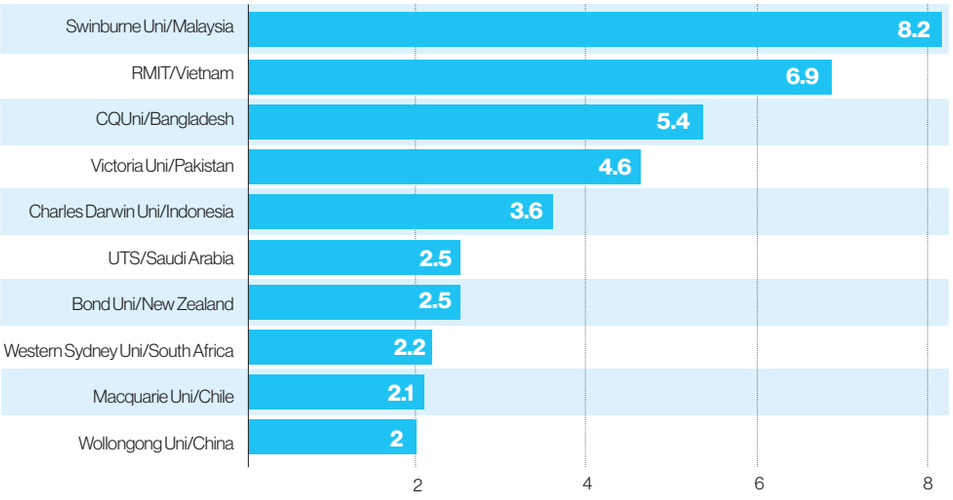
Diversity in collaborating with researchers in other countries, 2020-2025



Source: League of Scholars

Strongest partnerships

Intensity of research collaborations between Australian universities and other countries, 2020-2025



Source: League of Scholars

Engineering tomorrow's energy

Hydrogen Export using a Powder – a collaboration between Curtin University and Velox Energy Materials – is pioneering a way to turn renewable hydrogen into safe, affordable powder for energy export.

A unique electrochemical process to produce the hydrogen-rich powder makes it a more cost effective method to transport hydrogen compared to other technologies, resulting in the potential to transform Australia's hydrogen export industry.

It's just one part of our broader mission to help accelerate the shift to clean energy.

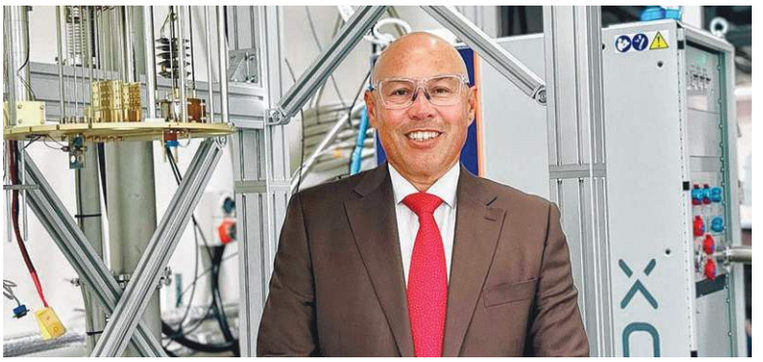
curtin.edu.au/energy-transition

Make tomorrow better.

Curtin University

CRICOS Provider Code 00301J. 6207ROC

UniSQ: Shaping Australia's future through research with impact



Professor Robert Sang

The University of Southern Queensland (UniSQ) is entering a new era, preparing for the future by investing in and nurturing research with impact. Our renewed ambition is to shape Australia's future by tackling the most pressing challenges – locally, nationally, and globally – through innovation, transformative partnerships and a clear focus on outcomes that matter.

To realise this vision, UniSQ is transforming the way we work. Through our Shaping Our Future program, we are aligning our research priorities and organisational structure to foster interdisciplinary collaboration, accelerate innovation and ensure our research directly addresses the needs of industry, government and communities. By integrating research and academic areas more deeply, we are positioning UniSQ to deliver greater impact through our four flagship research areas and educational programs.

This strategic shift comes at a pivotal time for Australian higher education. The sector continues to navigate the aftershocks of Covid-19, funding constraints and increased global competition. Yet, with the Australian Universities Accord setting out an ambitious goal for expanded research capacity and a more accessible, better-resourced higher education system, UniSQ is rising to the challenge.

UniSQ's Research Flagships

UniSQ's **Space, Defence and Advanced Technologies flagship** is delivering nationally recognised outcomes across astrophysics, hypersonics and rocketry, and materials engineering. The iLAuNCH Trailblazer program exemplifies UniSQ's leadership in space science and advanced manufacturing. In partnership with industry and government, iLAuNCH is driving the development of sovereign Australian space capabilities, including the landmark Optus-led consortium to build, launch and operate a low Earth orbit satellite. The program is also addressing the skills gap in the space sector through professional development, new degree programs and STEM outreach to nurture the next generation of space scientists and engineers. Complementing this momentum, UniSQ is advancing Australia's quantum science capabilities through the recent establishment of the National Cryogenics Electronics Measurement Facility with support from the Queensland Government's Queensland Quantum and Advanced Technologies Strategy. Providing critical infrastructure for quantum hardware, semiconductors and sensors, the facility supports the advancement of quantum solutions for the aerospace, medical and energy sectors.

The **Agriculture, Climate and the Environment flagship** drives innovation and impact across climate science, drought mitigation and adaptation, crop health, agricultural technology and environmental science, through key programs such as the Southern Queensland and Northern NSW Drought Resilience Adoption and Innovation Hub (SQNNSW Drought Innovation Hub), Northern Australia Climate Program, and Broad Acre Cropping Initiative.

A project with Meat and Livestock Australia is delivering climate-related decision-making tools that leverage machine learning to support informed and sustainable practices in livestock management. New initiatives such as the Australian Cotton Disease Collaboration in partnership with the Cotton Research and Development Corporation and the Queensland Department of Primary Industries, seek to reduce the impact of disease in cotton to less than 5 per cent of production costs, through research on systems-based disease control, pathogen behaviour, spatial analytics and plant defence.

In the **Thriving Communities and Regional Development flagship**, the SQNNSW Drought Innovation Hub remains a cornerstone of regional resilience. In 2025 alone, it has delivered over 170 activities and expanded partnerships with natural resource management entities to support producers and farming communities. A new collaboration with CleanCo Queensland is enabling research into cultural heritage, environmental law and clean energy transitions, demonstrating our commitment to inclusive and sustainable regional development.

UniSQ's **Health flagship**, represented by the new Institute for Health, is expanding its impact across sport and exercise science, mental health, biomedical research and allied health. Key projects span suicide prevention research, Indigenous-led digital health models and AI-powered motion capture for athlete development. Our researchers are also contributing to place-based mental health solutions, workforce development and community engagement as a founding member of the Manna Institute, a collaborative initiative of the Regional Universities Network.

Looking to the Future

UniSQ's research vision is clear: to foster a dynamic research ecosystem that delivers local, national and global impact. Our partnerships with industry and community position us as a first port of call for research and development endeavours.

Whether it's launching satellites, safeguarding crops, pioneering quantum breakthroughs, or supporting community wellbeing, UniSQ is shaping Australia's future one innovation at a time.

Professor Robert Sang
Pro Vice-Chancellor (Research, Development and Commercialisation)
University of Southern Queensland

Chemical & Material Sciences
Australia's research field leaders

These are the top researchers and institutions in the 17 fields of chemical and material sciences

Analytical Chemistry
Field leader: Jeremy Nicholson, Murdoch
Lead institution: Monash

Biochemistry
Field leader: Gavin Knott, Monash
Lead institution: Monash

Ceramic Engineering
Field leader: Sagar Shirsath, UNSW Sydney
Lead institution: UNSW Sydney

Chemical & Material Sciences (general)
Field leader: Pingan Song, UniSQ
Lead institution: UNSW Sydney

Chemical Kinetics & Catalysis
Field leader: Shaobin Wang, Adelaide
Lead institution: Adelaide

Combustion & Propulsion
Field leader: Juan Hidalgo, Uni of Queensland
Lead institution: UNSW Sydney

Composite Materials
Field leader: Chun Hui Wang, UNSW Sydney
Lead institution: UNSW Sydney

Crystallography & Structural Chemistry
Field leader: Tayebeh Hosseinnejad, RMIT
Lead institution: Curtin

Dispersion Chemistry
Field leader: Jason Stokes, Uni of Queensland
Lead institution: Uni of Queensland

Electrochemistry
Field leader: San Ping Jiang, Curtin
Lead institution: Uni of Wollongong

Inorganic Chemistry
Field leader: Deanna D'Alessandro, Uni of Sydney
Lead institution: Uni of Queensland

Materials Engineering
Field leader: Shi Xue Dou, Uni of Wollongong
Lead institution: UNSW Sydney

Medicinal Chemistry
Field leader: Christoph Nitsche, ANU
Lead institution: Uni of Queensland

Nanotechnology
Field leader: Xiaoli Zhang, RMIT
Lead institution: UNSW Sydney

Oil, Petroleum & Natural Gas
Field leader: Stefan Iglauer, Edith Cowan
Lead institution: UNSW Sydney

Organic Chemistry
Field leader: Vinh Nguyen, UNSW Sydney
Lead institution: Uni of Queensland

Polymers & Plastics
Field leader: Cyrille Boyer, UNSW Sydney
Lead institution: UNSW Sydney

Stefanie Zingsheim

FOCUS ON

Deanna D'Alessandro
University of Sydney
Field leader in Inorganic Chemistry

Not every researcher can say they were inspired by – and collaborated with – a Nobel prize winner, but for Deanna D'Alessandro, that has just happened.

Her career in researching metal-organic frameworks (MOFs) was sparked by the University of Melbourne's Richard Robson, who in October received the 2025 Nobel prize in chemistry, along with two international colleagues, for his pioneering work with MOFs.

"Like many Australian scientists, I was inspired to pursue research in this area because of Professor Robson," says D'Alessandro, a chemistry professor at the University of Sydney.

"I have been very fortunate to work with Richard – and his close colleague Professor Brendan Abrahams – on a number of projects and he's still in the lab at 88, mentoring students, teaching and collaborating with many of us."

A field leader in inorganic chemistry, D'Alessandro has focused her research

Continued on Page 26

Deanna D'Alessandro Stefanie Zingsheim

Continued from Page 25

on further developing MOFs, which were discovered by Robson in 1989.

They are molecular structures that have large spaces within them, capable of capturing and storing gases and other chemicals. They can be used to harvest water from desert air, capture carbon dioxide, store toxic gases, conduct electricity or catalyse chemical reactions.

The materials, which are very porous and absorbent, are made up of metal ions linked by organic bridges.

"Think of a household sponge – but with holes on an atomic scale. They are absorbent because the little pores inside of them are extremely small," she says. "Just a teaspoon of one of these materials can have the surface area of a football field. Designed well enough, one teaspoon could absorb a whole football field's worth of carbon dioxide."

D'Alessandro first encountered Robson's work during her postdoctoral research in the US, after completing her PhD in chemistry at James Cook University.

Returning to Australia, she joined the University of Sydney, focusing on the ability of MOFs to capture and separate greenhouse gases such as carbon dioxide.

"It is not only a greenhouse gas but also a resource," she says. "We can remove carbon dioxide from the atmosphere, and then put it to use in a variety of applications.

"We've been working on ways to capture it more efficiently, to reduce costs, scale the materials and integrate the MOFs into industrial uses."

Among the potential applications of capturing and storing carbon dioxide in this way is using it to replace fossil carbon as a resource – for example in food production and carbonated beverages.

> **Think of a household sponge on an atomic scale**

Sustainability has always been central to D'Alessandro's work, as she says growing up amid the natural beauty of north Queensland fostered her love of conservation.

As the academic director of the University of Sydney's Net Zero Institute, D'Alessandro now leads the multidisciplinary initiative with more than 180 researchers developing low and zero emissions solutions.

"Only by collaborating between academia, industry, government and communities can we drive the innovations needed to address the complex challenges we're facing," she says.

She's also a strong advocate for greater representation of women in science, technology, engineering and maths, seeing diversity as essential to further scientific breakthroughs.

"We do need to engage the best and brightest," she says. "And we need solutions that are going to be ones that are best for humanity and the planet which, by definition, means we need everybody at the table."

Carmel Sparke

BOLD SOLUTIONS FOR A BETTER WORLD

The University of Newcastle drives discoveries that improve lives. By unlocking the connection between traumatic injuries and acute critical and chronic illness, our researchers are improving the survival of trauma patients. And our Master of Traumatology program is an Australian first – blending clinically led research and teaching to enable tomorrow's trauma specialists to save lives.

PARTNER WITH US

Professor Zsolt Balogh
Master of Traumatology
Convenor and Field Leader
in Emergency Medicine
(2020, 2021, 2026)

Top 10

University in the world for
Good Health and Wellbeing*

UNIVERSITY OF NEWCASTLE

50 YEARS

Professor Balogh is also the Director of Trauma at John Hunter Hospital and leads the Injury and Trauma Research Program at the Hunter Medical Research Institute.

*Times Higher Education Impact Rankings 2025 | 202 1002 | CRICOS Provider 00109J

Humanities, Literature & Arts
Australia's research field leaders

These are the top researchers and institutions in the 21 fields of humanities, literature and arts

Asian Studies & History
Field leader: James Leibold, La Trobe
Lead institution: ANU

Chinese Studies & History
Field leader: Yixiao Zhou, ANU
Lead institution: ANU

Communication
Field leader: Crystal Abidin, Curtin
Lead institution: QUT

Drama & Theatre Arts
Field leader: Luke Hopper, Edith Cowan
Lead institution: Edith Cowan

English Language & Literature
Field leader: Werner Botha, Flinders
Lead institution: Macquarie

Epistemology & Scientific History
Field leader: Pierrick Bourrat, Macquarie
Lead institution: Macquarie

Ethnic & Cultural Studies
Field leader: Stuart Cunningham, QUT
Lead institution: Deakin

Feminism & Women's Studies
Field leader: Kim Toffoletti, Deakin
Lead institution: Monash

Film
Field leader: Sean Redmond, RMIT
Lead institution: Swinburne

Foreign Language Learning
Field leader: Sender Dovchin, Curtin
Lead institution: Curtin

Gender Studies
Field leader: Alison Pullen, Macquarie
Lead institution: UNSW Sydney

History
Field leader: Warwick Anderson, Uni of Sydney
Lead institution: ANU

Humanities, Literature & Arts (general)
Field leader: Martin Gibbs, Uni of Melbourne
Lead institution: Monash

Language & Linguistics
Field leader: Catherine Best, Western Sydney
Lead institution: Macquarie

Literature & Writing
Field leader: John Frow, Uni of Sydney
Lead institution: Uni of Sydney

Middle Eastern & Islamic Studies
Field leader: Zouhir Gabsi, Deakin
Lead institution: Deakin

Music & Musicology
Field leader: Gary McPherson, Uni of Melbourne
Lead institution: Uni of Melbourne

Philosophy
Field leader: Mark Alfano, Macquarie
Lead institution: Macquarie

Religion
Field leader: Ihsan Yilmaz, Deakin
Lead institution: Deakin

Sex & Sexuality
Field leader: Alan McKee, Uni of Sydney
Lead institution: UNSW Sydney

Visual Arts
Field leader: Lorraine Marshalsey, Edith Cowan
Lead institution: QUT

FOCUS ON

James Leibold
Deakin University
Field leader in Asian Studies & History

A childhood fascination with Chinese written characters led James Leibold on a lifelong journey in which he has documented Uyghur detention camps and human rights abuses in Tibet.

Leibold, who was raised in the US, had his interest sparked by the stories his father – a businessman who travelled to Hong Kong and Taiwan for work – would tell on returning home.

"But I think the drug that really hooked me was Chinese characters," the La Trobe University professor says.

"I had dyslexia – I still do – but there was something about Chinese that made it easier for me, because I only had to remember the image.

"I just love the language. Even to this day, there's nothing I love more than reading Chinese."

He studied the language at university, eventually completing a PhD in Chinese history and moving to La Trobe University in 2006.

His area of expertise has become China's nation-building policies, from imperial times to the present-day policies under Chinese President Xi Jinping.

"I've looked at how the Han-dominated Chinese state has sought to impose its power and norms over the diverse peoples of the borderlands, and transform their cultures and identities in the image of the Han ethnic majority," Leibold says.

Aaron Francis

His work centres on frontier regions such as Tibet, Xinjiang and Inner Mongolia, as well as what the Chinese Communist Party calls "soul-casting" – a type of brainwashing that erases diversity and dissent.

To varying degrees, state power has been used to suppress minority languages, traditions and religious practices, while encouraging Han Chinese settlement in these border regions, Leibold says.

Under Xi, these policies of "settler colonialism" have been pursued more aggressively, he says.

In 2017, the Chinese government launched a major crackdown on the Uyghur population in Xinjiang, leading to the mass detention of Uyghurs and other Muslim minorities in prison-style "re-education" camps.

Between 2020 and 2023, Leibold led a team at the Australian Strategic Policy Institute that, using satellite imagery, mapped more than 380 suspected detention centres across Xinjiang.

I've looked at how the Chinese state has sought to impose its power and norms over the peoples of the borderlands

In addition to the maps, the researchers produced a comprehensive governance chart and six reports detailing human rights abuses in the region, work that attracted international attention and led to policy changes.

"My research has helped to inform the public, lawmakers, media and politicians about the policies and real-world impacts of the Chinese Communist Party's settler colonial project," he says.

It is research that has also come at personal cost, as it is no longer safe for him to travel to China and his colleagues and friends have been questioned by security services in China.

"After documenting the Uyghur detention camps and forced labour practices I was denied a visa to China, effectively preventing me from conducting on-the-ground research," he says.

"I've spent more than a decade of my life in China, so it's a pity. But that's the price I had to pay for being critical of the party's policies."

Leibold stresses that such colonial resettlement and assimilation policies are not unique to China and many Western countries have a history of settler colonialism.

"But modern-day concentration camps are an extreme method of dealing with resistance," he says.

What troubles him most is what the future holds for minority cultures on the margins of Chinese society.

"I fear that in decades to come, the next generation of Uyghurs or Tibetans will lose their languages, much of their culture, religion and traditions under the current policies," he says.

Carmel Sparke

Is exercise the answer to ageing well?

Researchers at Victoria University are on the case.

We're undertaking an Australian first study on how bespoke exercise programs can slow the impact of **Motor Neurone Disease.**

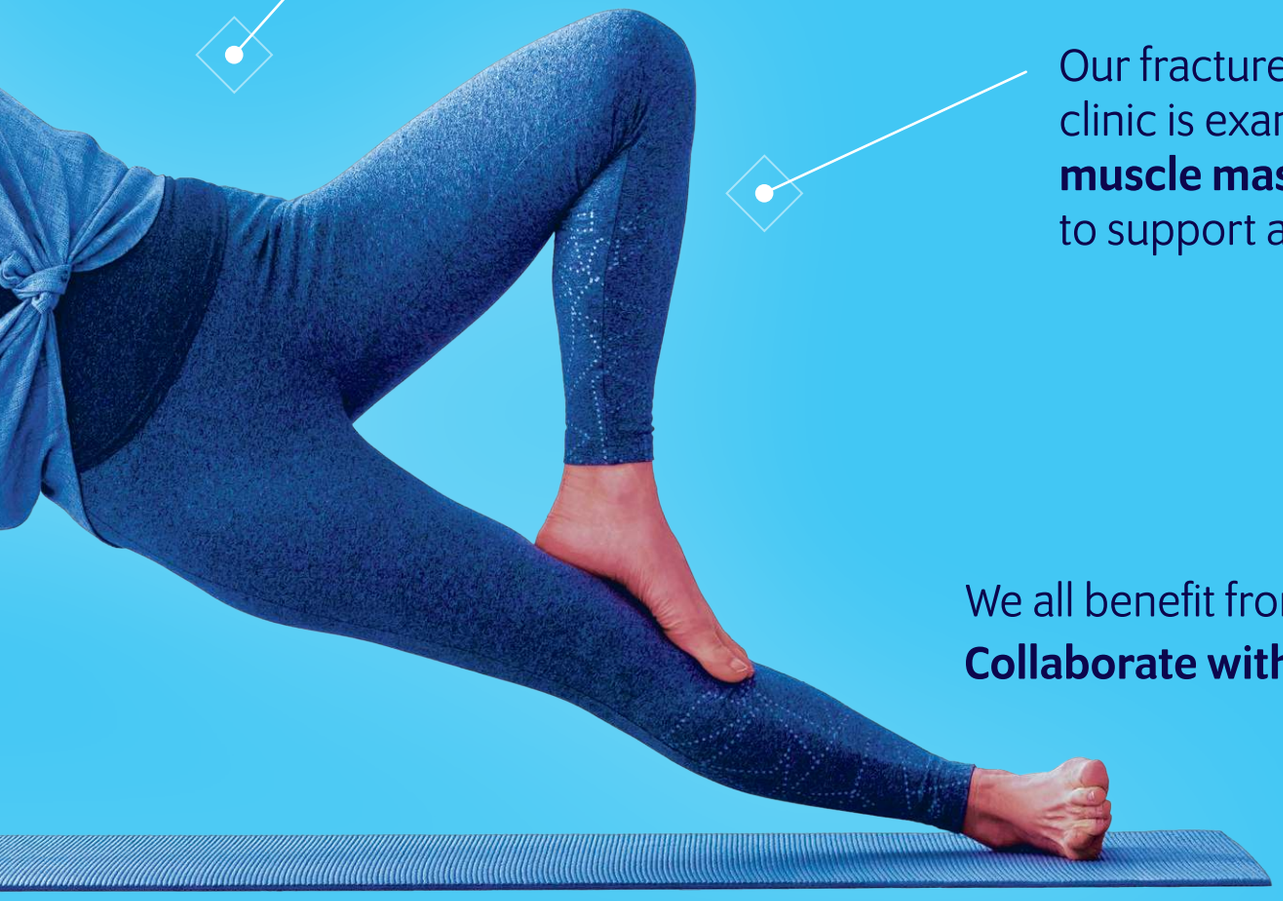
Our clinical trials are investigating the impact of intense exercise on brain health for people affected by **stroke and dementia.**

Our researchers are working with industry partners to introduce increased movement into our communities, **improving mental health and wellbeing.**

VICTORIA UNIVERSITY

Studies at our unique Sleep Hotel are showing the link between **exercise and improved sleep and health** outcomes.

Maximising technology and AI, **we are designing exoskeletons** to help our ageing communities stay active.



Our fractures and falls clinic is examining the **muscle mass needed** to support ageing bodies.

We all benefit from ageing well.
Collaborate with us

The Health & Medical Sciences list is supported by Victoria University

Health & Medical Sciences
Australia's research field leaders

Here are the top researchers and institutions in the 66 fields of health and medical sciences

Addiction
Field leader: Daniel King, Flinders
Lead institution: Uni of Queensland

AIDS & HIV
Field leader: Benjamin Bavinton, UNSW Sydney
Lead institution: UNSW Sydney

Alternative & Traditional Medicine
Field leader: Amie Steel, UTS
Lead institution: Western Sydney

Anaesthesiology
Field leader: Paul Myles, Monash
Lead institution: Monash

Audiology, Speech & Language Pathology
Field leader: Robert Eikelboom, Ear Science
Lead institution: Uni of Queensland

Bioethics
Field leader: Bridget Pratt, ACU
Lead institution: Uni of Sydney

Cardiology
Field leader: Prashanthan Sanders, Adelaide
Lead institution: Monash

Child & Adolescent Psychology
Field leader: Natasha Magson, Macquarie
Lead institution: Deakin

Clinical Laboratory Science
Field leader: Tony Badrick, RCPAQAP
Lead institution: NSW Health

Communicable Diseases
Field leader: Monica Slavin, Peter Mac
Lead institution: UNSW Sydney

Critical Care
Field leader: Naomi Hammond, George Institute
Lead institution: Monash

Dentistry
Field leader: Ove Peters, Uni of Queensland
Lead institution: Uni of Queensland

Dermatology
Field leader: Rod Sinclair, Uni of Melbourne
Lead institution: QIMR Berghofer

Developmental Disabilities
Field leader: Julian Trollor, UNSW Sydney
Lead institution: La Trobe

Diabetes
Field leader: Dianna Magliano, Monash
Lead institution: Monash

Emergency Medicine
Field leader: Zsolt Balogh, Uni of Newcastle
Lead institution: Monash

Endocrinology
Field leader: Peter Ebeling, Monash
Lead institution: Monash

Epidemiology
Field leader: Joanne McKenzie, Monash
Lead institution: Monash

Gastroenterology & Hepatology
Field leader: Jacob George, Uni of Sydney
Lead institution: Uni of Sydney

Genetics & Genomics
Field leader: Grant Montgomery, Uni of Queensland
Lead institution: Uni of Queensland

Gerontology & Geriatric Medicine
Field leader: Henry Brodaty, UNSW Sydney
Lead institution: Uni of Sydney

Gynaecology & Obstetrics
Field leader: Fabricio da Silva Costa, Griffith
Lead institution: Monash

Health & Medical Sciences (general)
Field leader: Benn Sartorius, Uni of Queensland
Lead institution: Monash

Heart & Thoracic Surgery
Field leader: Paul Bannon, Uni of Sydney
Lead institution: Monash

Haematology
Field leader: Emmanuel Favaloro, NSW Health
Lead institution: Peter Mac

Hospice & Palliative Care
Field leader: Lauren Breen, Curtin
Lead institution: Flinders

Continued on Page 34

FOCUS ON

Daniel King
Flinders University
Field leader in Addiction

What began with bulky arcade machines in game parlours has evolved into immersive, realistic online worlds that players can access with a tap on a smartphone.

Daniel King, a leading researcher in gaming addiction, says millions enjoy gaming as a recreational pastime, but for some, it has become an addiction. Young males are most commonly affected, Addiction can affect education, career prospects

and relationships. "The big picture of our research is trying to understand how people become hooked on digital technologies, particularly gaming, gambling and social media," says King, a clinical psychologist and a professor at Flinders University.

"What are the factors that drive problems with gaming for some people? What are the most effective ways to identify, prevent and respond to these issues? That's the big challenge we have now and will continue to have in the future as digital tech evolves."

King first became interested in the field at university in the early 2000s, just as online gaming was taking off, noticing the huge appeal gaming had for his fellow students.

When he did his PhD in 2006 at the University of Adelaide, his supervisor Paul Delfabbro, a professor in psychology, had an interest in gambling research and the pair continued to collaborate, in part because there was so much crossover between the two disorders – gambling and gaming.

In our surveys we found that people were consistently giving up sleep to play

Since then, games have become more immersive, more social, more connected – and far more portable, King says.

In the 1980s, the activity took place in arcade parlours, but by the 1990s, the rise of home consoles brought games into the family living room, then the teenage bedroom.

"Once it went online, around the early 2000s, I think that's when people really started to make it more a part of their life," King says. "These games offered players a new identity and new friendships in 24/7 living worlds, essentially."

Over the past 15 years, so-called "massively multiplayer online games" have become enormously popular, allowing players to create characters, develop personas and interact with others in virtual environments across the globe.

These games come in a huge variety, supported by large online communities. Players collaborate and compete to complete quests, problem-solve or optimise their chances.

A recent major innovation has been the rise of loot boxes and microtransactions, which are opportunities to continuously spend small amounts of real money in the game, which has the potential for financial harms similar to gambling, King says.

In 2019, the World Health

Continued on Page 34

Health & Medical Sciences continued

Supported by Victoria University


Daniel King

Continued from Page 32

Organisation officially recognised gaming addiction as a disorder. King says it affects between 1 and 3 per cent of the population. Males are four times more likely to report problem gaming than females.

A key sign a person may have a disorder is that they increasingly prioritise gaming over other activities. "In our surveys, we found that people were consistently giving up sleep to play," he says. "It then affects their mood, concentration at school or work or study, and overall performance, and then gaming becomes an appealing escape from these issues, creating a vicious cycle."

King's current research focus is on creating practical tools to support parents of teenagers affected by problem gaming, and to develop resources for public health bodies.

In 2023, King's team evaluated the mental health and bullying impact of a South Australian government ban on mobile phone use by students at school. His team now plans to study the federal government's ban on social media for under-16s, planning to run surveys before and after the policy's introduction.

"We're hoping our research provides useful insights into the personal and social impacts of digital technologies, so that families and governments have useful information and ways to effectively address these growing issues," he says.

Carmel Sparke

Continued from Page 32

Immunology
Field leader: Robyn O'Hehir, Alfred Health
Lead institution: Uni of Melbourne

Molecular Biology
Field leader: Attila Horvath, Peter Mac
Lead institution: Monash

Natural Medicines & Medicinal Plants
Field leader: Ian Cock, Griffith
Lead institution: Uni of Queensland

Neurology
Field leader: Tissa Wijeratne, Western Health
Lead institution: Monash

Neurosurgery
Field leader: Andrew Gogos, St Vincent's Health
Lead institution: Monash

Nuclear Medicine, Radiotherapy & Molecular Imaging
Field leader: Michael Hofman, Peter Mac
Lead institution: Peter Mac

Nursing
Field leader: Debra Jackson, Uni of Sydney
Lead institution: Uni of Wollongong

Nutrition Science
Field leader: Elizabeth Isenring, Bond
Lead institution: Deakin

Obesity
Field leader: Paul Burton, Monash
Lead institution: Uni of Sydney

Oncology
Field leader: Sherene Loi, Peter Mac
Lead institution: Peter Mac

Ophthalmology & Optometry
Field leader: Robyn Guymer, Uni of Melbourne
Lead institution: Uni of Melbourne

Oral & Maxillofacial Surgery
Field leader: Martin Batstone, Uni of Queensland
Lead institution: Uni of Melbourne

Orthopaedic Medicine & Surgery
Field leader: Ian Harris, UNSW Sydney
Lead institution: UNSW Sydney

Otolaryngology
Field leader: Richard Harvey, Macquarie
Lead institution: Macquarie

Pain & Pain Management
Field leader: Michele Sterling, Uni of Queensland
Lead institution: Uni of Sydney

Pathology
Field leader: Anthony Gill, Uni of Sydney
Lead institution: Uni of Sydney

Paediatric Medicine
Field leader: Nigel Curtis, RCH Melbourne
Lead institution: RCH Melbourne

Pharmacology & Pharmacy
Field leader: Kamal Dua, UTS
Lead institution: Uni of Queensland

Physical Education & Sports Medicine
Field leader: Emmanuel Stamatakis, Uni of Sydney
Lead institution: Uni of Sydney

Physiology
Field leader: Jiake Xu, UWA
Lead institution: Uni of Queensland

Plastic & Reconstructive Surgery
Field leader: David Hunter-Smith, Monash
Lead institution: Monash

Pregnancy & Childbirth
Field leader: Caroline Homer, Burnet Institute
Lead institution: Monash

Primary Health Care
Field leader: Barbara Mintzes, Uni of Sydney
Lead institution: Uni of Sydney

Psychiatry
Field leader: Helen Christensen, UNSW Sydney
Lead institution: Uni of Melbourne

Psychology
Field leader: Kit Double, Uni of Sydney
Lead institution: Uni of Melbourne

Public Health
Field leader: Corneel Vandelanotte, CQUni
Lead institution: Uni of Sydney

Pulmonology
Field leader: Jodie Simpson, Uni of Newcastle
Lead institution: Monash

Radiology & Medical Imaging
Field leader: Gregory Scalia, Uni of Queensland
Lead institution: Uni of Sydney

Rehabilitation Therapy
Field leader: Jennie Ponsford, Monash
Lead institution: Monash

Reproductive Health
Field leader: Ben Willem Mol, Monash
Lead institution: Monash

Rheumatology
Field leader: Catherine Hill, Adelaide
Lead institution: Monash

Social Psychology
Field leader: Jolanda Jetten, Uni of Queensland
Lead institution: Uni of Queensland

Surgery
Field leader: Dieter Weber, UWA
Lead institution: WA Health

Toxicology
Field leader: Bryan Fry, Uni of Queensland
Lead institution: Uni of Queensland

Transplantation
Field leader: Adam Philipoff, WA Health
Lead institution: Uni of Sydney

Tropical Medicine & Parasitology
Field leader: Una Ryan, Murdoch
Lead institution: Uni of Melbourne

Urology & Nephrology
Field leader: Jeremy Grummet, Monash
Lead institution: Uni of Sydney

Vascular Medicine
Field leader: Aletta Schutte, UNSW Sydney
Lead institution: Monash

Veterinary Medicine
Field leader: Clive Phillips, Curtin
Lead institution: Uni of Sydney

Virology
Field leader: Leon Caly, Uni of Melbourne
Lead institution: Monash

Why ageing well is everybody's business

Professor Andy Hill

We are at a critical moment in our nation's health story. Almost five million Australians are aged 65 years or over and two-thirds of the population are living with at least one chronic disease – which is only exacerbated as we age.

Ageing well is no longer just a nice to have, but an economic, social and cultural imperative.

State and federal governments spent more than $252.5 billion on health goods and services in 2022-23. Victoria alone is expected to spend more than $30 billion on health in 2026 and the costs associated with caring for our ageing population make up a large chunk.

And that's just the financial costs. The burden on our health systems, our communities and our families is real.

Ageing well means maintaining good physical, mental and social wellbeing for an increasing number of the Australian population. If we can achieve this, getting older will mean greater independence and social engagement, extended working options and a reduction in national health costs.

Exercise as medicine may be the key.

That's what our research at Victoria University is telling us. We are looking at the role of exercise in reducing the impact of motor neurone disease, which is now being diagnosed in two new people every day – primarily in those over 50 years. In this growing area of work, we have a team analysing the link between exercise and the slowing of damage to the brain caused by Alzheimer's disease.

Our researchers are working to demonstrate the critical role of muscle mass in keeping us active and healthy as we age. VU is also expanding its work on increased exercise and sleep quality and how movement might cleanse the brain when sleep is difficult to get.

Falls are a leading cause of hospitalisations for our ageing population, so tackling frailty is a research priority at VU. Like smart shoes that can predict a fall, or wearable external limbs that improve movement patterns and reduce the risk of tripping.

There are of course mental health benefits. Our research shows that even small amounts of regular movement can increase overall wellbeing. That's why VU is working with national mental health bodies, such as Orygen, advocating for greater inclusion of physical activity as a therapeutic approach in treatment.

VU, based in Melbourne's west, is proud to be part of one of the most diverse cultural communities in the country. This area is home to residents from more than 100 countries speaking more than 80 different languages. This has been a driver for improving exercise and rehabilitation among these communities with chronic disease.

We expect our impact to accelerate as we move into one of the largest new hospitals in the country. VU has invested $63 million in a research and teaching facility at the new Footscray Hospital in Melbourne, doubling the number of clinical trials we can run to fast track our work from the lab to the community. This expansion will support the work of more than 300 researchers and over 400 PhD and masters by research students.

From getting our population AI-ready to future-proofing our homes through green construction, VU is committed to shaping healthy communities. This is work that is happening now across our other research themes: innovating education and future-proofing Australia's workforce; transforming communities through policy, practice and governance, and smart, sustainable and liveable cities. Embedded across everything is our commitment to protecting country and First Nations knowledge.

Victoria University can't do this alone. We are proud of our industry ties and we welcome partners who are just as passionate about research with local impact and global reach. Join us as we work to shape the next chapter in health.

Together, let's help all Australians grow older with confidence.

Professor Andy Hill
Deputy Vice-Chancellor Research and Impact
Victoria University

VICTORIA UNIVERSITY

We're helping you age well.

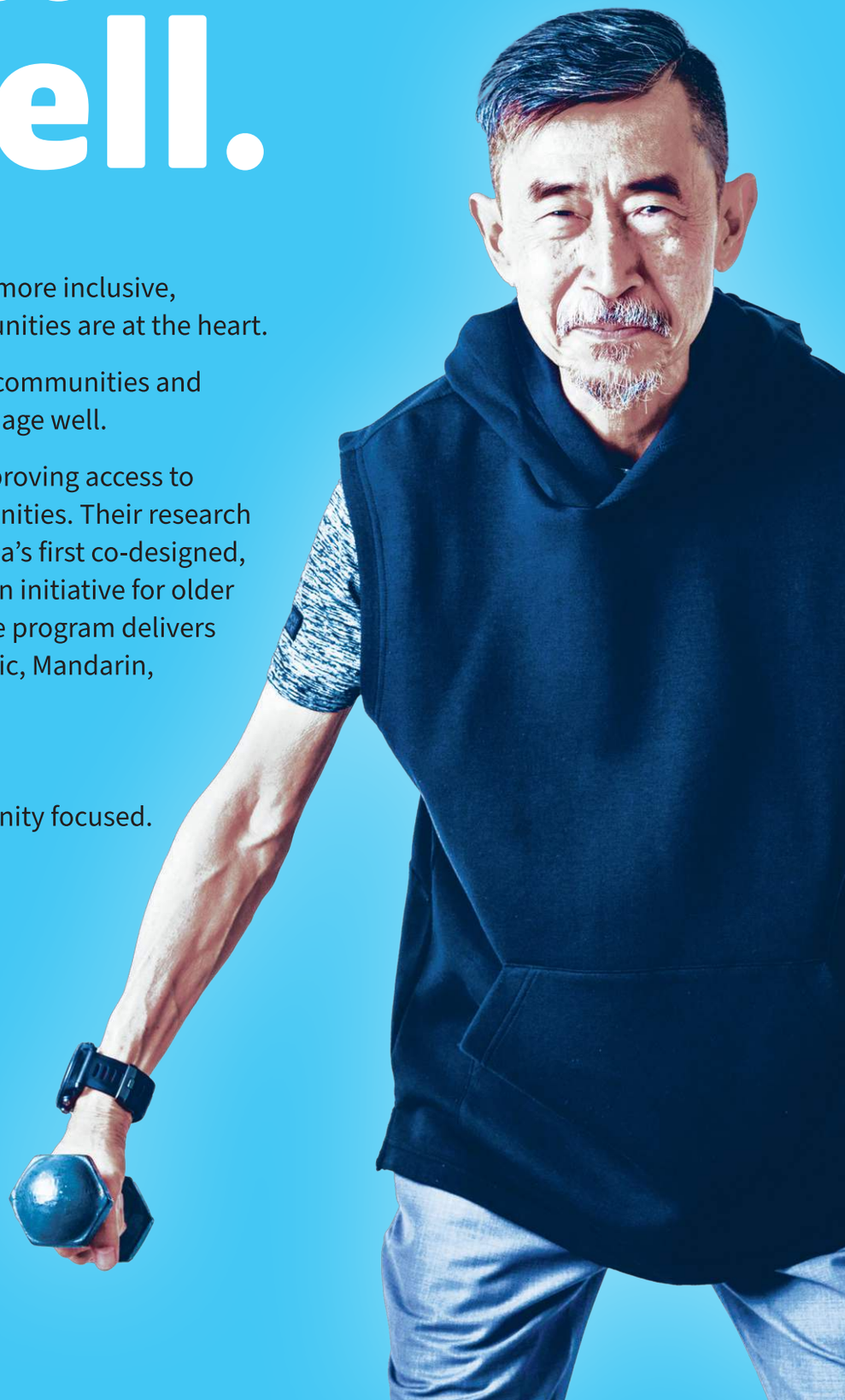
At Victoria University (VU) we are shaping a more inclusive, sustainable and resilient future. And communities are at the heart.

Young or old, healthy people make healthy communities and VU researchers are committed to helping us age well.

Professor Clarice Tang and her team are improving access to health services for our multicultural communities. Their research has led to the **MINDSET program** — Australia's first co-designed, culturally appropriate bone health education initiative for older people from multicultural communities. The program delivers practical, evidence-based education in Arabic, Mandarin, Vietnamese and English.

Next steps? Community rollout nationwide.

VU Research world-leading, always community focused.



We're making an impact.
Collaborate with us.

Business, Economics & Management

Australia's research field leaders

These are the top researchers and institutions in the 16 fields of business, economics & management

FOCUS ON

Sara Quach Thaichon

Griffith University

Field leader in Marketing

As a researcher in marketing, Sara Quach Thaichon works in a world where virtual social media influencers amass millions of followers and chatbots have become advisers, problem solvers and even friends.

Artificial intelligence and digital technology are transforming how companies connect with customers and build consumer relationships.

"The core of my work is how people interact with brands in a world that's increasingly digital," says the Griffith University associate professor in marketing.

"I'm especially interested in how technologies like AI, chatbots, social media, and virtual reality change the way people shop, create value and stay loyal."

At the same time, her research explores the darker side of digital technology, examining risks such as privacy concerns, so that the technologies can be used more responsibly and ethically.

"Data is like the bloodline of all of the technologies and when we exchange any information with them, we are giving away our data. That tension between privacy and data has become a central pillar of my research," Thaichon says.

She began her research career by examining relationships between companies and customers, looking at how brand loyalty fluctuates, which became the focus of her PhD, completed at Swinburne University of Technology.

"After a while, I became more interested in the relationship between humans and technology – which is still fundamentally about relationships," Thaichon says.

"It's been fascinating to see how technology is changing the landscape and the way we build and sustain relationships between the company and the customer, among customers, and even between customers and technology."

Today, the key question her research tries to answer is how to use marketing technologies, such as AI, to create value and build long-term relationships without compromising people's privacy, autonomy or wellbeing.

Her latest research involves leading a project funded by the Australian Research Council looking at the impact of virtual influencers on young Australians, particularly in terms of their body image and self esteem.

Virtual influencers are AI-generated personas or chatbots that have been built by companies or a third party to interact with consumers. Some of the more popular ones have gained millions of followers on platforms such as Instagram.

"They're not real. They can sing, they can talk, they have a very realistic appearance. Usually there is a disclosure in the bio stating that this is an AI influencer," she says.

"But it comes with a problem because, with virtual influencers, we can do anything to their appearance to make them as perfect, as flawless, as we want them to be. This can place pressure on followers, and could lead to issues such as body image dissatisfaction, depression, or even eating disorders."

Thaichon and her team will also examine ways to address these potential harms, looking at how to make virtual influencers more inclusive and diverse.

"Overall, I hope my research helps businesses build ethical and sustainable relationships with customers, while guiding policymakers on responsible regulation of digital marketing and AI," she says.

"Ultimately, I want my work to support a future where technology enhances people's lives and choices, rather than manipulates or restricts them."

Carmel Sparke

Accounting & Taxation
Field leader: John Dumay, Macquarie
Lead institution: Macquarie

Business, Economics & Management (general)
Field leader: Anastasios Panagiotelis, Monash
Lead institution: Monash

Development Economics
Field leader: Lisa Cameron, Uni of Melbourne
Lead institution: Uni of Melbourne

Economic History
Field leader: Claire Wright, UTS
Lead institution: Uni of Wollongong

Economic Policy
Field leader: Samar Fatima, RMIT
Lead institution: Monash

Economics
Field leader: Kaveh Majlesi, Monash
Lead institution: Monash

Educational Administration
Field leader: Jessica Holloway, ACU
Lead institution: Edith Cowan

Emergency Management
Field leader: Jonatan Lassa, Charles Darwin
Lead institution: Charles Darwin

Entrepreneurship & Innovation
Field leader: Per Davidsson, QUT
Lead institution: QUT

Finance
Field leader: Md Akhtaruzzaman, ACU
Lead institution: Monash

Game Theory & Decision Science
Field leader: Anton Kolotilin, UNSW Sydney
Lead institution: Monash

Human Resources & Organisations
Field leader: Sharon Parker, Curtin
Lead institution: Monash

International Business
Field leader: Dinh Phan, La Trobe
Lead institution: Monash

Marketing
Field leader: Sara Quach Thaichon, Griffith
Lead institution: Griffith

Strategic Management
Field leader: Ashish Malik, UNSW Sydney
Lead institution: Griffith

Tourism & Hospitality
Field leader: Mostafa Rasoolimanesh, Edith Cowan
Lead institution: Griffith

Is Australia ready for the third quantum revolution?

UNSW
SYDNEY

Test your quantum literacy

1 **The concept that a quantum object can exist in two states at once is called…?**

a) The Zeno effect
b) Superposition
c) Decoherence
d) Entanglement

2 **Which of the following is a potential application of quantum computers?**

a) Breaking modern encryption methods by factoring large numbers efficiently.
b) Simulating complex molecular interactions for drug discovery.
c) Optimising large-scale logistical problems, such as traffic flow or supply chains.
d) All of the above.

3 **Which of the following best describes how quantum computers differ from classical computers?**

a) Quantum computers use qubits that can exist in superposition, allowing them to explore many solutions simultaneously.
b) Quantum computers are much smaller than classical computers.
c) Quantum computers store information in binary bits, while classical computers use qubits.
d) Quantum computers are faster than classical computers for all types of problems.

4 **Can quantum entanglement be used to transport objects in a manner similar to the "beaming" transporter device in Star Trek?**

a) Yes, it allows for the physical teleportation of objects.
b) No, it only allows for the transfer of information about the state of particles, not the physical objects themselves.
c) Yes, but only for objects smaller than atoms.
d) No, quantum entanglement is purely theoretical and has no practical applications.

CRICOS Provider Code: 00098G

Answers: 1.b, 2.d, 3.a, 4.b

The Physics & Mathematics list is supported by UNSW Sydney

Physics & Mathematics
Australia's research field leaders

Here are the top researchers and institutions in the 21 fields of physics and mathematics

Acoustics & Sound
Field leader: Thushara Abhayapala, ANU
Lead institution: UTS

Algebra
Field leader: Kevin Coulembier, Uni of Sydney
Lead institution: ANU

Astronomy & Astrophysics
Field leader: Tamara Davis, Uni of Queensland
Lead institution: ANU

Computational Mathematics
Field leader: Ricardo Ruiz Baier, Monash
Lead institution: UNSW Sydney

Condensed Matter Physics & Semiconductors
Field leader: Damien Hicks, Swinburne
Lead institution: ANU

Discrete Mathematics
Field leader: David Wood, Monash
Lead institution: Monash

Electromagnetism
Field leader: Jay Guo, UTS
Lead institution: UTS

Fluid Mechanics
Field leader: Nicholas Hutchins, Uni of Melbourne
Lead institution: Uni of Melbourne

Geometry
Field leader: David Baraglia, Adelaide
Lead institution: ANU

Geophysics
Field leader: Mark Hoggard, ANU
Lead institution: Curtin

High Energy & Nuclear Physics
Field leader: Jordan Nash, Monash
Lead institution: Monash

Mathematical Analysis
Field leader: Yihong Du, UNE
Lead institution: UNSW Sydney

Mathematical Optimisation
Field leader: Matthew Tam, Uni of Melbourne
Lead institution: Uni of Sydney

Mathematical Physics
Field leader: Ian Marquette, La Trobe
Lead institution: Uni of Melbourne

Nonlinear Science
Field leader: Tonghua Zhang, Swinburne
Lead institution: RMIT

Optics & Photonics
Field leader: David Moss, Swinburne
Lead institution: Swinburne

Physics & Mathematics (general)
Field leader: Tony Murphy, CSIRO
Lead institution: Uni of Sydney

Probability & Statistics with Applications
Field leader: Timothy Neal, UNSW Sydney
Lead institution: Monash

Pure & Applied Mathematics
Field leader: Ahad Zehmakan, ANU
Lead institution: Monash

Spectroscopy & Molecular Physics
Field leader: Lars Goerigk, Uni of Melbourne
Lead institution: UNSW Sydney

Thermal Sciences
Field leader: Xiaolin Wang, Uni of Tasmania
Lead institution: UNSW Sydney

FOCUS ON

Jay Guo
University of Technology Sydney
Field leader in Electromagnetism

Jay Guo has spent a lifetime chasing electromagnetic waves, an interest that started in his childhood, building amateur radio sets to now working at the forefront of 6G technologies.

As a university student in Xi'an, China, in the late 1970s, Guo loved listening to the Voice of America, a radio program that connected him with the world.

"That was a great way to learn English," says Guo, now a distinguished professor at the University of Technology Sydney.

"I had always been fascinated by how electromagnetic waves could radiate into the air and propagate across such vast distances."

After specialising in electromagnetic engineering during his masters and PhD studies, Guo moved to Britain, first as an academic researcher working on a type of antenna called Fresnel zone antennas.

He then became an industrial R&D leader on 3G networks with Fujitsu, Siemens and NEC.

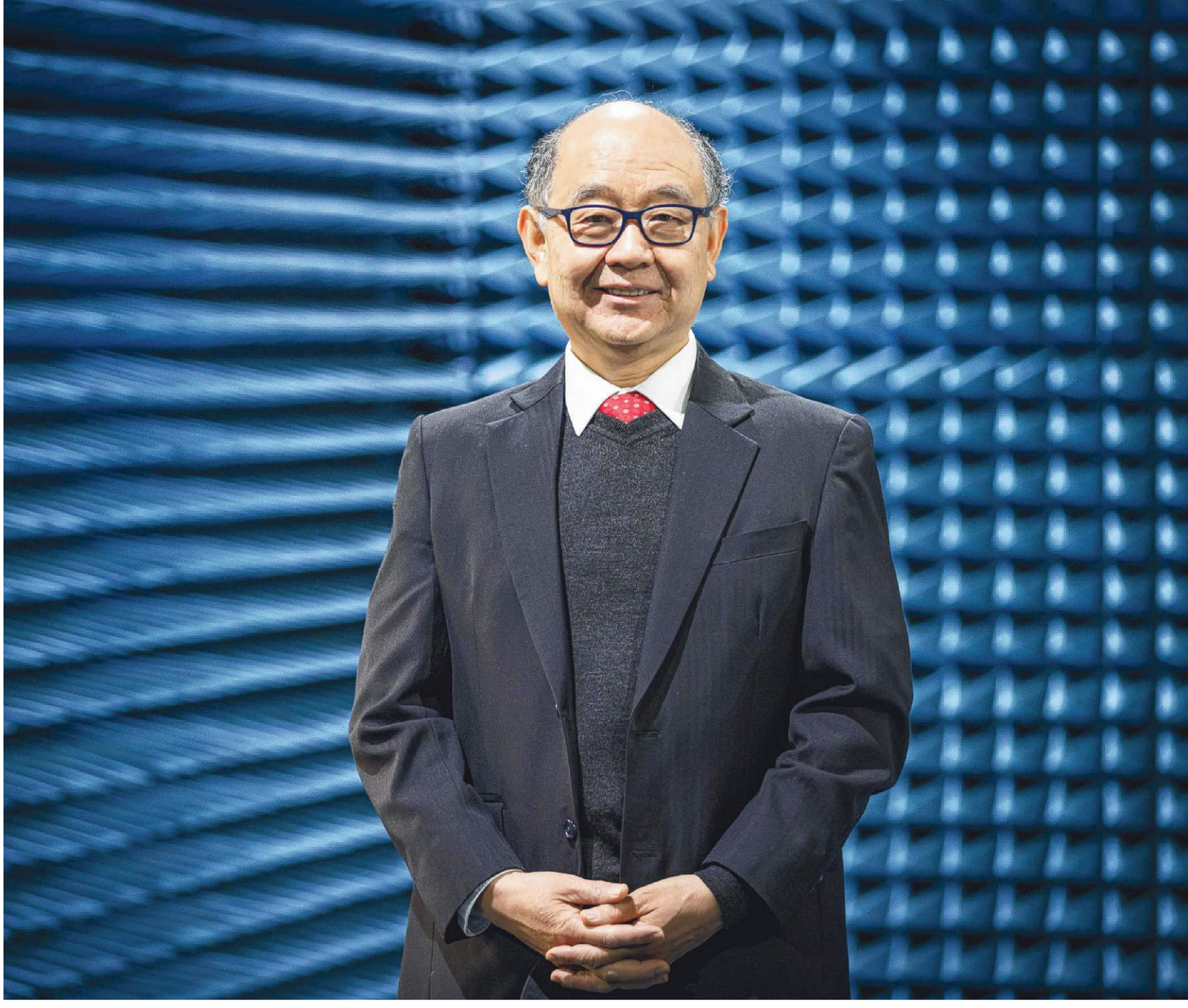
He later joined CSIRO in Australia in 2005 as a research director, continuing to work on wireless technologies.

His is currently pioneering research on 5G and 6G networks, focusing on network sensing for environment monitoring, an innovative technology to better predict flooding and storms, potentially saving lives and mitigating the economic impacts of such events.

"Electromagnetism underpins everything we do," he says.

As founding director of the Global Big Data Technologies Centre at UTS in Sydney, Guo leads research in antennas, wireless communications, networking and machine learning.

The environmental sensing work aims



Andy Roberts

to use the existing wireless communications infrastructure to obtain rainfall and water movement data, and an AI-driven digital twin for forecasting.

The digital twin is a real time, virtual replica of towns and areas, to assess the impacts of flooding as it occurs.

Guo believes the technology they have developed will significantly reduce the impact of disasters such as the 2022 flood that swept through Eugowra, a rural community in central western NSW.

Described as an "inland tsunami", floodwaters killed two people and destroyed most of the town when a local creek peaked at more than 11 metres.

"In flooding situations, even 10 minutes can mean the difference between life and death as knowing when to evacuate is essential, Guo says. "Yet the current prediction tools used by SES and other emergency services often lag behind real-time events.

"We've created an intelligent flood and storm intelligence platform that includes innovative algorithms for rainfall and water level detection. It then visualises and predicts flooding in a localised and real-time manner."

The other part of Guo's research focuses on developing low-cost and energy-efficient antennas for 6G, which are expected to arrive in five years.

One of his proudest achievements was having one of his antenna papers win the prestigious IEEE APS Sergei A. Schelkunoff Transactions Prize Paper Award in 2023 for the invention of a novel multiple beam-forming antenna, called the GJC matrix.

In future projects, he plans to enhance their environmental sensing models, so the technology will be ready to be used across NSW in the next three to five years.

"Apart from storms and floods, other applications include small traffic management, smart mining, precision agriculture and tsunami," he says.

"I believe our technology will significantly enhance the resilience of Australia and the world against natural disasters, and reduce the economic and societal impacts of climate change."

Carmel Sparke

UNSW is in the running to develop the world's first error-corrected quantum computer in silicon.

UNSW
SYDNEY

Professor Andrea Morello

UNSW leads quantum technology revolution for national benefit

Mathematics and physics are the language and the tools of the physical world, and the pulsating heart of the deep tech revolution that is taking place in the field of quantum technologies.

Quantum computers promise to enable high-precision simulations and calculations for key problems in the fields of global energy and materials, pharmaceuticals and medical products, the financial industry, and travel, transport, and logistics. The 2025 McKinsey Quantum Technology Monitor forecasts a global economic value of quantum computing of between $US900 billion ($1.38 trillion) and $US2 trillion by 2035.

This is a sector where Australia enjoys a phenomenal first-mover advantage, a highly skilled quantum workforce, and an enviable concentration of quantum start-ups. Our challenge now is to bring these advantages to full fruition, by creating a globally competitive quantum industry, rooted within an ecosystem that keeps generating breakthrough science, training specialists workers and that delivers benefits for the broader society.

Between 1998 and 2001, two groundbreaking ideas were put forward in Australia to create practical, realistic quantum computers using silicon or photons. The Australian Research Council Centre of Excellence for Quantum Computation Technology, headquartered at UNSW, was established in 2003 to synergistically develop these exciting directions. This initiative delivered most of the early scientific breakthroughs that proved the viability of building quantum computers using silicon chips, or using beams of light to encode information.

At UNSW, we recognised early the strategic advantage of building quantum technologies on silicon – a platform already central to the trillion-dollar semiconductor industry that powers the modern information era.

Our researchers went on to achieve a string of world firsts: quantum bits in silicon, universal quantum operations, high-fidelity quantum logic and atomic-scale device fabrication. These breakthroughs demonstrated that silicon-based quantum devices are a competitive platform for the construction of large-scale quantum computers.

Just as important, these efforts helped grow a new generation of (Australian) scientists and engineers who are now global leaders. Their success shows the long-term value of investing in young talent capable of building technologies that have never existed before.

Building on this, some of us took the matter even further by establishing, four years ago, the world's first bachelor's degree in quantum engineering. This revolutionary educational offering adopts the highest standards of maths and physics (especially quantum, of course) education and blends them with the rigorous training in engineering design that consistently made the School of Electrical Engineering & Telecommunications at UNSW first in the country and among the top 50 in the world.

Today, UNSW is a cauldron of academic excellence and innovation in quantum science and engineering. We host two quantum start-up companies on our campus, Diraq Pty Ltd and Silicon Quantum Computing Pty Ltd, and a lively cohort of academics who operate at the international forefront of the quantum computing discipline. This concentration of basic research and industry translation gives UNSW a unique edge in the fast-moving world of quantum.

Our university seeks to remain a world leader in the research and workforce training that will enable the construction of utility-scale quantum computers – that is, computers capable of solving problems whose economic value exceeds the cost of developing and operating the device itself. To get there, we need to: (i) drastically improve the performance of the underlying physical hardware, reducing the occurrence of errors that invalidate the outcome of the quantum computation; (ii) invent new forms of quantum software that can run using a much-reduced amount of hardware resources, and (iii) develop methods to interconnect quantum computers, both at short and long distances, to benefit from the multiplicative power of quantum computation.

These are not standard engineering tasks: they require the invention and application of new physics, and the capacity to translate this new physics into functional, economical devices. They also require a joint effort across academia, industry and government, ensuring that none of the aspects of this complex challenge are left unaddressed, and that we continue producing a skilled workforce capable of pushing the next frontier.

The construction of a utility-scale quantum computer is one of the most exciting challenges ever faced by humankind. We are on the brink of creating a machine that has no equivalent in the universe. It has the potential to unlock unprecedented computational abilities that can give us new materials, medicines, catalysts and energy storage, and it affects vast sectors across finance, mobility and data security and many more we cannot even fathom today.

UNSW is intent on maintaining and expanding its global leadership in this field, and on playing its part in ensuring that all Australians will benefit from the quantum technology revolution that we are helping create.

Andrea Morello
Quantum Engineering Professor
UNSW Sydney

Barriers that stifle our nation's innovation

Peter Høj

David Lloyd

Improving productivity has been on the national agenda for some time – and with good reason. Data shows that Australia continues to lag behind other wealthy countries in the post-pandemic era. But the path to progress is clear: Backing in a more robust research approach will drive greater innovation and growth.

The university sector currently accounts for around one-third of Australia's R&D spend, and it is rapidly moving away from the formulaic ways of the past. We are embracing the larger synergistic roles that both basic and applied research can play across the public and private sectors by working across the full value chain.

Through research translation, implementation and commercialisation, we are providing the essential bridge between research ambition and generating real societal impact and economic gains. However, more can be done.

Betterment will come through policy settings that further incentivise businesses to invest in nation-critical research and deepening the collaborations between industry and contemporary academia to tackle the big issues like the climate crisis, pollution and resource scarcity. Imagine that.

Through the creation of Australia's newest major university, we see a way for our merged research engine to accelerate at pace and be considerably sleeker and more integrated than is currently the norm.

By combining the experience, specialist infrastructure and resources of our founding institutions – including over $500 million in external research revenue per annum and about 7000 external collaborating organisations – our aim is to become Australia's most connected university across sectors and geographies. In this respect, size matters because complex solutions require expertise across multiple intersecting domains.

Our entrepreneurial model seeks to challenge those self-imposed fictional boundaries, borders and barriers that are stifling our nation's innovation capacity. As past CEO of the Australian Research Council and chair of the Irish Research Council respectively, we know first-hand the power that ingenuity can bring.

Adelaide University will not be defined (or confined) by the structures that enable it. We will provide an open gateway, partnering where it matters. This requires agility and the ability to simplify and strengthen ways to engage, breaking down perceived institutional walls.

This willingness to engage with purpose has already seen our researchers flex their strengths. In the latest round of Australia's Economic Accelerator Grant Scheme, the combined performance of our legacy institutions ranks number one in the country, demonstrating the diversity of our joint research portfolio and our capability of turning concepts into commercial outcomes.

This mindset and operational shift is coupled with a sharpened research lens to catalyse innovation through signature themes, designed to co-create integrated solutions across priority focuses.

One of the greatest multigenerational challenges we face is ensuring a cleaner future. Through our commitment to enabling a Sustainable Green Transition, our research will work to protect and restore the environment while also improving social prosperity.

Anchored by South Australia's strategic advantage, Adelaide University will leverage the state's unique position as a "natural laboratory" to improve global sustainability. And we are already making significant gains.

Our researchers are working to unlock technology-driven solutions to accelerate a low-carbon transformation for heavy industry given the vitality of steel, aluminium and cement to both the national and global economy. Our applied research has also converted the sludge from treating everyday drinking water into eco-friendly concrete.

In a first for green hydrogen reactor technology, we have launched a new research pilot plant on campus through collaboration and co-investment with industry. We are changing the game through photocatalysis, seeking to harness the sun's energy to directly deliver scalable, low-cost, renewable hydrogen sources.

Together with Shanghai Jiao Tong University, we are advancing the design of next generation renewable energy systems, maximising Australia's natural coastline and resource for sustainable offshore energy production to drive greater regional connectivity.

As leaders of the ARC's Training Centre for Battery Recycling, we are closing the gap in lithium-ion battery waste management, providing industry-led recycling solutions to support Australia's circular economy.

Locally, our researchers are seeking to understand South Australia's catastrophic algal bloom and future outbreaks and are preparing to help accelerate restoration of ecosystems to hasten recovery and rebuild natural resilience. We are also developing drought and climate resilient sheep farms and landscapes for low rainfall regions.

Partnering with one of Australia's most iconic ale producers, we are making beer more sustainable by improving cultivators and reducing the demand on energy and agriculture.

And out of this world, we are rocketing duckweed from the local River Torrens into space to test the aquatic plant and its potential as a nutrient food source for astronauts as we orbit new frontiers.

What is emerging is a new global top 100 university (ranked at 82nd, 2026 QS World University Rankings) and a differentiated member of Australia's research-intensive Group of Eight universities, delivering partnered research of scale that is nation-critical and globally relevant.

Yes, we must build our sovereign capabilities, but also the collective capabilities of our region – and world – to create a brighter future for all.

Aligned with and informed by our research capabilities, our legacy institutions have each reduced their operational emissions by around 50 per cent over the past decade through sustained investment in on-campus initiatives and the substantial decarbonisation of South Australia's electricity grid. Adelaide University will broaden these ambitions and educate future leaders in energy transition that is within reach.

Professor Peter Høj AC
Professor David Lloyd
co-Vice Chancellors of the new Adelaide University, opening in January 2026

The LIfe & Earth Sciences list is supported by Adelaide University

Life & Earth Sciences
Australia's research field leaders

Here are the top researchers and institutions in the 30 fields of life and earth sciences

Agronomy & Crop Science
Field leader: Kadambot Siddique, UWA
Lead institution: UWA

Animal Behaviour & Ethology
Field leader: Culum Brown, Macquarie
Lead institution: Macquarie

Animal Husbandry
Field leader: Peter Selle, Uni of Sydney
Lead institution: UNE

Atmospheric Sciences
Field leader: Jürgen Knauer, UTS
Lead institution: Uni of Melbourne

Biodiversity & Conservation Biology
Field leader: Nigel Stork, Griffith
Lead institution: Uni of Melbourne

Biophysics
Field leader: Stephen Wilson, Uni of Wollongong
Lead institution: Uni of Sydney

Birds
Field leader: Leo Joseph, CSIRO
Lead institution: ANU

Botany
Field leader: Rajeev Varshney, Murdoch
Lead institution: UWA

Cell Biology
Field leader: Lei Jin, Uni of Newcastle
Lead institution: Monash

Developmental Biology & Embryology
Field leader: Megan Munsie, Uni of Melbourne
Lead institution: Monash

Ecology
Field leader: Jane Elith, Uni of Melbourne
Lead institution: Uni of Melbourne

Environmental Sciences
Field leader: Nanthi Bolan, UWA
Lead institution: Uni of Queensland

Evolutionary Biology
Field leader: Bui Minh, ANU
Lead institution: ANU

Forests & Forestry
Field leader: David Forrester, CSIRO
Lead institution: Uni of Melbourne

Geochemistry & Mineralogy
Field leader: Ian Graham, UNSW Sydney
Lead institution: Curtin

Geology
Field leader: Peter Cawood, Monash
Lead institution: Curtin

Hydrology & Water Resources
Field leader: Okke Batelaan, Flinders
Lead institution: CSIRO

Insects & Arthropods
Field leader: Wee Tek Tay, CSIRO
Lead institution: CSIRO

Life Sciences & Earth Sciences (general)
Field leader: Dale Garsed, Peter Mac
Lead institution: Monash

Marine Sciences & Fisheries
Field leader: Jian Qin, Flinders
Lead institution: Uni of Tasmania

Microbiology
Field leader: Brajesh Singh, Western Sydney
Lead institution: Uni of Queensland

Mycology
Field leader: Laszlo Irinyi, NSW Health
Lead institution: Uni of Sydney

Oceanography
Field leader: Jessica Benthuysen, AIMS
Lead institution: CSIRO

Palaeontology
Field leader: Anthony Romilio, Uni of Queensland
Lead institution: Uni of Queensland

Pest Control & Pesticides
Field leader: Paul Umina, Uni of Melbourne
Lead institution: UWA

Plant Pathology
Field leader: Martin Barbetti, UWA
Lead institution: UWA

Proteomics, Peptides & Aminoacids
Field leader: David Greening, Baker
Lead institution: Murdoch

Soil Sciences
Field leader: Budiman Minasny, Uni of Sydney
Lead institution: UWA

Sustainable Development
Field leader: Carina Wyborn, ANU
Lead institution: Uni of Queensland

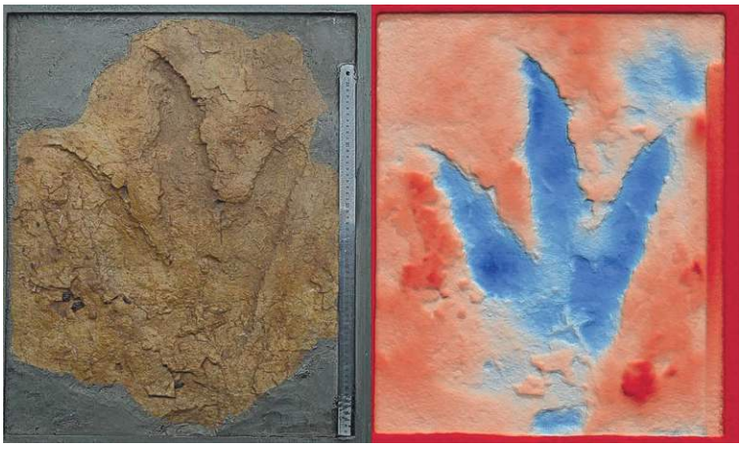
Zoology
Field leader: Adam Slipinski, CSIRO
Lead institution: CSIRO

FOCUS ON

Anthony Romilio
University of Queensland
Field leader in Palaeontology

Tourists taking in the breathtaking views of the Great Ocean Road may be unaware that a stretch of this iconic coastline is also home to at least 4000 dinosaur footprints.

Damian Kelly



A dinosaur footprint under examination by Anthony Romilio

Uncovered in recent years by citizen scientists, these ancient tracks are being analysed by Anthony Romilio, an expert in dinosaur ichnology – the study of fossilised footprints.

Using a self-designed computer tool, he has created detailed 3D models of the tracks, offering a unique window into the lives of dinosaurs that roamed the area 100 million years ago.

"With the tools I've developed, I measure every single step and run statistical tests, turning rock surfaces into testable motion data," says the part-time lecturer at the University of Queensland.

With the tools I've developed, I measure every step

"This technology reveals patterns like changes in speed, turning, limping, and group movement. These are often overlooked by the naked eye or lost in averages, but now we can see a much clearer, step-by-step picture of real dinosaur behaviour."

Despite having been named the field leader in palaeontology in four consecutive years, Romilio didn't grow up a dinosaur-obsessed kid, saying his fascination lay with animals and their history.

With a first degree in biochemistry, he worked in that area for a few years before switching to graphic design.

When an opportunity came to combine both scientific and artistic interests in a PhD on developing digital tools to analyse dinosaur footprints at the University of Queensland, he leapt at it.

He began work on writing code in Python – a programming language – to create 3D reconstructions and animations of the footprints, improving how palaeontological information was collected and interpreted.

Now he collaborates with scientists and citizen scientists around the world, who send him photos and maps of fossilised dinosaur footprints for analysis.

Using his tool, he's shown the Great Ocean Road footprints were made by small-to-medium-sized, two-legged herbivorous and carnivorous dinosaurs, although he notes the full analysis is still under way.

The footprints were first spotted in 2022 by citizen scientists Tim and Kate Wagstaff, who have since documented nearly 4000 fossilised prints on a rock platform near Apollo Bay.

Romilio's work has also made him a global expert in analysing long dinosaur trackways, which are a series of footprints left by a single animal, preserved by sediment over millions of years. The longest known trackway he is researching is close to 400 metres long.

"Traditionally, researchers avoid long trackways because they're logistically too difficult to study," he says.

"But with my coding, it doesn't matter whether it's a single print or a path a hundred metres long. It's a very powerful tool as scale is not an issue."

His research has focused on developing improved digital methods, studying longer trackways in places like Colorado and Bolivia to reconstruct detailed movements and behaviour patterns.

He also creates visual reconstructions and step-by-step animations for schools and museums, to help communities gain a better understanding and appreciation of their local prehistoric heritage.

"I go to rural and Indigenous schools every year to talk about dinosaurs in their local area," he says. "Kids love dinosaurs and they're amazed to learn that discoveries have been made just five kilometres from their homes.

"It's all about providing information and talking to different audiences in order for them to be aware of the local heritage that is beneath their feet – be it vast periods of time ago."

Carmel Sparke

Adelaide University

Demonstrating multidisciplinary research excellence

Our world-class expertise and deep industry connectivity deliver cutting-edge innovation, boosting productivity, sustainability, and competitiveness across sectors.

Sustainable Green Transition leaders

Leaders of the ARC's Training Centre for Battery Recycling, home to the Sparc Hydrogen Advanced Research Pilot — a first for green hydrogen reactor technology, and partners with Shanghai Jiao Tong University on designing next-generation offshore energy production.

Agriculture research expertise

Home to the Southern Hemisphere's largest concentration of agricultural research and teaching expertise, the Waite Research Precinct, with leading insights, engaged partners, and proven commercialisation success.

Strategic regional location advantage

Substantial regional footprint connected with strong fundamental research capability, capitalising on South Australia's diverse environments, agricultural productivity, global food and wine reputation, and Adelaide's Great Wine Capitals Global Network membership.

adelaideuni.edu.au/research

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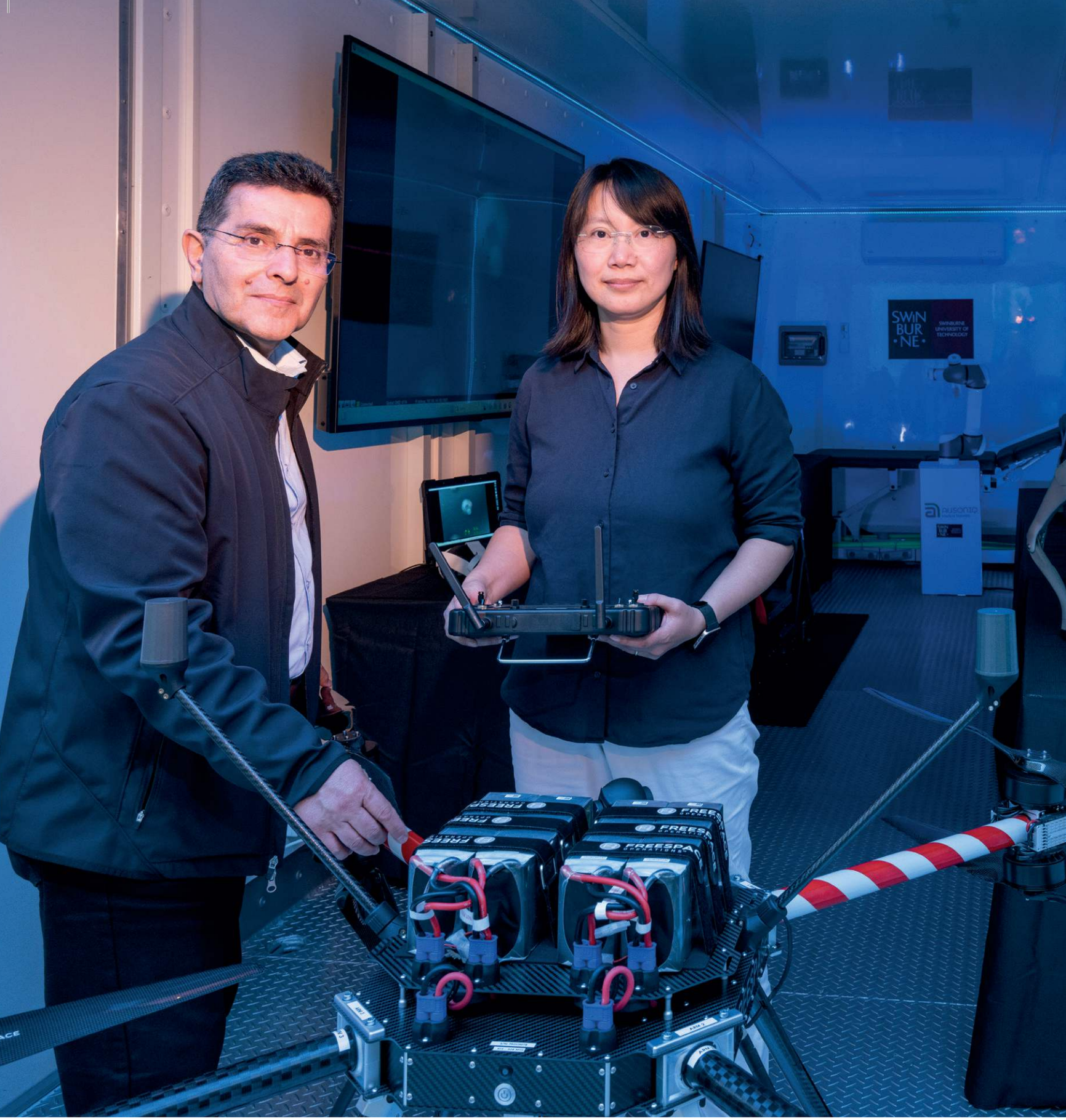

Mobile Innovation Lab:
Distinguished Professor Saeid Nahavandi and Associate Professor Hailing Zhou in Swinburne's Mobile Innovation Lab which includes a range of autonomous robots and drones and tele-operated robotic systems for emergency medicine applications.

SWINBURNE UNIVERSITY OF TECHNOLOGY

Where intelligent systems take flight

Swinburne University of Technology is at the forefront of automation and control theory, recognised globally for cutting-edge robotics and autonomous systems.

Our researchers are dedicated to leading the next wave of innovation.

Distinguished Professor Saeid Nahavandi, IEEE and ATSE Fellow and Google Scholar's highest cited expert in Field Robotics, is a pioneer in haptically-enabled robotics, motion simulators, and Industry 5.0.

Associate Professor Hailing Zhou is globally renowned for her work in AI-driven image processing in robotics. Combined with her deep industry experience, she is transforming how robots perceive, interpret, and interact with the world around them.

This work is enabled through state-of-the-art facilities, including the Mobile Innovation Lab, which is designed for research, industry, and education outreach, housing advanced simulators, cybersecurity systems, VR/AR experiences, drones, robots, and autonomous systems.

Discover how Swinburne's world-leading capabilities are shaping the future of autonomous systems for Australia and beyond.

swinburne.edu.au/research

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TEQSA PRV12148 Australian University

The Engineering & Computer Science list is supported by Swinburne University of Technology

Engineering & Computer Science
Australia's research field leaders

These are the top researchers and institutions in the 50 fields of engineering and computer science

Architecture
Field leader: Samad Sepasgozar, UNSW Sydney
Lead institution: UNSW Sydney

Artificial Intelligence
Field leader: Shirui Pan, Griffith
Lead institution: UTS

Automation & Control Theory
Field leader: Qing Long Han, Swinburne
Lead institution: Swinburne

Aviation & Aerospace Engineering
Field leader: Suraj Bijjahalli, Q-CTRL
Lead institution: RMIT

Bioinformatics & Computational Biology
Field leader: Thuc Duy Le, Adelaide
Lead institution: Uni of Queensland

Biomedical Technology
Field leader: Cuie Wen, RMIT
Lead institution: Uni of Queensland

Biotechnology
Field leader: Lars Nielsen, Uni of Queensland
Lead institution: Uni of Queensland

Civil Engineering
Field leader: Jay Sanjayan, Swinburne
Lead institution: UNSW Sydney

Computational Linguistics
Field leader: Reza Haffari, Monash
Lead institution: Uni of Melbourne

Computer Graphics
Field leader: Tim Dwyer, Monash
Lead institution: Monash

Computer Hardware Design
Field leader: Ho Ching Iu, UWA
Lead institution: Swinburne

Computer Networks & Wireless Communication
Field leader: Derrick Wing Kwan Ng, UNSW Sydney
Lead institution: UNSW Sydney

Computer Security & Cryptography
Field leader: Willy Susilo, Uni of Wollongong
Lead institution: CSIRO

Computer Vision & Pattern Recognition
Field leader: Mohammed Bennamoun, UWA
Lead institution: ANU

Computing Systems
Field leader: Albert Zomaya, Uni of Sydney
Lead institution: Deakin

Data Mining & Analysis
Field leader: Geoff Webb, Monash
Lead institution: QUT

Databases & Information Systems
Field leader: Jianxin Li, Edith Cowan
Lead institution: QUT

Educational Technology
Field leader: Dragan Gasevic, Monash
Lead institution: Monash

Engineering & Computer Science (general)
Field leader: Laurie Hughes, Edith Cowan
Lead institution: UNSW Sydney

Environmental & Geological Engineering
Field leader: Danial Armaghani, UTS
Lead institution: RMIT

Evolutionary Computation
Field leader: Kathryn Kasmarik, UNSW Sydney
Lead institution: UNSW Sydney

Food Science & Technology
Field leader: Bhesh Bhandari, Uni of Queensland
Lead institution: Uni of Queensland

Fuzzy Systems
Field leader: Gleb Beliakov, Deakin
Lead institution: UTS

Human Computer Interaction
Field leader: Stephen Palmisano, Uni of Wollongong
Lead institution: QUT

Library & Information Science
Field leader: Hamid Jamali, Charles Sturt
Lead institution: Charles Sturt

Manufacturing & Machinery
Field leader: Ang Liu, UNSW Sydney
Lead institution: RMIT

Mechanical Engineering
Field leader: Kiet Tieu, Uni of Wollongong
Lead institution: RMIT

Medical Informatics
Field leader: Centaine Snoswell, Uni of Queensland
Lead institution: Uni of Queensland

Metallurgy
Field leader: Huijun Li, Uni of Wollongong
Lead institution: Uni of Queensland

Microelectronics & Electronic Packaging
Field leader: Sima Dimitrijev, Griffith
Lead institution: RMIT

Mining & Mineral Resources
Field leader: Ranjith Gamage, Monash
Lead institution: UNSW Sydney

FOCUS ON

Rashina Hoda
Monash University
Field leader in Software Systems

From the moment a computer arrived at her school in a small town in India, Rashina Hoda was hooked.

She recalls taking every chance she could to work on the school's computers, which were kept in the only airconditioned room in the school.

"I fell in love," says Hoda, who is now a professor of software engineering at Monash University.

"It amazes me now to think that my all-girls school back in the '90s, in a small town in India, was advanced enough to expose us to programming.

"Every hour we had to tinker with those machines was precious. I was enamoured by logic and analytical thinking – computer science became my subject of choice."

After high school, Hoda attended Louisiana State University in the US, where she graduated with a bachelor of computer science with highest honours in 2002. She began her career in the software industry as a developer before returning to academia to do her PhD at Victoria University of Wellington in New Zealand.

More than two decades into her career, she has witnessed huge changes in software development, now increasingly dominated by artificial intelligence and large language models (LLMs).

Her most recent work has focused on investigating AI-based software for ethics, bias and human values, along with understanding the impact of LLMs on software system teams and managers.

While accuracy in AI remains a concern, Hoda says her research has revealed even deeper challenges.

"These large language models are trained on massive amounts of data, and that data often has biases," she says. "So this can cause skewed outcomes."

One example is in recruitment, where companies use AI-based tools to filter job applications. In one study, her team from Monash University, collaborating with colleagues from the CSIRO, found clear gender bias in such systems.

Angkit Thapa Magar / Monash University

"We created identical synthetic profiles for a job as a software engineer. The only difference was the name, which was used as a proxy for gender," Hoda says. "The AI system would more often recommend men applicants than women, even though they had the exact same qualifications and experiences.

"It was a clear case of bias, and part of the reason is the data these AI models are trained on."

She sees similar issues arising in digital healthcare. If AI agents are used to replace human nursing triage processes, there could be problems as the training data often lacks information about certain ethnic or cultural groups.

"For example, if the system hasn't been trained on enough data about Indigenous people, its responses are likely to be inaccurate and discriminatory for that group," she says.

"There are ethical concerns, cultural considerations and issues around emotional intelligence. It's a minefield."

Beyond her academic research, Hoda also serves as the associate dean of equity, diversity and inclusion at Monash.

She says it's vital to get more women into STEM (science, technology, engineering and maths), given that women make up only 20 per cent to 25 per cent of those fields in the Western world.

"Championing STEM is super important in under-represented communities, whether it be particular ethnic groups or people of colour or women, or combinations thereof," she says.

As for the future, she says AI tools have enormous potential to benefit humankind, in areas such as education, healthcare, drug discovery, space exploration, deep sea exploration and climate change research.

"My biggest hope for AI is that humanity will choose to use this powerful technology to help people and the planet," she says.

"I hope we choose wisely – because our future literally depends on it."

Carmel Sparke

Multimedia
Field leader: Min Xu, UTS
Lead institution: UTS

Ocean & Marine Engineering
Field leader: Sasan Tavakoli, Uni of Tasmania
Lead institution: UWA

Operations Research
Field leader: Kannan Govindan, Adelaide
Lead institution: Uni of Melbourne

Plasma & Fusion
Field leader: Trevor Lafleur, UNSW Sydney
Lead institution: ANU

Power Engineering
Field leader: Joe Zhu, Uni of Sydney
Lead institution: Uni of Sydney

Quality & Reliability
Field leader: Sidney Dekker, Griffith
Lead institution: Uni of Melbourne

Radar, Positioning & Navigation
Field leader: Jinling Wang, UNSW Sydney
Lead institution: UNSW Sydney

Remote Sensing
Field leader: Biswajeet Pradhan, UTS
Lead institution: CSIRO

Robotics
Field leader: Peter Corke, QUT
Lead institution: QUT

Signal Processing
Field leader: Reza Hoseinnezhad, RMIT
Lead institution: UNSW Sydney

Software Systems
Field leader: Rashina Hoda, Monash
Lead institution: Monash

Structural Engineering
Field leader: Yi Xie, RMIT
Lead institution: RMIT

Sustainable Energy
Field leader: GM Shafiullah, Murdoch
Lead institution: UNSW Sydney

Technology Law
Field leader: Christopher Marsden, Monash
Lead institution: Monash

Textile Engineering
Field leader: Milad Razbin, Uni of Sydney
Lead institution: Deakin

Theoretical Computer Science
Field leader: Cezary Kaliszyk, Uni of Melbourne
Lead institution: Uni of Wollongong

Transportation
Field leader: David Hensher, Uni of Sydney
Lead institution: Uni of Sydney

Water Supply & Treatment
Field leader: Hokyong Shon, UTS
Lead institution: UTS

Wood Science & Technology
Field leader: Warren Batchelor, Monash
Lead institution: Deakin

Ngarrgu Tindebeek supercomputer: Artwork by Mandi Barton.

Supercharged innovation

Swinburne's Ngarrgu Tindebeek supercomputer produces groundbreaking research in areas ranging from space technology through to medical and environmental research.

We have a long history of supercomputer design, development and operation, which includes discovering many of the first Fast Radio Bursts and determining the parameters of gravitational wave events.

Proudly boasting a processing capacity of millions of times beyond that of regular computers, the Ngarrgu Tindebeek supercomputer enables groundbreaking research across fields such as astrophysics, molecular dynamics, quantum chemistry, atom optics and oceanography.

Named by Wurundjeri elders, *Ngarrgu Tindebeek* translates as "Knowledge of the Void" in the local Woiwurrung language, reflecting the goal of harnessing the power of a supercomputer to enable researchers to explain the unknown and push the boundaries of knowledge.

Want to see how our high-performance supercomputing facility can supercharge your research and innovation? Contact us today.

swinburne.edu.au/research

SWINBURNE UNIVERSITY OF TECHNOLOGY

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TEQSA PRV12148 Australian University

Professor Karen Hapgood

In research, bigger is not always better

Australia has a rich history of innovating for our climate, our community and our future. Our country's researchers have developed critical technologies that change the world, from cochlear implants to the blackbox flight recorder, and the Gardasil HPV anticancer vaccine.

Despite a small and dispersed population, our ideas and R&D expertise have created a huge impact worldwide.

Publicly funded universities and research organisations like the CSIRO and ANSTO within the Australian research ecosystem have driven much of this. While the largest universities are most frequently mentioned, the truth is that the top researchers and field leaders are spread across institutions of all sizes across the country.

Younger universities like mine are not encumbered by long histories or large bureaucracies. The freedom to look for fresh opportunities without the need to maintain historical legacy research areas gives us the freedom to reinvent what university is about, and create a prototype of global best practice. Our size and agility keeps us laser focused on the needs of our industries and communities, adaptable to local and global changes and driven to make an impact in the areas that matter most.

By concentrating our efforts across six flagship initiatives – our north stars for research and development, innovation and commercialisation – we are maximising our leverage to create technology for purpose and co-create the industries of the future.

Take one of these flagships: Innovative Planet. With a focus on green energy and sustainable transport, we're investing in developing cutting-edge solutions that can make a resilient future a reality.

That work is already driving technologies like wireless charging embedded directly into roads, unlocking the uptake of electric heavy vehicles. Or our efforts to develop carbon-neutral steelmaking, ensuring heavy industry plays its part in the energy transition, supported by a brand-new Green Steel Alliance.

But energy is a global problem, and it requires global solutions. No matter our size, we need to collaborate across borders, industries and universities. Only together can we train the people and build the technology that will create a better world.

It's that spirit of collaboration that helped create the Franco-Australian Centre for Energy Transition (FACET), which is advancing co-operation on sustainable and inclusive energy initiatives in France, Australia and the Indo-Pacific.

This work goes beyond platitudes of international collaboration; it's about investing in good ideas and good people, wherever they are in the world. By encouraging start-ups and spin-outs, we move beyond pure research to implement solutions and create jobs – even spawning entire new industries. Because change is not just made in the lab; it must be embedded in local communities around the world.

Take mDetect, a technology platform that uses particles from space called muons, to 'see' structures hidden underground for mining and construction companies. Through Swinburne Innovation Studio's Elevate program, our interdisciplinary research team took the venture from exciting research to a full-scale commercial product that can make our infrastructure safer and massively reduce the risk of environmental disasters.

This isn't a once off. Entromat, our latest start-up company, started from fundamental research on unusually complicated metal alloys and grew into advanced manufacturing of new powders. Their exceptional mechanical strength and resistance to corrosion, wear, and radiation makes them useful for aerospace, mining and medical technology.

In addition to global collaboration, research and commercialisation, our learning ecosystem must also transform to make real change. As a multisector university, we're adapting to the needs of rapidly evolving and emerging industries, from vocational education to professional development.

This means supporting learners at every stage of their career to upskill and re-skill, ensuring research breakthroughs have the workforce to implement them.

For example, the state-of-the-art Swinburne Siemens Energy Transition Hub is bringing together students, industry partners and mid-career professionals to create an integrated pipeline from education and research to solutions to workforce capability. All of this is possible thanks to our approach and position as a tech-focused, impact-driven institution.

This is the blueprint of a new and different university: agile, responsive and collaborative. We know it works overseas. Sheffield University in Britain is about the same size as my university and is home to the Advanced Manufacturing Research Centre, which is sought out by multinational companies as a hub of truly global innovation. Bold initiatives led by an Australian university with "only" 30,000 students are too often deemed too small to have critical mass, despite accolades for similar international initiatives and Australia's unique history of defying this stereotype.

We are bringing that blueprint to Australia – working smarter, harder and together to make real change in the world. Guided by our recently launched strategy, Ad Astra_2030, we can solve wicked problems, build sovereign capability and boost productivity. The future is bright and Swinburne stands ready to forge Australia's path towards it.

Professor Karen Hapgood
Deputy Vice-Chancellor, Research
Swinburne University of Technology

Social Sciences
Australia's research field leaders

These are the top researchers and institutions in the 29 fields of the social sciences

Academic & Psychological Testing
Field leader: Martin Sellbom, Monash
Lead institution: Deakin

Anthropology
Field leader: Luca Fiorenza, Monash
Lead institution: ANU

Archaeology
Field leader: Adam Sookdeo, NSW Health
Lead institution: UNSW Sydney

Cognitive Science
Field leader: Ullrich Ecker, UWA
Lead institution: Uni of Queensland

Criminology, Criminal Law & Policing
Field leader: Kristina Murphy, Griffith
Lead institution: Griffith

Diplomacy & International Relations
Field leader: Tobias Ide, Murdoch
Lead institution: Deakin

Early Childhood Education
Field leader: Sandie Wong, Macquarie
Lead institution: Macquarie

Education
Field leader: Lisa Kim, Uni of Sydney
Lead institution: Monash

Educational Psychology & Counselling
Field leader: Philip Parker, ACU
Lead institution: ACU

Environmental & Occupational Medicine
Field leader: Malcolm Sim, Monash
Lead institution: Monash

Environmental Law & Policy
Field leader: Russell Smyth, Monash
Lead institution: Monash

Ethics
Field leader: Krzysztof Dembek, Swinburne
Lead institution: Monash

Family Studies
Field leader: Alina Morawska, Uni of Queensland
Lead institution: Uni of Queensland

Forensic Science
Field leader: Duncan Taylor, Flinders
Lead institution: UTS

Geography & Cartography
Field leader: Lauren Rickards, La Trobe
Lead institution: Uni of Melbourne

Health Policy & Medical Law
Field leader: Karen Lee, Uni of Sydney
Lead institution: Uni of Sydney

Higher Education
Field leader: David Boud, Deakin
Lead institution: Deakin

Human Migration
Field leader: Fethi Mansouri, Deakin
Lead institution: Deakin

International Law
Field leader: Surya Deva, Macquarie
Lead institution: Uni of Melbourne

Military Studies
Field leader: Emma Belton, Uni of Queensland
Lead institution: Deakin

Political Science
Field leader: Benjamin Moffitt, Monash
Lead institution: ANU

Public Policy & Administration
Field leader: Jenny Lewis, Uni of Melbourne
Lead institution: Uni of Melbourne

Science & Engineering Education
Field leader: Annette Burgess, Uni of Sydney
Lead institution: Monash

Social Sciences (general)
Field leader: Rob Raven, Monash
Lead institution: Uni of Queensland

Social Work
Field leader: Donna Chung, Curtin
Lead institution: Monash

Sociology
Field leader: Signe Ravn, Uni of Melbourne
Lead institution: Uni of Melbourne

Special Education
Field leader: Umesh Sharma, Monash
Lead institution: Monash

Teaching & Teacher Education
Field leader: Louise Starkey, Uni of Tasmania
Lead institution: Monash

Urban Studies & Planning
Field leader: Kim Dovey, Uni of Melbourne
Lead institution: Uni of Melbourne

FOCUS ON

Ullrich Ecker
University of Western Australia
Field leader in Cognitive Science

Ullrich Ecker, a misinformation researcher, had a tragic early encounter with what happens when a loved one clings onto misguided beliefs.

His father had a scientific mindset but Ecker's mother was raised by parents who believed herbal teas could cure nearly all ailments.

"My mum died of cancer when I was quite young," says Ecker, a professor in cognitive psychology at the University of Western Australia.

"She abandoned traditional medicine at some point, and died not long after relying solely on alternative therapies.

"Even as a child, I felt it wasn't right for someone to recommend herbal tea for a life-threatening illness. So I've always been interested in why people sometimes struggle to let go of ideas that have been disproven."

This question has become the central focus of his research, which investigates why misinformation continues to influence people's thinking even after it has become clear that the information is false or misleading.

His early work included a PhD on the cognitive neuroscience of memory at Saarland University in Germany.

On moving to Australia in 2008, he began to research the social and cognitive mechanisms of why people believe false ideas, and how best to counteract this influence.

Misinformation comes in many forms, Ecker says. It might be as simple as incorrectly recalling an event, to clinging on to beliefs about public health issues, such as vaccines causing autism.

One reason people hang on to misinformation is they prefer to believe things that align with their world view, or bolster their social identity, Ecker says.

It's also difficult for people to change their beliefs because of how memory

Colin Murty

operates. “For us to remember things and plan for the future, we want stable representations, but if the world changes, we also need to have some flexibility, and that’s a difficult tension for memory to resolve,” Ecker says.

Countering misinformation requires repeating accurate information over and over, because repetition is one of the strongest drivers of belief.

“Even if it comes from just a single source, repetition has an influence because the more familiar a piece of information becomes, the more we tend to believe it,” Ecker says.

While misinformation has existed since humans began communicating, recent developments have exacerbated the issue.

“One of these is the advent of social media, which serves as an accelerant,” he says.

“Fifty years ago, if you believed the Earth was flat, you would have been the village idiot. Today, you can find many others online who think the same and now you’re the enlightened one.”

The other change has been in the way leaders communicate and form policy.

“Politicians have always twisted the truth, but there has been a measurable shift away from speaking about evidence towards justifying decisions merely based on beliefs,” Ecker says. Now with the emergence of generative AI and deep fakes, sifting truth from misinformation is becoming ever more challenging.

Ecker’s recent research has been on how AI-generated deep fake videos can influence people’s judgments even when they know a video is fake.

“As this technology matures, we will no longer be able to tell the difference between AI-generated and real content,” Ecker says.

“One implication is that I’m less concerned about how deep fakes will change people’s beliefs and more concerned that people will no longer trust any information.”

Carmel Sparke

“I’ve always been interested in why people sometimes struggle to let go of ideas that have been disproven

Healthy body, healthy mind

Exercise helps slow the aging of the brain

Victoria University's James Broatch is on a mission to understand why physical activity slows the onset of brain diseases like dementia

Researcher James Broatch was on a sports science path until his mother received a devastating diagnosis that inspired him to switch focus to brain health. Now a senior research fellow at the Institute for Health and Sport at Victoria University, Broatch investigates how physical activity might help prevent or slow dementia.

"My mum was diagnosed with dementia in her late 60s, in about 2017 so that was definitely the catalyst for me to become involved in this area," Broatch says.

"We know that exercise is really good for the brain, so I hope to better understand how we can utilise exercise to help protect the brain and reduce the burden that is dementia."

With a background in health and exercise science and a 2016 PhD focused on how muscles respond to exercise, Broatch wanted to apply his knowledge to brain health.

"Despite decades of evidence showing exercise supports brain health, we still don't fully understand the underlying mechanisms," he says. "We hope that by studying the complex biological mechanisms by which exercise protects the brain we will be able to develop targeted exercise therapies for healthy brain ageing."

"How can we harness the benefits of exercise to slow or prevent brain ageing and neurodegenerative diseases like dementia?"

One of Broatch's recent pieces of research used cutting edge MRI scans to assess how exercise influenced brain health markers in a group of people aged 45 to 65.

The previously sedentary participants completed a 12-week exercise program using stationary bikes. They underwent a brain MRI scan before and after the program, and were also tested for fitness and cognition.

Preliminary results are demonstrating exercise intensity is an important regulator of several physiological processes important for brain health, including brain blood flow, white-matter integrity and connectivity – processes that often decline with age and in diseases like Alzheimer's. He has also published a review showing how aerobic exercise intensity could drive proteins and other factors released by the muscles that are tied to better brain health.

Another of his studies identified new molecular and cellular pathways activated in the brain tissue of exercised mice, several of which are impaired in Alzheimer's disease.

Luis Enrique Ascui

James Broatch: "The goal is to keep people healthier for longer."

Broatch highlights three factors that come with exercise, that are among the many contributors to brain health.

First there's the increased blood flow to the brain that occurs during exercise. Second, proteins and extracellular vesicles (EVs) released by contracting muscles may influence brain function.

"We're specifically interested in these little extracellular vesicles that are released into circulation during exercise," he says. "EVs have a profound effect right across the body and now it's emerging that they're facilitating the beneficial effects of exercise on the brain."

Third, the cognitive stimulation that occurs during exercise, from co-ordinating movement to the social component, may improve connectivity between different parts of the brain.

"Over the next decade, I hope our work helps shape how we prescribe exercise – not just as a lifestyle choice, but as a targeted intervention for brain health," Broatch says.

"I also see this research informing new public health strategies and clinical programs that integrate exercise into the prevention and treatment of age-related brain disorders.

"Ultimately, the goal is to keep people healthier for longer, reducing the burden of dementia and cognitive decline."

Carmel Sparke

Powering **innovation** through **world-class** facilities

As the **#1 Victorian university for facilities and resources**^, our multimillion-dollar research facilities provide the space, technology and expertise that empower researchers to bring their bold ideas to life.

For Associate Research Fellow **Asher Winter**, access to state-of-the-art robotics and motion simulation equipment has transformed what's possible in his field. His work at our Deakin Institute for Intelligent Systems exemplifies how great facilities power great research.

Every breakthrough begins with the right environment. Our investment in cutting-edge facilities is an investment in people, supporting the brilliant minds driving innovation that shapes our future.

> I would not have been able to conduct my research if it was not for the research facility in which I work. The right facility matters as its purpose is to support you in reaching your goal.

Dr Asher Winter,
ASSOCIATE RESEARCH FELLOW

^ 2024 Student Experience Survey, Quality Indicators for Learning and Teaching (QILT).

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