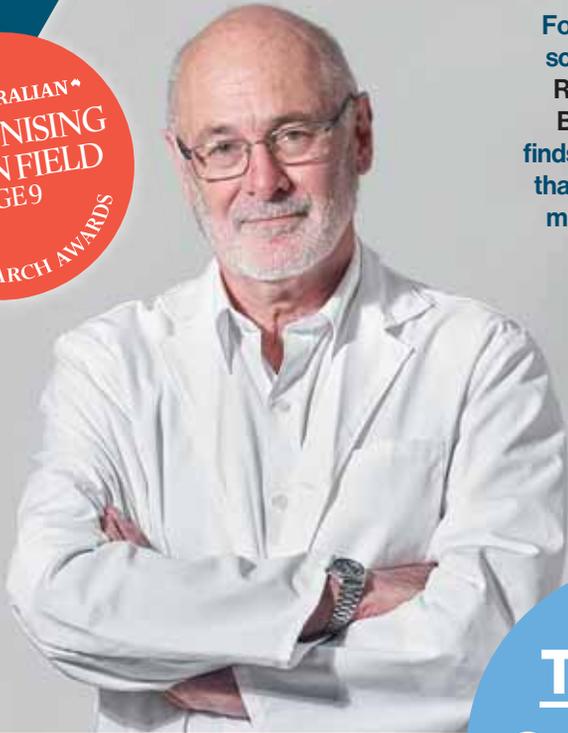


World-leading Aussies > Entrepreneurial universities > Best 10 books

THE AUSTRALIAN

RESEARCH 2021

THE AUSTRALIAN
RECOGNISING
BEST IN FIELD
PAGE 9
2021 RESEARCH AWARDS



Forensic scientist
ROGER BYARD
finds clues that solve murders
10



Urban thinker
ROBYN DOWLING
makes Smart Cities work
38

THE LIST Our top 250 researchers

Engineer
KATE NGUYEN
saves the bush from fire
27



Psychologist
ALEXANDER NEWMAN
helps refugees find careers
19



Building on our track record of **research** strength

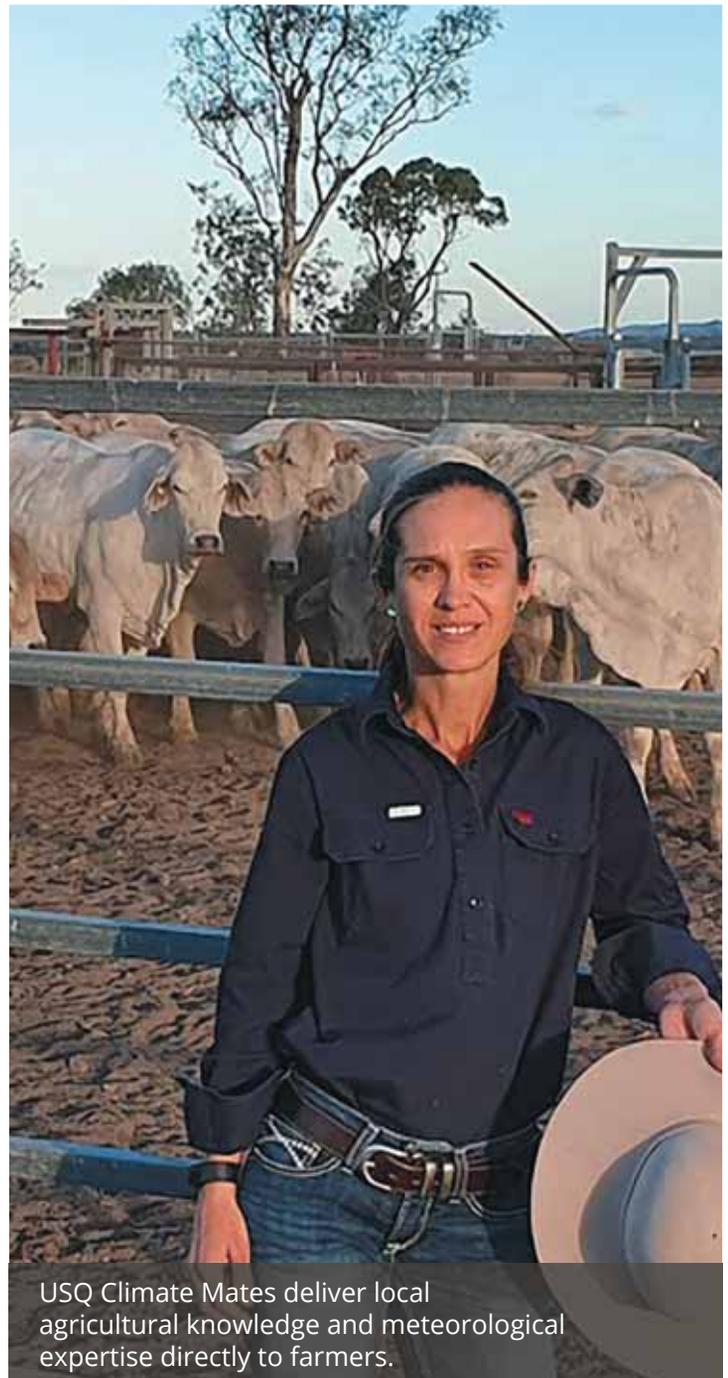
The University of Southern Queensland's research is forging ahead and delivering real impact.

Standing beside agricultural producers for nearly two decades

USQ's long-running Northern Australia Climate Program pairs 'Climate Mates' – regionally-located extension officers with a background in industry, who are trained in climate science, and trusted in the community – with agricultural producers in key red meat regions of northern Australia.

In 2021, USQ has been chosen to lead one of eight national Drought Resilience Adoption and Innovation Hubs, a flagship of the Australian Government's multi-billion-dollar Future Drought Fund. The Hub will connect research expertise with existing on-the-ground knowledge and empower farmers to be more profitable and adaptable, reducing community vulnerability and ensuring the future growth and success of our regions.

USQ is ranked in the Top 500 in the Times Higher Education World Rankings.



USQ Climate Mates deliver local agricultural knowledge and meteorological expertise directly to farmers.



UNIVERSITY
OF SOUTHERN
QUEENSLAND

Toowoomba | Springfield | Ipswich

Space agriculture: the final frontier of farming

USQ is working with NASA to grow healthy food crops for astronauts on deep space missions. Existing research expertise in automated technologies that have been successfully applied to earth-side farms is enabling the development of space agriculture systems suitable for the harshest of environments.

Sustainable farming is becoming increasingly challenging. Global climate variability, a shortage of viable land and a growing population is placing more demand on resources than ever before. Innovative robotics and artificial intelligence technologies developed by USQ are the key to addressing these challenges and ultimately, providing food for the global population.



USQ researchers are exploring space agriculture systems to solve food supply problems in space and on earth.



Professor Odette Best is providing an opportunity for the stories of Aboriginal nurses and midwives to finally be told.

Uncovering the hidden histories of Aboriginal nurses and midwives

USQ researchers are bringing to life the stories of Aboriginal women who trained as nurses or midwives from the 1890s – 1950s, countering existing assumptions that First Nations women could not access education and were limited to domestic employment.

These stories are timely given the current global pandemic highlighting the frontline service provision by nurses in keeping our nation healthy. USQ researchers are laying a solid foundation for Aboriginal people to build pride through new cultural knowledge that celebrates Aboriginal women's contributions and acknowledges them as active providers of care.

usq.edu.au/research

Foreword



Australia is home to some of the world's finest research minds, and we have produced some of the most significant global breakthroughs in history.

More than 600,000 people worldwide have been given the gift of hearing thanks to Cochlear implants, developed through research at Melbourne University in the 1970s.

Today, Australian institutions like the Walter and Eliza Hall Institute are at the cutting edge of global medical research and CSIRO is focused on solving the biggest challenges facing our nation and our world.

Earlier this year, I toured the government-funded Australian National Fabrication Facility in Melbourne and was shown a new microscope slide developed by researchers at La Trobe University that is making it easier to identify cancer cells. Researchers described the difference as going from black and white television to colour.

The Morrison government

Alan Tudge

FEDERAL EDUCATION AND YOUTH MINISTER

recognises the important role research plays in bettering our lives and our nation. We commit around \$3bn a year into research through the Education portfolio alone and have added an additional \$1bn this year through the Research Support Program.

While Australia is home to many great success stories, as a nation we underperform on research commercialisation outcomes and business engagement.

There is more we can do to get better outcomes from the public investment in research. This is why, as a government, we have made research commercialisation a top priority.

We want our universities to not just produce brilliant pure research work, but also to partner with businesses to translate that research into breakthrough products, start-ups and ideas to grow our economy and strengthen our society.

This ambitious translation of research will be critical for our long-term economic success and it will help power our Covid recovery.

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Institution abbreviations

Australian Catholic University: **ACU**
Australian National University: **ANU**
Australian Nuclear Science and Technology Organisation: **ANSTO**
Central Queensland University: **CQUniversity**
Charles Darwin University: **CDU**
Charles Sturt University: **CSU**
Edith Cowan University: **ECU**
Peter MacCallum Cancer Centre: **Peter Mac**
QIMR Berghofer Medical Research Institute: **QIMR Berghofer**
Queensland Health: **Qld Health**

Queensland University of Technology: **QUT**
Royal Botanic Gardens Victoria: **Botanic Gardens Vic**
Royal Brisbane and Women's Hospital: **RBWH**
Royal Children's Hospital Melbourne: **RCH Melbourne**
University of Queensland: **Uni of Qld**
University of South Australia: **UniSA**
University of Technology Sydney: **UTS**
University of Western Australia: **UWA**
University of Wollongong: **UOW**
Western Sydney University: **Western**

THE AUSTRALIAN * RESEARCH

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Printed by Ovato Print Pty Ltd, 8 Priddle Street, Warwick Farm NSW 2170 for the proprietor and publisher Nationwide News Pty Ltd (ACN 008 438 828) of 2 Holt Street, Surry Hills, NSW 2010, for insertion in The Australian on November 10, 2021

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TO APPLY NOW.**



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TAKING ON
Australia's
CARE CRISIS





Brave Minds making a difference.

A suite of research initiatives is under way at Flinders University that is set to radically boost the quality and depth of aged care research.

As Australia's ageing population continues to rise, our ageing community has more complex needs than ever before.

Despite the current aged care crisis, our brave health and care researchers see hope.

They are determined to create a future where aged care is a data-informed and technology engaged sector. One that provides sought-after career pathways and evidence-based, personal-centred quality care and services.

**We're up to the challenge.
Join us in our fearless research.**

Find out more:

flinders.edu.au/research



Flinders
UNIVERSITY

FEARLESS

A deep dive into research

Using online information to reveal excellence

The Australian and its partner, League of Scholars, use a trove of online information to identify Australia's top researchers and top research institutions

Not for many decades has the value of research been so clear. Less than two years after the appearance of a new and dangerous virus, and thanks to countless researchers in infectious disease, immunology, epidemiology and other fields, we now have many effective vaccines in mass production, and numerous tests and treatments for Covid-19.

In The Australian's annual Research magazine, we acknowledge the talent and dedication of our researchers. And again, as we have for the previous four years, we present The List – a roll call of the best researchers and the best research institutions in Australia in 250 individual fields of research.

We do this by teaming with talent discovery and research analytics firm League of Scholars to comprehensively scan online data about Australia's research output. It enables us to identify the best researcher and the best research institution in each field, based on the excellence of their research and the impact it has in discovery and scholarship.

This is a unique listing. Because it zeros in on the particular specialties of individual researchers and research institutions, it provides fine-grained detail and recognises countless areas of excellence which would otherwise go unnoticed in the public arena.

One thing we learn is that most, but not all, of the best Australian research institutions, are universities. For example, the CSIRO is the top research institution in 10 scientific fields and hospitals host the best research in some medical fields.

The 250 fields of research are divided into eight major discipline areas. In the magazine you will find listings of Australia's best researcher and research institution for all of the fields, classified by their discipline area. We also bring you stories of some of our top researchers, who explain why their work is important and the impact it has in the community.

But there's more. Not only do the data scans carried out by League of Scholars enable us to identify the best research in Australia, we can also identify the world's best. And by cross-checking against the Australian data we



Patient, painstaking work: An Australian university researcher at work on Covid vaccine research

discover that in 15 fields an Australian-based researcher is first in the world and in 20 fields it is an Australian research institution that is world's best. Being able to claim 20 global firsts in 250 research fields is a testament to the quality of research in Australia.

Looking for merit field by field is one way to identify the best in Australian research. Another way, which we also use, is to look more broadly at the researchers who, regardless of their field, have demonstrated consistently high achievement over their career. We do this by identifying 40 lifetime achievers who are Australia's "superstars of research" (page 44). We also name 40 up-and-coming researchers who, in the first years of their career, show huge promise for the future. We list these early career achievers as the "rising stars of research" (page 16).

This is the fourth year we have used League of Scholars data to paint a detailed picture of Australian research and, each year, we look for new ways to analyse this trove of information.

This year we look specifically at Australian research journals (pages 47 and 48), which are often overlooked when research is analysed from a global perspective. But papers in

Australian journals are particularly important because of the research they publish on topics of importance to Australia.

We also again examine Australian academic books and build a top 10 list (page 50) of books published in the past year.

Finally there is another area, entrepreneurship, which we explore for the first time using a set of data from Crunchbase.

We've identified which universities have produced the most start-up founders (page 12) an area of immense interest as the federal government works on policies to encourage commercialisation of university research.

We hope you will enjoy this deep dive into the data on Australian research.

Tim Dodd

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THE AUSTRALIAN,
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Paul McCarthy

**CEO, LEAGUE OF SCHOLARS
PAUL@LEAGUEOFSCHOLARS.COM**



Paul McCarthy



Rasika Amarasiri

Methodology behind the data

We've taken a data-driven route to dissect the detail of Australian research. It is an approach which is now possible because of the volume and quality of the information available online.

To gather and analyse the data we partner with League of Scholars whose co-founders, Paul McCarthy and Rasika Amarasiri, are pioneers in using publicly available online information to assemble large databases about published research.

Most of the data is drawn from Google Scholar and we use it principally to determine a leading researcher and a leading research institution in Australia.

We largely follow the taxonomy used by Google Scholar to determining the 250 fields of research which are analysed. We have omitted some fields where Australian research is not strong.

Here is the methodology we've used to create lists and rankings:

Top researcher: The leading Australian-based researcher in a field is the individual whose papers published in the 20 top journals in their field (measured by H-index) over the past five years have had the most citations by other researchers. This is a measure which filters for both quality and impact.

Top institution: The leading Australian institution in a field is found by summing the number of citations over the past five years which were given to papers published by

researchers affiliated with that institution in the top 20 journals in that field.

World leaders: World leading researchers and research institutions in a particular field are found in the same way, except they are measured against the world, not just Australia.

Lifetime achievers: We find them using a methodology based on the researcher's annualised H-index, that is their H-Index divided by the number of years a researcher has been active. The five researchers with the highest annualised H-index in each of the eight research disciplines are the 40 lifetime achievers.

Early career achievers: We find them using the same methodology used for lifetime achievers, except we consider only researchers who are less than 10 years into their career.

Top Australian journals: We rank the top 10 Australian journals by their H-index for papers published over the past five years.

Australian academic books: We rank the top ten Australian academic books of 2020 by the number of citations they have received.

The H-index of a researcher or a journal is defined as the highest number H, such that a given researcher or journal has published H papers which have each been cited at least H times. So, for example, if a researcher has published 50 papers each with 50 citations, but has not yet managed to get 50 citations for a 51st paper, then their H-index is 5.



New Research Awards are a badge of excellence

Each year in the Research magazine, we delve into the data to reveal the top universities and other institutions across 250 fields of research.

The Australian's Research Awards, launched this year, recognise the performance of these top universities and institutions.

They are a badge of research excellence and offer the opportunity to universities and institutions to communicate their achievement more widely.

If your university or institution is named in this year's top 250 list, a Research Award seal is available to give immediate recognition to your achievements in a particular field.

The seal can be used in email, on websites, in other documentation, and in advertising and promotion.

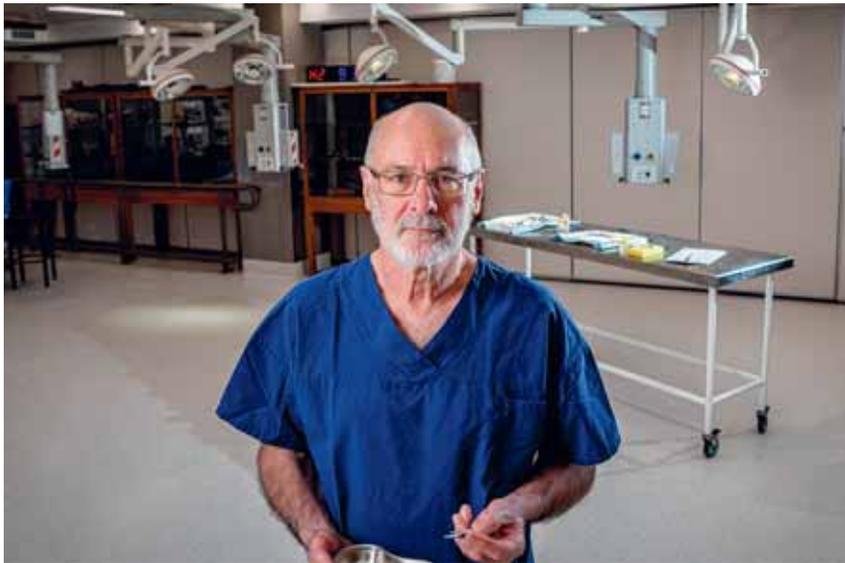
If you would like to know more about this opportunity to use Research Award seals and explore other benefits that are available,

please contact simon.banks@news.com.au

Unmatched in the world

Global research field leaders

These Australian-based researchers are the best in the world in these 15 fields of research



Matt Turner

Roger Byard

University of Adelaide

World leader in Forensic Science

In his late 20s, budding forensic pathologist Roger Byard was directed to ask an old man near death for permission to conduct an autopsy to retrospectively discover the nature of his cancer. “He asked me who would perform the autopsy and I told him it would be me,” Byard says. “He leaned back and after a while he said, ‘You know son, you’re going to be all right’. So I received this blessing for this career, and it still means a tremendous amount to me.”

The career the old man blessed has been abundant. Byard, who holds the Marks chair of pathology at the University of Adelaide, has published widely. Subjects include sudden infant death syndrome (SIDS), what multiple tattoos indicate about potential mortality, the possible side effects of herbal medicine on domestic animals, even post traumatic stress in the forensic pathologist.

Apart from the normal range of work, he has been involved in South Australia’s Snowtown “bodies in the barrels” case, and the trial of

convicted child-murderer Kathleen Folbigg.

He is best known for his work in paediatric forensics, and on the scourge of SIDS, which came to prominence in the 1980s.

“I’ve always liked paediatrics because kids have a right to be healthy and to survive,” he says. “I started doing autopsies on young children and just realised the tragedy of it all. It’s something that parents should never see and something they never get over.”

By the early 1990s the phalanx of doctors and scientists working on the problem had established that dangerous cots, smoky environments and, most importantly, sleeping face down, were part of the problem, but it was felt there were yet more factors at play. Why, for example didn’t the babies lying face down change the position of their heads if they were having difficulty breathing?

“Effectively, we now understand that SIDS occurs because of defects in the brain stem. Only four years ago we found that SIDS babies have significantly reduced levels of the

Global Leaders

Academic & Psychological Testing

David Boud, Deakin

Education

David Boud, Deakin

Educational Psychology & Counselling

Andrew Martin, UNSW

Fluid Mechanics

Ivan Marusic, Uni of Melbourne

Forensic Science

Roger Byard, Uni of Adelaide

Genetics & Genomics

Peter Visscher, Uni of Queensland

Higher Education

David Boud, Deakin

Hydrology & Water Resources

Albert Van Dijk, ANU

International Business

Paresh Narayan, Deakin

Mining & Mineral Resources

Ranjith Pathegama Gamage, Monash

Nursing

Debra Jackson, UTS

Pest Control & Pesticides

Bhagirath Singh Chauhan, Uni of Queensland

Plant Pathology

Bhagirath Singh Chauhan, Uni of Queensland

Reproductive Health

Ben Willem Mol, Monash

Software Systems

Rajkumar Buyya, Uni of Melbourne

neuropeptide ‘substance P’ in five areas of their brain stem,” he says. “Two of the areas control the response to low oxygen levels and three of them control head and neck movement.”

Now the hunt is on to find genetic links to further the research.

Herbal toxicity is another area of keen interest. “It’s something that is under the radar in a way, because herbal preparations are not controlled as tightly as pharmaceuticals. We’re doing studies showing that if you put paracetamol and certain anti-arthritis herbs on to liver cell cultures, the cells die. There’s a synergistic effect here and it’s quite a concern.”

Byard is also interested in historical forensics and has collaborated on studies of Tasmanian convicts and will study the mortality and morbidity of Tasmanian Aboriginals on the west coast in the early 19th century

“Forensics runs all over the place, it’s tremendously exciting,” he says.

Jill Rowbotham



World-changing solutions from world-class talent

Australia's national science agency, CSIRO, is solving the greatest challenges. Will you join us?

Grow your innovative advantage

We connect industry, investors and management teams to world-class scientific research, technology and innovation to create economic, environmental and societal value.

We worked with partners to commercialise our PhotonAssay™ technology – spinning out Chrysos Corporation. Chrysos delivers faster, safer, more accurate and environmentally-friendly gold analysis in minutes rather than hours to customers globally. Chrysos has grown to a valuation of \$430m and is looking towards an IPO in 2022.

We've connected more than 1,000 small and medium businesses with Australian research partners through programs like Innovation Connections and Kick-Start. Kick-Start introduced Australian Plant Proteins to food scientists who increased their faba bean powder protein content from 45% to 80%, leading to development of a \$35m processing facility in Victoria.

Turn your concept into impact

Our ON program has supported more than 2,000 researchers, helping them to turn their projects into market-ready customer propositions. Researchers from 40 Australian universities, research institutes, industry and government have grown their skills through the training program, with ON alumni going on to create 66 companies and 269 new jobs, and raise more than \$67m in investment capital.

Telehealth start-up Coviui, a successful ON alumni, was spun-out of CSIRO in 2018. During COVID-19, it grew from 300 to 25,000 consultations a day and has now delivered 5 million consultations for 65,000 health practitioners.

Invest in innovation

The CSIRO Innovation Fund was established to create, invest in and grow Australia's next commercial giants from today's science and technology from the publicly funded research sector. Main Sequence was formed to manage the Fund, and has helped build 37 companies that work with 22 universities and CSIRO, generating 850 jobs.

CSIRO worked with Competitive Foods to create v2food, a plant-based protein company harnessing Australian science to provide more options to feed the world's growing population. Since launching in 2019, v2food has raised \$113m and its products are available in hundreds of supermarkets and restaurants across Australia.

Join our team

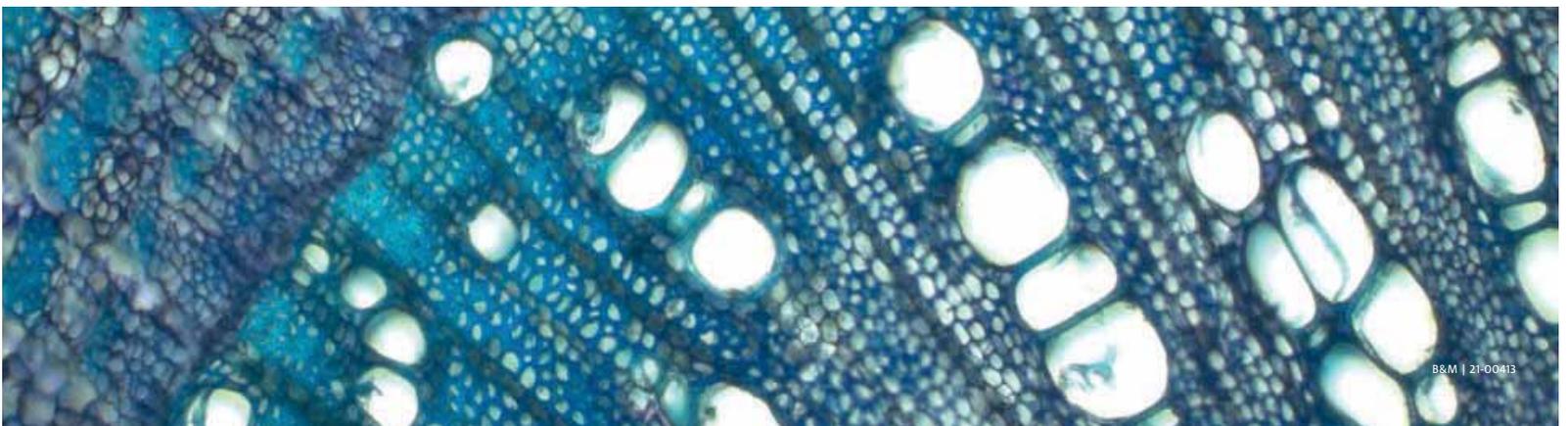
We recruit the best talent to deliver world-changing impact. Bold change-makers, imaginative problem solvers and people driven to make a difference, whose creativity and skill match their enthusiasm for science and innovation.

We are recruiting the next generation of leaders for Australia's innovation system, seeking over 150 CSIRO Early Research Career (CERC) Postdoctoral and Engineering Fellows to join our team over the next 12 months.

We're also looking for talented researchers and engineers at all levels to join one of the world's largest artificial intelligence and data science research and development teams.

Talk to us about being part of Australia's
innovative future

[csiro.au](https://www.csiro.au)



Unis with start-up spark

Top entrepreneurial universities

These Australian universities have produced the most founders of successful start-ups – those that have attracted venture capital funding

As Education Minister Alan Tudge drives his push for Australian universities to commercialise more of their research, a question needs to be answered: how successful are our universities at the moment in creating a climate for successful entrepreneurship?

League of Scholars used data from Crunchbase, the world's largest source of data on venture capital funded start-ups, to discover which Australian universities have produced the most founders of successful start-ups – those that have reached the key milestone of attracting venture capital funding.

The top three universities on the list probably won't surprise you. The University of Melbourne heads the list with 100 of its graduates having founded start-ups that attracted venture capital funding in the past 10 years. UNSW and the University of Sydney are close behind with 98 and 97 respectively.

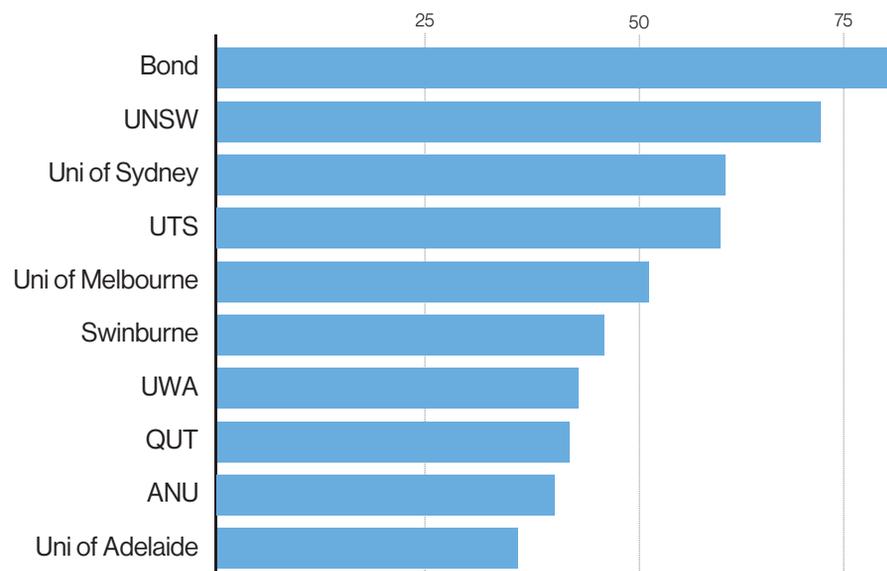
The University of Technology Sydney (66), Monash University (57), Queensland University of Technology (51), RMIT (45) and the University of Queensland (41) follow.

But after adjusting for size of university (using the number of start-up founders per 100,000 graduates over the last 10 years) it is a small university, Bond, which rises to the top. Even though Bond has only 15 funded start-up founders, it has over 75 founders per 100,000 graduates. The other nine of the 10 best performing entrepreneurial universities (measured on this basis) are shown in the graph.

Clearly there are many factors which influence these outcomes. One is the background of students and graduates, and their readiness to launch entrepreneurial ventures. But another is the culture and atmosphere of the university. Does it encourage students to be entrepreneurs, back them in generating and testing ideas, and support them in small ventures?

Venture capital success

Number of alumni who have founded start-ups that attract funding, adjusted for size of university



Graph shows number of venture capital funded start-ups founded by alumni of a university, per 100,000 undergraduate and post graduate completions at the university from 2009-2019. Source: Crunchbase, League of Scholars

Over the past decade more universities are offering students practical education in entrepreneurship and the full results of this are still to be seen.

It is significant that UNSW does well in producing entrepreneurs. Atlassian founders Mike Cannon-Brookes and Scott Farquhar are UNSW alumni, and the university has developed a culture of entrepreneurialism.

It's also noteworthy that technology universities (UTS, Swinburne and Queensland University of Technology) in Sydney, Melbourne and Brisbane are in the top 10 because they teach a combination of

technology and business skills which equip students to be entrepreneurs.

Other universities in the top 10 also have standout entrepreneur graduates.

University of Western Australia alumni Melanie Perkins and Cliff Obrecht founded the \$53bn company Canva. Richard White, the founder of logistics software company Wisetech (currently capitalised at \$13bn), is a graduate of UTS and the University of Adelaide. Thomas Brunskill, founder of rapidly growing internship placement company Forage, is an ANU graduate.

Tim Dodd

Unrivalled on the planet

Global research field leaders

These Australian institutions are the best in the world in these 20 fields of research



It's a measure of the impact that Australian universities have in global research that they are world leaders in 20 different research fields, or 8 per cent of the total.

UNSW and Monash University are the stand outs. Each of them are world leaders in four fields of research.

Also noteworthy, is that fact that the fields in which Australian universities are world leaders are spread across the spectrum of research disciplines. Some, such as Asian Studies & History, are areas in which Australia has long had recognised expertise. The Australian National University is the world leader in this field and, not surprisingly, two other Australian institutions – the University of Melbourne and RMIT University – are second and third.

Other areas of global leadership are in fields where Australia has invested research effort because of our country's

unique challenges. For example, the University of Queensland is the global leader in Water Supply & Treatment (and UTS is third.) The University of Melbourne leads globally in Biodiversity & Conservation Biology, and Curtin University is world leader in Geochemistry & Mineralogy.

This distinction of global leadership in research also extends to health fields – Addiction, AIDS & HIV (UNSW), Nursing (Griffith University), Physical Education & Sports Medicine (Australian Catholic University), Rehabilitation Therapy (Monash University). Then there are the technological fields in which Australian institutions are world leading – Polymers & Plastics (UNSW), Software Systems (University of Melbourne), and Environmental & Geological Engineering (Monash University).

Tim Dodd



Andrew Henshaw

Institutional Global Leaders

Addiction

UNSW

AIDS & HIV

UNSW

Asian Studies & History

ANU

Audiology, Speech & Language Pathology

Uni of Sydney

Biodiversity & Conservation Biology

Uni of Melbourne

Discrete Mathematics

Monash

Education

Deakin

Environmental & Geological Engineering

Monash

Forensic Science

UTS

Game Theory and Decision Science

UNSW

Geochemistry & Mineralogy

Curtin

Higher Education

Deakin

International Business

Deakin

Nursing

Griffith

Physical Education & Sports Medicine

ACU

Polymers & Plastics

UNSW

Rehabilitation Therapy

Monash

Reproductive Health

Monash

Software Systems

Uni of Melbourne

Water Supply & Treatment

Uni of Qld

PROTOTYPING A BRIGHTER FUTURE

Griffith's new Advanced Design and Prototyping Technologies Institute (ADaPT) will shape whole new industries for Australia.

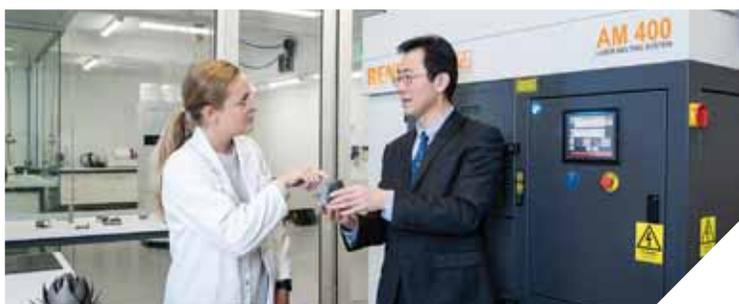
As a key enabler for end-to-end advanced manufacturing in South East Queensland, ADaPT will be a key R&D engagement platform with industry and a strong vehicle for Australia's future global success in priority industries such as aerospace and medical technologies.

From its base within the Gold Coast's Health and Knowledge Precinct, ADaPT's research, commercial and clinical partners will work alongside Griffith researchers on joint projects and programs.

ADaPT's work continues our strong history of innovation and social impact. Already, we're helping to create artificial hearts, revolutionising treatments for common injuries, and even supporting Australia's elite sportspeople through cutting-edge developments in digital twin creation, 3D printing, nano- and microtechnology, and more.

Blurring the lines between academic lab and commercial hub, ADaPT represents Griffith's commitment to Australia's modern manufacturing future. It will work to answer the great challenges of our time, translating our cross-disciplinary innovation into new products for emerging and established commercial markets.





SOLUTIONS FROM EARTH TO THE STARS

In a flagship project for ADaPT, Griffith University will support Gold Coast aerospace innovator Gilmour Space Technologies to prototype and develop a new class of low Earth orbit satellites, called the G-Satellite, set to launch in 2023.

Weighing 100 kilograms, the satellite's design and prototyping is part of a recently established five-year partnership between the University and Gilmour.

The project will use ADaPT's unique manufacturing and 3D-printing capabilities to reduce construction and operational costs, and improve metrics such as weight, payload, strength, and tolerance of forces such as extreme temperatures and vibrations.

ADaPT will provide researchers with access to the instruments, technology, and materials to enable critical breakthroughs in aerospace additive manufacturing—as well as create the next generation of aerospace engineers.

Expected to create hundreds of jobs over its lifetime, the deal will accelerate Australia's multibillion-dollar space industry and launch a range of future research opportunities.

With demand from commercial customers in a range of industries, these technological advancements will have applications for sectors including defence, mining and resources, disaster management, precision farming and environmental monitoring.



REIMAGINING DISABILITY AND REHABILITATION

Improving patients' lives and helping them to one day walk again lie at the heart of Griffith's BioSpine project, which seeks to personalise spinal injury rehabilitation through groundbreaking medical technology.

Led by biomechanical engineers Professor David Lloyd and Dr Claudio Pizzolato, the project combines leading approaches to treating spinal cord injury by integrating existing, commercially available rehabilitation devices with a digital twin.

Alongside fellow co-lead researcher—and 2021 Queensland Australian of the Year—Dr Dinesh Palipana OAM, the team uses functional modelling of a patient's musculoskeletal system to create smart rehabilitation devices designed to meet their individual needs.

At its heart, BioSpine is a testament to the strength of ADaPT's cross-disciplinary focus, with researchers combining, integrating, modifying and enhancing devices and technologies from a range of areas.

Further testifying to its collaborative nature, the project has worked with patients, clinicians, researchers, and engineers from the beginning to ensure the technology it is creating works and is easy to use in clinics and hospitals.

BioSpine recently received \$2 million in funding from the Motor Accident Insurance Commission, and includes researchers from Griffith, the University of Sydney, and University of Canterbury.



Business, Economics & Management

Hossein Rizeei
McGregor Coxall (ex UTS)
Emergency Management

This geospatial scientist researches data-driven support systems with applications for harmonising built and natural environments and managing natural disasters. "From data capturing techniques that simulate the natural behaviour of nature, to finding practical solutions that widen humanity's perspective over our planet, this 'work' is my castle in the sky."

Alexander Newman
Deakin University
Human Resources & Organisations

Nik Steffens
University of Queensland
Human Resources & Organisations

Jun Wen
Edith Cowan University
Tourism & Hospitality

Mingming Cheng
Curtin University
Tourism & Hospitality

Engineering & Computer Science

Shariful Islam
Deakin University
Medical Informatics

His research focuses on global health and using innovative mHealth, sensors, wearable devices and artificial intelligence for improving cardiovascular and metabolic health. "My interest includes understanding the influence of risk factors on diseases, how they change over time, developing new markers and novel approaches to prevention and management."



Seyedali Mirjalili
La Trobe University
Artificial Intelligence

Wanli Ouyang
University of Sydney
Computer Vision & Pattern Recognition

Derrick Wing Kwan Ng
UNSW
Computer Networks & Wireless Communication

Hwai Chyuan Ong
University of Technology Sydney
Sustainable Energy



Chemical & Material Sciences

Anthony Vasileff
Novafast (ex University of Adelaide)
Materials Engineering

He received his PhD in chemical engineering at the University of Adelaide in 2020, and researches the reaction fundamentals of key energy conversion processes like water electrolysis and CO2 reduction to fuels in order to develop catalyst design strategies. He aims to provide innovative solutions for a green economy.

Xiaoguang Duan
University of Adelaide
Chemical Kinetics & Catalysis

Dongliang Chao
University of Adelaide
Materials Engineering

Zengxia Pei
University of Sydney
Materials Engineering

Dawei Su
University of Technology Sydney
Materials Engineering

Physics & Mathematics

Peyman Mayeli
Monash University
Electromagnetism

One of this PhD student's most recent papers dealt with rotary electromagnetic energy-harvesting shock absorbers. He describes his research as the development and application of computational algorithms that can solve fluid and thermal convection challenges, and the use of optimisation techniques for thermo-flow system design.



Lu-Xing Yang
Deakin University
Physics & Mathematics (general)

Junqi Zhang
UNSW
Computational Mathematics

Nghia Nguyen Trong
University of Adelaide
Electromagnetism

Ran (Daniel) Zhang
RMIT University
Acoustics & Sound

Research

These are Australia's top 40 young researchers, the leaders of the future



Health & Medical Sciences

Fiona Charlson
University of Queensland
Psychiatry

At the Queensland Centre of Mental Health Research she uses psychiatric epidemiology and health services research to address the most challenging global mental health research questions, including the mental health impacts of climate change and conflict. "My ultimate goal is to improve mental health outcomes, particularly in vulnerable populations."

Felix Ogbo
Western Sydney University
Neurology

Simon Rosenbaum
UNSW
Psychiatry

Janni Leung
UNSW
Addiction

Loïc Yengo
University of Queensland
Genetics & Genomics

Humanities, Literature & Arts

Crystal Abidin
Curtin University
Communication

She is a sociocultural anthropologist of vernacular internet cultures, particularly young people's relationships with internet celebrity, self-curation, and vulnerability. She is program lead of Social Media Pop Cultures and founded the TikTok Cultures Research Network. Her research has contributed to policy updates for Facebook, Google, and Instagram.



Matthew Fuller-Tyszkiewicz
Deakin University
Gender Studies

Miriam Forbes
Macquarie University
Sex & Sexuality

Kelly-Ann Allen
Monash University
Religion

Axel Constant
University of Sydney
Philosophy



Social Sciences

Emily Corner
Australian National University
Diplomacy & International Relations

She researches how mental health and personality affect terrorist decision-making, drawing on criminology, psychology, psychiatry, sociology, and terrorism studies. "I want to understand why people become terrorists; expanding research and knowledge, influencing policy and practice, and offering insight into enacting meaningful behavioural changes in those at risk of offending."

Zaheer Allam
University of Western Australia
Urban Studies & Planning

Sefa Awaworyi Churchill
RMIT University
Environmental Law & Policy

Rebecca Collie
UNSW
Educational Psychology & Counseling

Patrick Brandful Cobbinah
University of Melbourne
Urban Studies & Planning

Life Sciences & Earth Sciences

Mohsin Tanveer
University of Tasmania
Botany

He is a plant physiologist who explores and improves crop performance under climate change conditions such as uncertain precipitation, high soil salinity and heavy metal pollution. "We need to revolutionise our way of thinking, and give our crops the ability to survive on their own once more."



Babar Shahzad
University of Tasmania
Botany

Xianbo Zhao
CQUniversity
Sustainable Development

Jinxing Ma
UNSW
Environmental Sciences

Qinglin Chen
University of Melbourne
Environmental Sciences

SAVING THE FROGS



THE UNIVERSITY OF
NEWCASTLE
AUSTRALIA



SCAN TO
WATCH VIDEO



Discover how our researchers and students are coming together to protect Australia's endangered frog population.

newcastle.edu.au/hippocampus

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CENTRAL COAST
NSW

Business, Economics & Management

Australia's research field leaders

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

Accounting & Taxation

Field leader: Ian Gow, Uni of Melbourne

Lead institution: Macquarie

Business, Economics & Management (general)

Field leader: Felix Ter Chian Tan, UNSW

Lead institution: Uni of Qld

Development Economics

Field leader: Paul Raschky, Monash

Lead institution: Monash

Economic History

Field leader: Pierre van der Eng, ANU

Lead institution: Uni of Melbourne

Economic Policy

Field leader: Yves Zenou, Monash

Lead institution: Monash

Economics

Field leader: Yves Zenou, Monash

Lead institution: UNSW

Educational Administration

Field leader: Jessica Holloway, ACU

Lead institution: Deakin

Emergency Management

Field leader: Douglas Paton, CDU

Lead institution: Uni of Qld

Entrepreneurship & Innovation

Field leader: Allan O'Connor, UniSA

Lead institution: QUT

Finance

Field leader: Dirk Baur, UWA

Lead institution: UNSW

Game Theory and Decision Science

Field leader: Haris Aziz, UNSW

Lead institution: UNSW

Human Resources & Organizations

Field leader: Alexander Newman, Deakin

Lead institution: Monash

International Business

Field leader: Paresh Narayan, Deakin

Lead institution: Deakin

Marketing

Field leader: Shahriar Akter, UOW

Lead institution: Griffith

Strategic Management

Field leader: Shahriar Akter, UOW

Lead institution: UNSW

Tourism & Hospitality

Field leader: Brent Ritchie, Uni of Qld

Lead institution: Griffith



Jesse Marlow

Alexander Newman

Deakin University

Field leader in Human Resources & Organizations

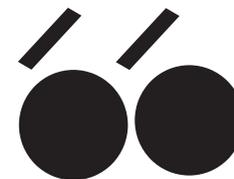
Wise heads warned Alexander Newman at the start of his academic career that he would need to have a clear focus, a speciality, to succeed.

And it's clear from his substantial publishing record and reputation in human resources and organisations that he took the advice – up to a point.

However, he has diverse interests, including fostering the careers of people from refugee backgrounds into employment.

“Careers is now my third research

Continued on P20



We had 60% success in helping people find jobs



Entrepreneurial people experience curiosity and excitement in doing new things, says Alexander Newman

Simon Peter Fox

Continued from P19

stream on top of organisational psychology and entrepreneurial psychology,” says the head of the management department at Deakin University’s business school.

Entrepreneurship is a burgeoning field, and some of Newman’s highly cited papers are about entrepreneurial self-efficacy – “the confidence to do entrepreneurial tasks”, as well as entrepreneurial leadership – where innovators “encourage their subordinates to engage in entrepreneurial thinking and implement entrepreneurial ideas”.

He confirms an innate tendency towards innovation is important – the children of business owners are more likely to go into business themselves – but also gives credit to the education system, where a lot more schools are now teaching entrepreneurship from an early age.

“I believe that we can develop these skills, however, there is that innate personality

profile,” he says, summarising it as “being open to experience ... that curiosity and excitement in doing new things”.

While the positive side is the vigour that comes from those qualities, the downsides can be burnout, plus the fact that the founder of a business is not necessarily the one to take it forward to, say, stock market listing.

Newman had his own entrepreneurial moment soon after he arrived in Australia when, in 2013, the federal government reintroduced the policy of turning back boats of asylum seekers.

“I saw this as a really important social issue,” he says. “People from a refugee background have a lot to provide to Australian society and the economy and we would benefit from a more humane approach.”

He set out to help. “A lot of agencies were providing support for people to get low skilled jobs such as catering and cleaning, but a lot of highly skilled professionals ... were not able to get access to the kind of jobs that they had

back in their home countries, and students from refugee backgrounds found it quite difficult to obtain graduate positions without a specific visa type.”

An Australian Research Council grant in 2014 enabled him and others to begin work and in 2019 they set up the Centre for Refugee Employment Advocacy, Training and Education, where he is director.

It runs career clinics that cater for 200 people annually, with an eight-week program and individual mentorship.

The centre has also developed guides to educate employers about the benefits of hiring people from a refugee background, and guides to support those people into the workforce and education system.

“Last year during the pandemic, we had a 60 per cent success rate in helping people to find skilled employment. That’s what I want to be known for, because it’s having the most social impact.”

Jill Rowbotham

Relevant research for regional Australia

Global pandemic pressures and geopolitical tensions are dramatically heightening the responsibility of educators and researchers to support and help build capacity in Australia's regional communities and industries.

Attention is turning to regional Australia: a growing recognition of secure lifestyle benefits in line with Regional Australia Institute's "Move to More" campaign; the search for answers to climate debates and urban population pressures; the path to new energy futures; and food and water security for domestic and international consumers. It is particularly regional communities and industries that must lead the charge in embracing growing environmental and social governance (ESG) demands.

As a leading regional research institution, the University of Southern Queensland (USQ) has a robust track record in education excellence, world-class research and real engagement with the regions it supports. As regional industries and communities, together with the three tiers of government, rightfully demand community and industry-led research, development, extension, adoption and commercialisation supported by strong collaboration between research providers, USQ is delivering.

USQ's Institute for Resilient Regions (IRR) leads the university's Regional Development flagship by focusing on social science research supporting regional communities to embrace change, adapt to change and innovate, all while maintaining their identity.

Change is ever-present. International supply chain disruption is focusing attention on regional sovereign manufacturing capabilities; telecommunications technology adoption and utilisation fast-tracked by Covid realities is paving the way for a new era of regional health services; and infrastructure needs (road, rail, water, education, health) have come to the



John McVeigh from the University of Southern Queensland

forefront of political priorities around the nation – all while the ESG demands of worldwide consumers and international financiers are finding an eager audience in regional food, fibre, energy, manufacturing and construction industries.

In the face of these global challenges and opportunities, the adage of think global, act local applies to regional Australia more than ever. In fact, this is at the core of USQ and IRR's strategic plans – regional engagement, educational excellence and research that addresses problems that matter. IRR's three research centres are doing just that:

- The Centre for Health Research is focused on health and wellbeing in regional communities – from adolescent mental health support, to cancer prevention strategies, to the battle against chronic health conditions such as heart disease and diabetes.
- The Centre for Heritage and Culture recognises the importance of storied landscapes – most especially through the Indigenous lens – that provide knowledge and learning through archaeology, anthropology and the arts, regarding our past and future potential.
- The USQ-led Rural Economies Centre of Excellence (RECoE), a research collaboration between USQ, UQ, CQU and JCU, assists rural economic development and diversification through entrepreneurship, technological development, innovation and new models of business and marketing.

USQ's research across these themes – health and wellbeing, heritage and culture, and regional innovation – is at the heart of recent achievements, current efforts and future plans to support communities and industries.

Under the federal government's \$5bn Future Drought Fund (FDF), USQ is leading

the new Southern Qld / Northern NSW Drought Innovation Hub, one of eight national hubs building drought preparedness and resilience in regional Australia. Through nodes at Longreach, Roma, Stanthorpe, Narrabri, Armidale (with

UNE) and Lismore (with SCU), researchers are tasked with co-designing and developing solutions that meet community identified needs.

USQ/RECoE is also a proud partner in the FDF's Drought Resilient Leaders Program with the Australian Rural Leadership Foundation and the Foundation for Rural and Regional Renewal and is now engaged by the Queensland government to facilitate statewide Regional Drought Resilience Planning with the local government sector.

Be it research and engagement with the Ipswich and Toowoomba Chambers of Commerce; the AgTech & Logistics Hub; the Darling Downs and South West Queensland Mayors' Forum; regional innovation ecosystem development in Goondiwindi, Quilpie, Wide Bay/Burnett, Roma or Longreach; leading edge waste-to-energy technology in beef processing; or the next generation of global precision agricultural technology with the John Deere Corporation; USQ is unashamedly focused on applied practical research to actively support regional Australia. Community, industry and all levels of government are insisting USQ does so.

Global uncertainties are amplifying the need for regional Australia to be proactive for our social, economic and environmental future. USQ is up to that challenge and so too are the regions, communities and industries it is proud to support.

**Professor the Honourable
John McVeigh**

**EXECUTIVE DIRECTOR,
INSTITUTE FOR RESILIENT REGIONS,
UNIVERSITY OF SOUTHERN QUEENSLAND**



UNSW
RNA Institute

RNA for a more resilient future

UNSW Sydney is leading a new \$25 million institute that will establish Australia's first RNA-based manufacturing hub. The **UNSW RNA Institute** applies cross-disciplinary research expertise to develop RNA technologies and therapies that will not only combat current and future pandemics, but also treat cancer, genetic and autoimmune diseases.

The mRNA vaccine is one of the few positives to emerge from COVID-19 but it's just the tip of the iceberg. RNA therapeutics are revolutionising

medicine and RNA will form the foundation for many advancements in biotechnology.

The **UNSW RNA Institute** is part of the NSW RNA Bioscience Alliance, a partnership across all the state's universities, and the NSW Government-funded \$15 million NSW RNA Production and Research Network. Together, we're building a world-leading manufacturing capability in NSW that will yield jobs, skills, and innovation in an industry with the potential to transform lives.

> Join our RNA ecosystem: unswrna.institute





Priority health areas

- 1 COVID-19 – infection treatment and vaccines for current and future variants
- 2 Cancer – focus on hard-to-treat cancers in children
- 3 Rare and genetic disorders in children

Professor Pall Thordarson, expert in nanomedicine and synthetic chemistry, is Director of the UNSW RNA Institute and leads the collaborative NSW RNA Bioscience Alliance.



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: Xianbo Zhao, CQUniversity

Lead institution: UNSW

Artificial Intelligence

Field leader: Seyedali Mirjalili, Torrens

Lead institution: UTS

Automation & Control Theory

Field leader: Peng Shi, Uni of Adelaide

Lead institution: Swinburne

Aviation & Aerospace Engineering

Field leader: Roberto Sabatini, RMIT

Lead institution: RMIT

Bioinformatics & Computational Biology

Field leader: Geoff Webb, Monash

Lead institution: Monash

Biomedical Technology

Field leader: Yin Xiao, QUT

Lead institution: QUT

Biotechnology

Field leader: Huu Hao Ngo, UTS

Lead institution: Uni of Qld

Civil Engineering

Field leader: Joshua Zhao, UNSW

Lead institution: Monash

Computational Linguistics

Field leader: Timothy Baldwin, Uni of Melbourne

Lead institution: Uni of Melbourne

Computer Graphics

Field leader: Maxime Cordeil, Monash

Lead institution: Monash

Computer Hardware Design

Field leader: Xinghuo Yu, RMIT

Lead institution: RMIT

Computer Networks & Wireless

Communication

Field leader: Derrick Wing Kwan Ng, UNSW

Lead institution: UNSW

Computer Security & Cryptography

Field leader: Yang Xiang, Swinburne

Lead institution: Swinburne

Computer Vision & Pattern Recognition

Field leader: Dacheng Tao, Uni of Sydney

Lead institution: Uni of Sydney

Computing Systems

Field leader: Rajkumar Buyya, Uni of Melbourne

Lead institution: Uni of Melbourne

Data Mining & Analysis

Field leader: Xiaofang Zhou, Uni of Qld

Lead institution: UTS

Databases & Information Systems

Field leader: Chengqi Zhang, UTS

Lead institution: UTS

Educational Technology

Field leader: Dragan Gasevic, Monash

Lead institution: UniSA

Engineering & Computer Science (general)

Field leader: Qing-Long Han, Swinburne

Lead institution: UNSW

Environmental & Geological Engineering

Field leader: Ranjith Pathegama Gamage, Monash

Lead institution: Monash

Evolutionary Computation

Field leader: Seyedali Mirjalili, Torrens

Lead institution: Deakin

Food Science & Technology

Field leader: Bhesh Bhandari, Uni of Qld

Lead institution: Uni of Qld

Fuzzy Systems

Field leader: Seyedali Mirjalili, Torrens

Lead institution: UTS

Human Computer Interaction

Field leader: Marcus Carter, Uni of Sydney

Lead institution: Uni of Melbourne

Library & Information Science

Field leader: Hamid Jamali, CSU

Lead institution: UTS

Manufacturing & Machinery

Field leader: Ang Liu, UNSW

Lead institution: UOW

Mechanical Engineering

Field leader: Jie Yang, RMIT

Lead institution: RMIT

Medical Informatics

Field leader: Enrico Coiera, Macquarie

Lead institution: Macquarie

Metallurgy

Field leader: Huijun Li, UOW

Lead institution: Monash

Microelectronics & Electronic Packaging

Field leader: Xiangdong Li, RMIT

Lead institution: Griffith

Dong-Sheng Jeng

Griffith University

Field leader in Ocean & Marine Engineering

From the moment pipelines began snaking their way between continents under the ocean and oil companies punched pylons through seabeds and topped them with giant platforms, engineers such as Dong-Sheng Jeng have had their work cut out for them.

The professor in Griffith University's school of engineering and built environment is part of the worldwide effort to protect submarine structures, including infrastructure such as power transmission cables, that are subject to natural marine geo-hazards such as earthquakes, seabed movement, wind and wave loadings.

Apparently the challenge is simple. "Nowadays, the structure above the water can withstand environmental loading with current civil engineering technique, but without that stability in the seabed, they can fall down," says the field leader in ocean and marine engineering.

However, the answers are complex, and Jeng's research in the field has taken him into directions that include studies of porous flow, offshore geotechnics, ocean and coastal engineering, groundwater and offshore wind energy.

Geopolitical tensions are part of the reason many countries are funding this area of research, especially when it comes to the North Sea and the South China Sea.

"Whichever country can control the ocean resources will become the top country," he says.

"Many countries are trying to do that in South China Sea recently. My research team don't get involved in political issues, we just try to find a way to protect our marine environment."

Controlling the resources means establishing and protecting reliable infrastructure – and vigilant maintenance. "The foundations can cause problems for the whole



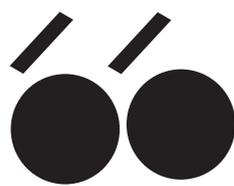
Russell Shakespeare

structure over time. Earthquakes are one main concern that can cause structural and foundational damage, but another is ocean wave loading. Waves generate pressure and that causes problems.”

How long it takes for the stability to erode varies greatly, but “wave loading just keeps going, it depends on the seabed condition and also on the size of the wave,” he says.

“If there is a storm – say a cyclone – huge waves generate wave pressure on the seabed and the foundations can develop problems immediately. However, if there are small waves, sometimes it takes years because they change the soil condition gradually.”

Water depth is also an issue. “In shallow water the waves will dominate a system; in deep water – over 100m – surface waves may not be a problem, although even steady



We just try to find a way to protect the oceans

wave pressure can create huge pressure beneath. In deep water, currents will be more important than wave pressure.”

Engineers like him design foundations taking into account the possibility of “20 year” storms with additional safety factors. “But there are still the unknowns, that’s why we are still doing research,” he says.

A recent project he is involved with is the Blue Economy Cooperative Research Centre’s 10-year effort to increase seafood and renewable energy production, specifically through the offshore technology program led by the University of Queensland’s Chien Ming Wang. “I am working on the mooring system and the anchors and associated foundation problems for the offshore aquaculture pens,” he says.

Jill Rowbotham

Mining & Mineral Resources

Field leader: Ranjith Pathegama Gamage, Monash

Lead institution: Curtin

Multimedia

Field leader: Wanqing Li, UOW

Lead institution: UTS

Ocean & Marine Engineering

Field leader: Dong-Sheng Jeng, Griffith

Lead institution: Uni of Tasmania

Operations Research

Field leader: Ben Fahimnia, Uni of Sydney

Lead institution: UNSW

Plasma & Fusion

Field leader: Boyd Blackwell, ANU

Lead institution: ANU

Power Engineering

Field leader: Zhaoyang Dong, UNSW

Lead institution: UNSW

Quality & Reliability

Field leader: Paul Salmon, USC

Lead institution: USC

Radar, Positioning & Navigation

Field leader: Peter Teunissen, Curtin

Lead institution: Curtin

Remote Sensing

Field leader: Xiuping Jia, UNSW

Lead institution: Monash

Robotics

Field leader: Michael Milford, QUT

Lead institution: QUT

Signal Processing

Field leader: Dacheng Tao, Uni of Sydney

Lead institution: Uni of Sydney

Software Systems

Field leader: Rajkumar Buyya, Uni of Melbourne

Lead institution: Uni of Melbourne

Structural Engineering

Field leader: Jie Yang, RMIT

Lead institution: UNSW

Sustainable Energy

Field leader: Anita Ho-Baillie, Uni of Sydney

Lead institution: UNSW

Technology Law

Field leader: Dan Svantesson, Bond

Lead institution: Griffith

Textile Engineering

Field leader: Lijing Wang, RMIT

Lead institution: RMIT

Theoretical Computer Science

Field leader: Nicholas Wormald, Monash

Lead institution: Monash

Transportation

Field leader: David Hensher, Uni of Sydney

Lead institution: Uni of Sydney

Water Supply & Treatment

Field leader: Ho Kyong Shon, UTS

Lead institution: Uni of Qld

Wood Science & Technology

Field leader: Wu Ta Yeong, Monash

Lead institution: Monash



Australian research excellence should be celebrated like our sporting prowess and internationally acclaimed movie making. Australian researchers have

pioneered some of the greatest breakthroughs in world history. From Howard Florey's role in the medical application of penicillin, to the invention of the black box flight recorder, the development of wi-fi and the Gardasil vaccine, we can be proud of our nation's role in advancing society.

Researchers at UNSW Sydney are part of that legacy. They have led the way in high-profile areas such as photovoltaics (solar energy), quantum computing and HIV treatment.

But for every research project you've heard of, hundreds – across a range of scientific and human endeavour – remain relatively unknown despite their potential to make a profound difference.

A few examples from UNSW make this clear. Researchers in our SMaRT Centre have developed an internationally patented green steelmaking process; UNSW Law & Justice has partnered with the UK Government on sustainable ocean development; and experts from the School of Built Environment are working on new generation building materials to counteract the effects of climate change on cities. This is just a sample of the extensive list of UNSW research contributions.

In recent years, that research has been guided by the UNSW 2025 Strategy, a document developed after extensive consultation with the UNSW community. The Strategy highlights our commitment to partnership and a multidisciplinary approach as we seek solutions to society's greatest challenges. Our mission is for our research to add value and make a difference to people's lives – locally and globally.

UNSW's response to COVID-19 is an example of this people-centric attitude. Our epidemiologists and virologists have interpreted complex information for the general public, while our researchers and students worked on such vital initiatives as rapid testing for remote Indigenous communities, and repurposing ventilators to relieve stress on our hospital system.

Our long-term commitment to the community is also evident in the university's recent investment of \$25m to establish an RNA Institute to assist the NSW Government in building a much-needed onshore manufacturing hub for RNA technologies and therapies.

It reflects the specialist capability within our institution and the breadth of UNSW's



Professor Ian Jacobs, UNSW Vice-Chancellor

Research creates huge economic and social benefits

experience in working with industry to commercialise research.

Researchers at UNSW have long known the benefit of optimising funding, expertise, infrastructure and outcomes through partnership, but our strategic commitment to collaboration has also positioned us well to navigate a more fiscally constrained environment.

In western Sydney, a region with enormous potential, UNSW is working with other universities, TAFE, industry, and government to create an innovative multiversity. This new, integrated education, training and research approach will support a hi-tech manufacturing hub that will coalesce around the Aerotropolis.

In Randwick, a new health and innovation precinct is realising a decades-long dream to integrate health, research and education. This relationship between the Randwick hospitals, UNSW, research institutes, the NSW Government and our health partners will see researchers work side-by-side with clinicians and patients to provide more personalised, holistic healthcare.

These examples of the focus of UNSW research sit alongside metrics by which we measure our qualitative and quantitative progress. In the 2020 Highly Cited

Researchers list, 31 UNSW academics were named among the world's most influential in their fields, up from three in 2015. That places us 25th among universities globally.

We are also ranked as Australia's leader for the combination of research quality and research impact in the most recent government report on Excellence in Research for Australia and Engagement and Impact.

When developing Strategy 2025, UNSW set the bold and ambitious objective of becoming a Top 50 global university by 2025 on the combination of the three leading rankings – QS, ARWU and THE. We are hopeful this will be achieved four years ahead of schedule, by the end of 2021.

Rankings may not be a perfect system, but they are the best measure for comparing the relative research strength of universities, globally. They are part of a virtuous circle. The better the research, the greater the research outputs and impact, the better the reputation, and the higher the institution places in the rankings. Success attracts more industry partners, more commercialisation of research, more grants, more outstanding academics and more high calibre students from around the world.

Total investment in research and development in Australia, as a percentage of GDP, is below the OECD average. That means in the current university funding model, attracting international education, philanthropy and industry partnerships is essential to remain competitive. Being a highly ranked university makes that much easier.

For UNSW, attracting different sources of income means we can deliver our university's ambitious strategy which is, fundamentally, about improving lives. The national Higher Education Research Data Collection shows our research income has grown by some 65 per cent since 2015 – a testament to the strength of our partnerships and research credentials.

As our country regains its footing after COVID, university researchers have the knowledge and skills to guide an innovative, hi-tech, equitable recovery. However, that requires greater public funding.

Investment in research is not a burden on the public purse. It is a wise investment in Australia's future that generates enormous economic and social return.

Professor Ian Jacobs
PRESIDENT AND VICE-CHANCELLOR,
UNSW SYDNEY

Chemical & Material Sciences

Australia's research field leaders

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



Jesse Marlow

Kate Nguyen

RMIT University

Field leader in

Composite Materials

With degrees in chemical engineering and materials engineering from Vietnam universities, followed by a doctorate in civil engineering from the University of Melbourne, Thuy Quynh Nguyen was inspired to use her expertise to limit bushfire damage to Australia's rural homes.

Nguyen, often known as Kate, arrived in Australia in 2011 to study for her doctorate and soon heard about the intense bushfires that explode across the nation in summer.

"When I saw the issues around bushfires, then it triggered me to think about a solution from a materials point of view, a construction point of view, because that is where my expertise is," she says.

Now 38, and a leader in the field of composite materials, Nguyen is developing a spray-on coating for rural buildings to help them resist the ravages of bushfires.

"I work on flame-retardant construction materials, also on construction technologies

to increase the fire safety of the buildings," she says, adding it is important to consider the fire safety of a structure as a whole, as well as assessing the fire safety of the individual construction elements.

The frequency and severity of bushfires has increased with climate change and they have become an increasing threat to lives, the environment and people's homes. While devastating, bushfires often move quickly, and a rural building may only have to resist the heat and flames for a short time until the danger passes, Nguyen says.

"That's why I came up with the idea of having an additional coating on top of the existing infrastructure – so that we can buy some more time, extend the time the structure can withstand that fire intensity."

A senior lecturer at RMIT University and chief engineer at Cladding Safety Victoria, Nguyen is developing the fire-retardant coating for rural buildings as an independent project, sponsored by the L'Oréal-UNESCO For Women in Science foundation.

The coating she is working on differs from cladding. External cladding panels attached to buildings can be dangerous: the flammable cladding on the Grenfell building in London was blamed for spreading the fire that eventually led to the loss of 72 lives.

"If we look at the issues we have faced with cladding recently, we didn't have a holistic view of the building," Nguyen says, adding that while a facade can insulate a building and improve its thermal performance, fire safety concerns should always be of primary importance.

The ceramic-like coating she is developing as a fire retardant will sit flush on the walls of buildings and provide a protective outer shell, filling in any gaps in the building's envelope to both fireproof it and increase thermal efficiency.

Nguyen has already achieved success in reducing the heat and pressure needed to make the coating. Working with industry partners, she expects the fireproof coating to be commercially available within a year.

"I don't want to just create something that is safe, but that compromises the sustainability side of construction or vice versa. My passion is to bring fire safety and sustainability together."

Sian Powell

Analytical Chemistry

Field leader: Nam-Trung Nguyen, Griffith

Lead institution: Monash

Biochemistry

Field leader: Daniel Murphy, UWA

Lead institution: Monash

Ceramic Engineering

Field leader: Shujun Zhang, UOW

Lead institution: UNSW

Chemical & Material Sciences (general)

Field leader: Shi Zhang Qiao, Uni of Adelaide

Lead institution: UNSW

Chemical Kinetics & Catalysis

Field leader: Shaobin Wang, Uni of Adelaide

Lead institution: Uni of Adelaide

Combustion & Propulsion

Field leader: Evatt Hawkes, UNSW

Lead institution: UNSW

Composite Materials

Field leader: Kate Nguyen, RMIT

Lead institution: RMIT

Crystallography & Structural Chemistry

Field leader: Stuart Batten, Monash

Lead institution: ANSTO

Dispersion Chemistry

Field leader: Shaobin Wang, Uni of Adelaide

Lead institution: Uni of Qld

Electrochemistry

Field leader: Shi Xue Dou, UOW

Lead institution: UOW

Inorganic Chemistry

Field leader: Mark Humphrey, ANU

Lead institution: Uni of Sydney

Materials Engineering

Field leader: Shi Xue Dou, UOW

Lead institution: UOW

Medicinal Chemistry

Field leader: Anthony Carroll, Griffith

Lead institution: Uni of Qld

Nanotechnology

Field leader: Shi Xue Dou, UOW

Lead institution: UOW

Oil, Petroleum & Natural Gas

Field leader: Zhejun Pan, CSIRO

Lead institution: Curtin

Organic Chemistry

Field leader: Yusuke Yamauchi, Uni of Qld

Lead institution: Uni of Qld

Polymers & Plastics

Field leader: Cyrille Boyer, UNSW

Lead institution: UNSW

Physics & Mathematics

Australia's research field leaders

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

Acoustics & Sound

Field leader: Nicole Kessissoglou, UNSW

Lead institution: UNSW

Algebra

Field leader: Aidan Sims, UOW

Lead institution: UNSW

Astronomy & Astrophysics

Field leader: Joss Bland-Hawthorn, Uni of Sydney

Lead institution: ANU

Computational Mathematics

Field leader: Fawang Liu, QUT

Lead institution: UNSW

Condensed Matter Physics & Semiconductors

Field leader: Paul Lasky, Monash

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: Ivan Marusic, Uni of Melbourne

Lead institution: Uni of Melbourne

Geometry

Field leader: Brett Parker, Monash

Lead institution: Monash

Geophysics

Field leader: Peter Teunissen, Curtin

Lead institution: ANU

High Energy & Nuclear Physics

Field leader: Bruce Yabsley, Uni of Sydney

Lead institution: Uni of Adelaide

Mathematical Analysis

Field leader: Fedor Sukochev, UNSW

Lead institution: Curtin

Mathematical Optimisation

Field leader: Matthew Tam, Uni of Melbourne

Lead institution: UTS

Mathematical Physics

Field leader: Ian Marquette, Uni of Qld

Lead institution: Uni of Sydney

Nonlinear Science

Field leader: Tonghua Zhang, Swinburne

Lead institution: Swinburne

Optics & Photonics

Field leader: Jiayang Wu, Swinburne

Lead institution: ANU

Physics & Mathematics (general)

Field leader: Vincent Wallace, UWA

Lead institution: ANU

Peter Teunissen

Curtin University

Field leader in Geophysics



Curtin University senior professor Peter Teunissen has seen the field of satellite technology expand at a phenomenal rate over the past few decades.

From a distance of thousands of kilometres, satellites can now help detect ore deposits on Earth, determine the moisture content of soil for better crop planting, provide instant navigation assistance for walkers and motorists, accurately predict weather patterns and ensure that no one with a satellite-connected device will ever be truly lost again.

Today, dependence on global navigation satellite systems (GNSS) has penetrated all levels of society, Teunissen says.

“The timing systems we are using for computers, the synchronisation of timing – that’s all linked to GNSS.”

Awarded an Australian Research Council Federation Fellowship, the precursor of the current ARC Laureate Fellowship, Teunissen moved to Australia more than a decade ago.

He has been associated with Curtin University since 2009 and he is now an award-winning expert in the field of satellite technology, specialising in interferometric GNSS, the use of satellite signals for the high precision measurement of the parameters of water and land masses.

The new frontier of miniaturised satellites has also caught Teunissen’s

attention. Called cubesats – and often not much larger than a loaf of bread – the mini-satellites are within the economic reach of universities and corporations. “The cubesats really are the future for increasing the number of satellites and constellations because even students, of course with proper supervision, are able to design satellites and then they can be launched with a much lower budget,” he says.

Teunissen has been fascinated by the potential of satellite technology from the field’s earliest days. As a professor of geodesy, classically the study of the Earth’s shape and surface, in the early 1990s he was invited to choose his own specialisation at the Delft University of Technology in the Netherlands.

He looked to the emerging field of satellite technology and discovered that his homeland had no GPS know-how, no GPS infrastructure and no GPS equipment. He used generous grant funding from the Netherlands’ Royal Academy of Sciences to buy the nation’s first GPS receiver for \$US300,000.

As a demonstration of the rocketing speed of the field’s development, he says that nowadays such a GPS receiver might cost \$US100.

Sian Powell

Probability & Statistics with Applications

Field leader: Minh-Ngoc Tran, Uni of Sydney

Lead institution: Monash

Pure & Applied Mathematics

Field leader: David Wood, Monash

Lead institution: Monash

Spectroscopy & Molecular Physics

Field leader: Kamila Kochan, Monash

Lead institution: Uni of Qld

Thermal Sciences

Field leader: Jiyuan Tu, RMIT

Lead institution: Uni of Adelaide

Building a prototype for a brighter future

Research and innovation will not only help chart a way out of the Covid pandemic, they will also be the foundation to rebuild and shape our cities, states and nation. Simply getting back to where we were before the pandemic won't be enough if we are to flourish in the future. The actions that we take today will determine the future that we create for Australia.

Improving Queensland's prototyping and manufacturing capabilities is a tangible step towards ensuring that future is a bright one. These capabilities, and our capacity to engage and grow them, will offer the opportunity to help shape whole new industries for Australia. Not only will investment in these areas create immediate and long-term regional jobs, but it will also help to ensure our ongoing financial and technological resilience.

At Griffith University, we have long recognised the importance of these fields in providing solutions to problems in a range of sectors including health, aerospace, data and AI, engineering, mining and beyond. For the past few years, researchers at our Advanced Design and Prototyping Technology (ADaPT) pilot facility on the Gold Coast have been working across disciplinary lines to break new ground through industry-led design, prototyping and manufacturing projects.

Through our new proposed ADaPT facility, to be located in the Gold Coast's Health and Knowledge Precinct, we plan to create an effective "one-stop shop" for end-to-end services in the design, development and manufacture of game-changing innovations. Our staff and students will not only work to translate their own research into solutions for real world problems, they will work closely with industry partners as well. ADaPT will provide a hub for engagement through embedding industry partners and working with them to create cutting-edge solutions using 3D printing,



Professor Carolyn Evans, Vice-Chancellor of Griffith University

digital twins, micro- and nano-technology, big data analytics, artificial intelligence, complex imaging, and industrial design.

Already, we have seen an enthusiastic response from industry, with several organisations engaged in partnerships with our researchers.

One such flagship relationship is the recently signed five-year agreement between Griffith and local company Gilmour Space Technologies, which will see the University work with Gilmour Space to improve Australia's aerospace capabilities and presence by developing Australia's largest low Earth orbit (LEO) satellite. This project alone is expected to create 1000 jobs over its lifetime and build greater economic diversity and resilience in the Gold Coast, which has been hard hit by Covid.

Another of ADaPT's success stories is the BioSpine personalised spinal-injury rehabilitation project, led by biomechanical engineers Professor David Lloyd and Dr Claudio Pizzolato, alongside Queensland's 2021 Australian of the Year (and Griffith graduate), Dr Dinesh Palipana. Using existing, commercially available rehabilitation devices as their base, the team are working to integrate biomechanical technologies, known as digital twins, to improve quality of life for spinal injury patients – and even give them the hope of one day walking again.

Other exciting projects include Griffith researchers' work in developing artificial wrist ligaments to help treat injuries

commonly experienced by active, young people and athletes, mapping patients' brain aneurysms through 3D-printed personalised replicas to allow surgeons to rehearse incredibly delicate procedures, and the development of "blood-friendly" prostheses for use in a total artificial heart.

Ultimately, ADaPT will provide Queensland with a world-class research and industry access facility, to nurture the skills and knowledge necessary for the jobs of the future.

Moreover, the facility clearly demonstrates Griffith's commitment to high-quality, professional science, engineering and design, as well as health education and research. Its location in a precinct that already houses a facility for promising start ups, established companies and two hospitals will create significant opportunities for both formal partnerships and the sparks of inspiration provided by co-location.

It is our great hope that it will stand as a beacon of proactive and meaningful industry engagement that directly benefits our partner organisations, the economy and our local communities – and therefore the whole of Australia.

Professor Carolyn Evans
VICE-CHANCELLOR,
GRIFFITH UNIVERSITY



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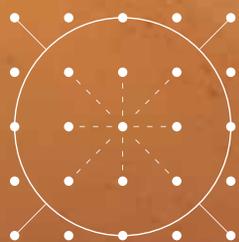
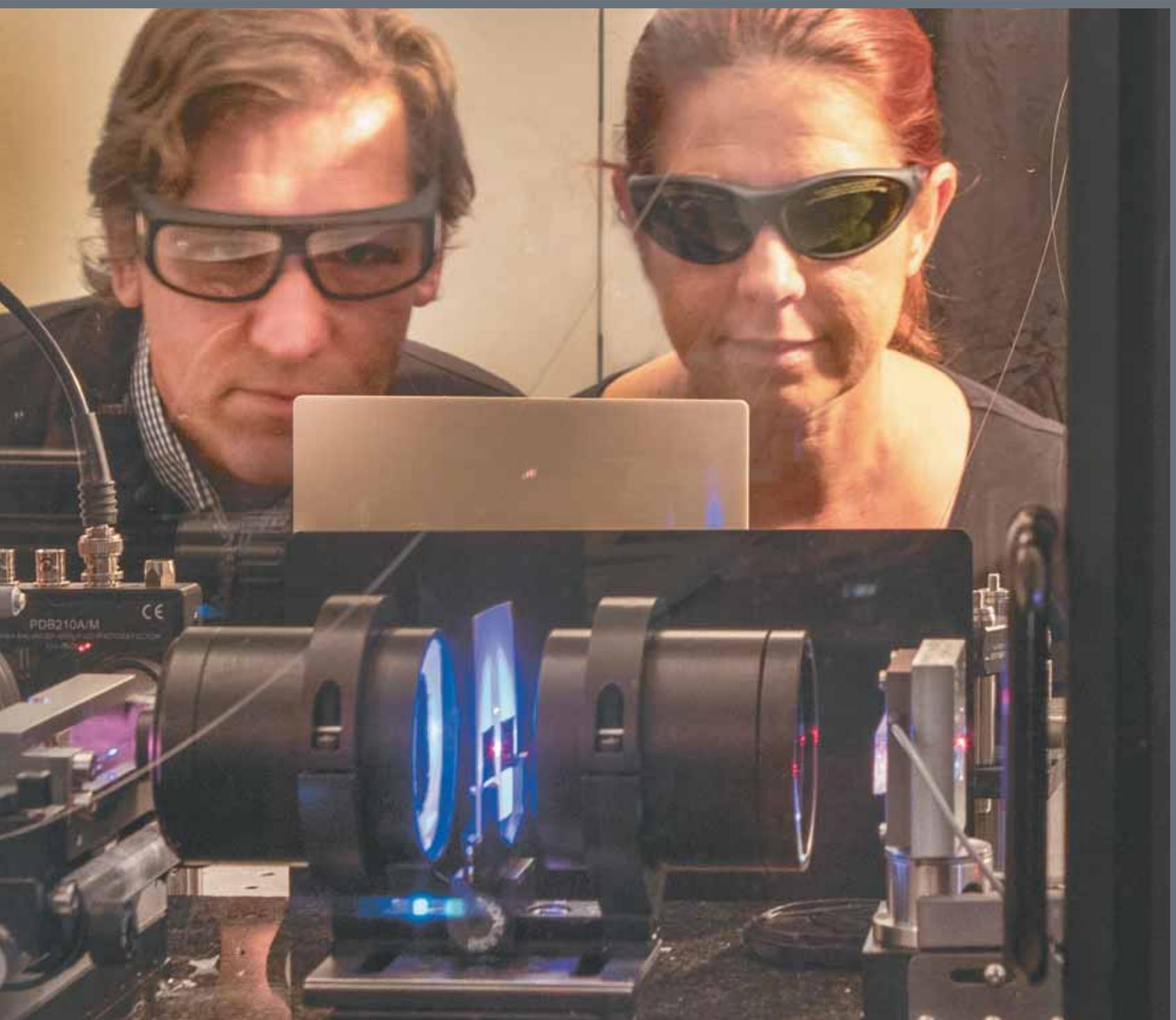
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SUMMIT 2022**

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Health & Medical Sciences

Australia's research field leaders

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

Addiction

Field leader: Daniel King, Flinders

Lead institution: UNSW

AIDS & HIV

Field leader: Matthew Law, UNSW

Lead institution: UNSW

Alternative & Traditional Medicine

Field leader: Amie Steel, UTS

Lead institution: UTS

Anaesthesiology

Field leader: Paul Myles, Monash

Lead institution: Monash

Audiology, Speech & Language Pathology

Field leader: Louise Hickson, Uni of Qld

Lead institution: Uni of Sydney

Bioethics

Field leader: Wendy Lipworth, Uni of Sydney

Lead institution: Uni of Sydney

Cardiology

Field leader: Paul Bannon, Uni of Sydney

Lead institution: Uni of Sydney

Child & Adolescent Psychology

Field leader: Marleen Westerveld, Griffith

Lead institution: La Trobe

Clinical Laboratory Science

Field leader: William Parsonage, RBWH

Lead institution: Qld Health

Communicable Diseases

Field leader: David Paterson, Uni of Qld

Lead institution: Monash

Critical Care

Field leader: Craig French, Western Health

Lead institution: Western Health

Dentistry

Field leader: Zohaib Akram, UWA

Lead institution: Uni of Adelaide

Dermatology

Field leader: Adele Green, QIMR Berghofer

Lead institution: Uni of Qld

Developmental Disabilities

Field leader: Cheryl Dissanayake, La Trobe

Lead institution: La Trobe

Diabetes

Field leader: Vlado Perkovic, UNSW

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: Paul Glasziou, Bond

Lead institution: Monash

Gastroenterology & Hepatology

Field leader: Behzad Hajarizadeh, UNSW

Lead institution: UNSW

Genetics & Genomics

Field leader: Peter Visscher, Uni of Qld

Lead institution: Uni of Qld

Gerontology & Geriatric Medicine

Field leader: Christopher Cleon Rowe, Austin Health

Lead institution: Uni of Sydney

Gynaecology & Obstetrics

Field leader: Ben Willem Mol, Monash

Lead institution: Uni of Qld

Health & Medical Sciences (general)

Field leader: Yohannes Kinfu, Uni of Canberra

Lead institution: Uni of Qld

Heart & Thoracic Surgery

Field leader: Yves d'Udekem, RCH Melbourne

Lead institution: Royal Melbourne Hospital

Haematology

Field leader: Constantine Tam, Uni of Melbourne

Lead institution: Monash

Hospice & Palliative Care

Field leader: Jane Phillips, QUT

Lead institution: UNSW

Immunology

Field leader: Richard Kefford, Macquarie

Lead institution: Monash

Molecular Biology

Field leader: Graham Mann, ANU

Lead institution: Macquarie

Natural Medicines & Medicinal Plants

Field leader: Anthony Carroll, Griffith

Lead institution: Griffith

Neurology

Field leader: Graeme Hankey, UWA

Lead institution: Monash

Neurosurgery

Field leader: Jeffrey Rosenfeld, Monash

Lead institution: Monash

Nuclear Medicine, Radiotherapy & Molecular Imaging

Field leader: Rod Hicks, Peter Mac

Lead institution: Uni of Sydney

Nursing

Field leader: Debra Jackson, UTS

Lead institution: Griffith

Amie Steel

University of Technology Sydney

Field leader in Alternative & Traditional Medicine

Having established at an early age that she wanted to devote her career to health care, Amie Steel was pleased to discover that didn't necessarily mean becoming a doctor.

"That there was an option to provide health care for people using natural interventions really appealed to me," says the senior

Continued on P35



The economics of complementary medicine is a barrier

Russell Shakespeare

research fellow at University of Technology Sydney's Australian Research Centre in Complementary and Integrative Medicine.

Steel trained as a naturopath in her home city of Brisbane and practised there and in regional NSW before embarking on a research career. She is this year's most highly cited scholar in the field of alternative and traditional medicine.

While she started out with and retains a research interest in prenatal care, she says that now: "my overarching drive is to see a more integrated, collaborative, person-centred health system".

Recent published work from 2018 showed two-thirds of Australians had used complementary medicine of some kind in the previous 12 months. Bodywork was the most popular, including massage therapy, chiropractic and yoga, but

naturopathy, vitamin supplements, herbal medicine are there too.

Complementary medicine therapies are distinct from allied health disciplines such as osteopathy, podiatry, and dietetics.

Of the Australians who used complementary medicine, one-third visited a practitioner, such as a naturopath or acupuncturist and half used a product (such as vitamins) or a practice (such as yoga), with some using both a product and a practice.

"If we've got two-thirds of the population using some form of complementary medicine we need to know how to make sure that the people providing that care are part of the conversation among the health care team that are looking after that individual."

This ambition touches on some of the complexities Steel grapples

with in her research. It is straightforward to establish that Australians like and use a range of treatments not taught as part of medical degrees, however being "part of the conversation" gives rise to a complicated set of issues.

These include the lack of an agreed evidence base for the effectiveness of complementary medicines, which discourages its acceptance by the medical community and by the policy makers who set the rebates for medical care.

"The economics of complementary medicine is a barrier – it ends up painting complementary medicines as something for the worried well," Steel says.

Hence her keen interest in what is called implementation science.

"It's about how different types of

knowledge are used, shared and prioritised in a clinical consultation and how can we get better evidence into complementary medicine practice," she says.

"But also how can we learn from what clinicians are observing in clinical practise to help to develop better research questions and develop studies, evaluating the sorts of treatments that the public is already accessing in complementary medicine practice."

In fact, Steel would like to dispense with the label "complementary medicine", as being so broad as to be almost meaningless.

"I would like to see each of the professions that are currently encompassed by complementary medicine treated and evaluated on their own merits," she says.

Jill Rowbotham

Paul Glasziou Bond University Field leader in Epidemiology

Among the challenges the Covid-19 outbreak presented to researchers was the need to get studies about it done quickly: its spread, characteristics, treatment and prevention were all top priorities.

From the perspective of clinical epidemiologist and Bond University director of the Institute for Evidence-Based Healthcare, Paul Glasziou, speed bred poor practices.

"A problem with the whole pandemic [was] very poor quality of research and very poor quality of reporting," Glasziou says.

While his research mainly focuses on what he calls "big neglected problems – like antibiotic resistance and antibiotic stewardship, non-drug therapies and overtreatment and overdiagnosis", research wastage is another major field of study.

Glasziou collaborated on one of the first reviews of the critical question of how many people who contracted Covid-19 were asymptomatic.

"There was a lot of worry about people having no symptoms but being able to transmit the virus. And a lot of the papers that were published on that were flawed," he says.

The chief difficulty was the failure to follow subjects for long enough to produce valid results.

"Well-designed studies told us a reasonably true estimate of that asymptomatic rate, which turned out to be around about 17 per cent when you averaged across all of the good quality studies," Glasziou says.

That very influential 2020 paper was picked up by the World Health Organisation, via review team member and UNSW epidemiologist Mary-Louise McLaws, who is also a member of two hugely important WHO committees dealing with its response to Covid-19 and development of guidance in relation to it.



While good work "saved hundreds of thousands of lives in the pandemic", Glasziou argues much of it arose from a level of preparedness among scientists who had experienced previous pandemics.

An example was the Coalition for Epidemic Preparedness Innovations (CEPI), launched at the World Economic Forum at Davos, Switzerland, in 2017 to develop vaccines to stop future epidemics. Among the Covid-19 vaccine trials it invested in are Moderna, the (abandoned) University of Queensland vaccine, and AstraZeneca.

"It wasn't a standing start," Glasziou says. "The funding was already allocated, the protocols were

designed. The whole system was ready to go, just waiting ... to start the clock as soon as a pandemic was called."

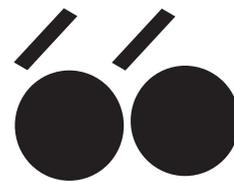
It is a good news story amid a frustrating fight against the virus, most recently its Delta variant.

Challenges such as the coronavirus compound the urgency of making each piece of research count, something Glasziou and others have been pushing for decades.

One highly cited paper was co-written with colleague Iain Chalmers in 2009.

"We calculated that about 85 per cent of research goes to waste because of non publication, poor reporting or avoidable serious flaws in the design of the research," Glasziou says.

He argues that funders of research



**About 85%
of research
goes to
waste**



can play an important role in solving the problem, by building into the research infrastructure an insistence on conditions such as quality and proper reporting.

The Ensuring Value in Research Funders' Forum (EViR), established in 2017, grew out of that work.

"It involves about 40 funders from around the world who are working out ways to address the 85 per cent waste," he says.

It was a huge vindication, "the fact that EViR meets twice a year, basically using the framework that we set out 12 years ago for analysing how to deal with the problems and what the solutions might be and working them up".

Jill Rowbotham

Continued from P 32

Nutrition Science

Field leader: Elizabeth Isenring, Bond

Lead institution: Uni of Qld

Obesity

Field leader: Vlado Perkovic, UNSW

Lead institution: Uni of Sydney

Oncology

Field leader: Georgina Long, Uni of Sydney

Lead institution: Uni of Sydney

Ophthalmology & Optometry

Field leader: Fiona Stapleton, UNSW

Lead institution: UNSW

Oral & Maxillofacial Surgery

Field leader: Zohaib Akram, UWA

Lead institution: UWA

Orthopaedic Medicine & Surgery

Field leader: Julian Feller, OrthoSport Victoria

Lead institution: Uni of Sydney

Otolaryngology

Field leader: Richard Harvey, Macquarie

Lead institution: Macquarie

Pain & Pain Management

Field leader: Michael Nicholas, Uni of Sydney

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: Arthur Christopoulos, Monash

Lead institution: Monash

Physical Education & Sports Medicine

Field leader: Paul McCrory, Florey Institute

Lead institution: ACU

Physiology

Field leader: Jonathan Peake, QUT

Lead institution: Monash

Plastic & Reconstructive Surgery

Field leader: Anand Deva, Macquarie

Lead institution: Macquarie

Pregnancy & Childbirth

Field leader: Debra Creedy, Griffith

Lead institution: Griffith

Primary Health Care

Field leader: Sarah Dennis, Uni of Sydney

Lead institution: Uni of Sydney

Psychiatry

Field leader: Helen Christensen, UNSW

Lead institution: UNSW

Psychology

Field leader: Nicholas Van Dam, Uni of Melbourne

Lead institution: Deakin

Public Health

Field leader: Anthony Okely, UOW

Lead institution: Uni of Sydney

Pulmonology

Field leader: Peter Frith, Government of South Australia

Lead institution: Monash

Radiology & Medical Imaging

Field leader: Thomas Marwick, Baker Institute

Lead institution: Uni of Sydney

Rehabilitation Therapy

Field leader: Natasha Lannin, Monash

Lead institution: Monash

Reproductive Health

Field leader: Ben Willem Mol, Monash

Lead institution: Monash

Rheumatology

Field leader: Peter Nash, Griffith

Lead institution: Uni of Sydney

Social Psychology

Field leader: Luke Smillie, Uni of Melbourne

Lead institution: Uni of Melbourne

Surgery

Field leader: Jonathan Golledge, JCU

Lead institution: Uni of Sydney

Toxicology

Field leader: Bryan Grieg Fry, Uni of Qld

Lead institution: Uni of Qld

Transplantation

Field leader: Daniel Chambers, Prince Charles Hospital

Lead institution: Qld Health

Tropical Medicine & Parasitology

Field leader: Una Ryan, Murdoch University

Lead institution: Uni of Melbourne

Urology & Nephrology

Field leader: Declan Murphy, Peter Mac

Lead institution: Monash

Vascular Medicine

Field leader: Jonathan Golledge, JCU

Lead institution: Monash

Veterinary Medicine

Field leader: Paul McGreevy, Uni of Sydney

Lead institution: Uni of Sydney

Virology

Field leader: Peter Walker, Uni of Qld

Lead institution: UNSW

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: Vedi Hadiz, Uni of Melbourne

Lead institution: ANU

Chinese Studies & History

Field leader: Haiqing Yu, RMIT

Lead institution: UNSW

Communication

Field leader: Deborah Lupton, UNSW

Lead institution: QUT

Drama & Theatre Arts

Field leader: Sarah Wallwork, UniSA

Lead institution: UniSA

English Language & Literature

Field leader: Subhan Zein, Uni of Qld

Lead institution: ECU

Epistemology & Scientific History

Field leader: Jelle Bruineberg, Macquarie

Lead institution: Macquarie

Ethnic & Cultural Studies

Field leader: Loretta Baldassar, UWA

Lead institution: Deakin

Feminism & Women's Studies

Field leader: Kim Toffoletti, Deakin

Lead institution: Deakin

Film

Field leader: Craig Batty, UniSA

Lead institution: RMIT

Foreign Language Learning

Field leader: Andy Gao, UNSW

Lead institution: Macquarie

Gender Studies

Field leader: Andrew Gorman-Murray, Western

Lead institution: Uni of Melbourne

History

Field leader: Pierre van der Eng, ANU

Lead institution: ANU

Humanities, Literature & Arts (general)

Field leader: Deborah Lupton, UNSW

Lead institution: UOW

Language & Linguistics

Field leader: Sender Dovchin, Curtin

Lead institution: Western

Literature & Writing

Field leader: Katherine Bode, ANU

Lead institution: ANU

Middle Eastern & Islamic Studies

Field leader: Jacqueline Ewart, Griffith

Lead institution: Monash

Music & Musicology

Field leader: Katrina McFerran, Uni of Melbourne

Lead institution: Uni of Melbourne

Philosophy

Field leader: Jelle Bruineberg, Macquarie

Lead institution: Macquarie

Religion

Field leader: Kelly-Ann Allen, Monash

Lead institution: Monash

Sex & Sexuality

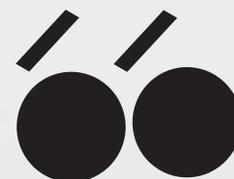
Field leader: Anthony Lyons, La Trobe

Lead institution: UNSW

Visual Arts

Field leader: Nicolas Bullot, CDU

Lead institution: RMIT



**How do
people define
belonging?**



Jesse Marlow

Kelly-Ann Allen Monash University Field leader in Religion

Like many of Australia's most highly cited researchers, educational and developmental psychologist Dr Kelly-Ann Allen is a scholar of many parts.

While she is field leader in the broad category of religion, collaboratively publishing on subjects such as the relationship between spiritual wellbeing and hope in patients with cardiovascular disease; religious coping and self-care behaviours in Iranian medical students; and the mediating role of hope, religiosity, and life satisfaction in older adults, there is another broad category in which Allen is making a significant contribution: belonging.

This interest was piqued by two experiences about 10 years ago, when she was working as a school psychologist in Melbourne. She heard the esteemed organisational and social psychologist Alex Haslam speak "about how belonging to multiple groups has important implications for mental health, wellbeing, and physical health – including being a predictor of stroke recovery," Allen says.

She was also powerfully affected by a chance encounter while training to walk the Kokoda Track, nightly tracing and retracing a course around her neighbourhood. Gradually she realised her route regularly took her past a woman living in a car. When she plucked up the courage to have a conversation it transpired the woman had chosen that spot to park her car because it was near the school she had attended as a girl.

"She was the most articulate, intelligent woman, who had fled from domestic violence. She had decided to come back and stay in her car around the corner from where she went to school – and she talked about school being a place

where she felt safe, where she belonged even though it was 20 years since she had graduated.

"So that was another prompt for me to think about school belonging – what was it about a school that could hook somebody in so strongly?"

These were questions she addressed in her doctoral research while at the University of Melbourne. "The most powerful factor was the student-teacher relationship, but the personal characteristics of students, like coping skills, self efficacy, and other social and emotional competencies were hugely important for their sense of belonging to school."

Allen is now a senior lecturer in the school of educational psychology and counselling in Monash University's education faculty. She recently led the development of a free, ready-to-use policy for schools, assisted by 72 contributors and multiple partners including industry funders. "I am particularly interested in research translation and making sure that people who need to hear the results of a study actually receive the findings in a useful way," she says.

Her latest research is an international study involving 1000 students in seven countries, focused on student perspectives. "How do they define belonging, what it means for them."

Preliminary findings reinforce the primacy of the student-teacher relationship. "Teachers being approachable and allowing students to have a say over their learning came out as really important, and teachers knowing students and being able to connect with them. The students in the study really wanted their teachers to notice when they weren't travelling well."

Jill Rowbotham

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: David Boud, Deakin
Lead institution: Deakin

Anthropology

Field leader: Paul Goldberg, UOW
Lead institution: ANU

Archaeology

Field leader: Sue O'Connor, ANU
Lead institution: ANU

Cognitive Science

Field leader: Graeme Hankey, UWA
Lead institution: Uni of Sydney

Criminology, Criminal Law & Policing

Field leader: Lorraine Mazerolle, Uni of Qld
Lead institution: Griffith

Diplomacy & International Relations

Field leader: Kristina Murphy, Griffith
Lead institution: Uni of Qld

Early Childhood Education

Field leader: Michelle Margaret Neumann, Griffith
Lead institution: Griffith

Education

Field leader: David Boud, Deakin
Lead institution: Deakin

Educational Psychology & Counselling

Field leader: Andrew Martin, UNSW
Lead institution: ACU

Environmental & Occupational Medicine

Field leader: Yuming Guo, Monash
Lead institution: Monash

Environmental Law & Policy

Field leader: Ram Pandit, UWA
Lead institution: CSIRO

Ethics

Field leader: Alexander Newman, Deakin
Lead institution: Deakin

Family Studies

Field leader: Alina Morawska, Uni of Qld
Lead institution: Uni of Qld

Forensic Science

Field leader: Roger Byard, Uni of Adelaide
Lead institution: UTS

Geography & Cartography

Field leader: Robyn Dowling, Uni of Sydney
Lead institution: Uni of Melbourne

Health Policy & Medical Law

Field leader: Abby Haynes, Uni of Sydney
Lead institution: Uni of Sydney

Higher Education

Field leader: David Boud, Deakin
Lead institution: Deakin

Human Migration

Field leader: Loretta Baldassar, UWA
Lead institution: Monash

International Law

Field leader: Jonathan Bonnitcha, UNSW
Lead institution: UNSW

Military Studies

Field leader: Charles Hunt, RMIT
Lead institution: RMIT

Political Science

Field leader: Robert Thomson, Monash
Lead institution: ANU

Public Policy & Administration

Field leader: Brian Head, Uni of Qld
Lead institution: Uni of Melbourne

Science & Engineering Education

Field leader: Rola Ajjawi, Deakin
Lead institution: Monash

Social Sciences (general)

Field leader: Simine Vazire, Uni of Melbourne
Lead institution: Uni of Melbourne

Social Work

Field leader: Paul Delfabbro, Uni of Adelaide
Lead institution: Griffith

Sociology

Field leader: Diane van den Broek, Uni of Sydney
Lead institution: Uni of Sydney

Special Education

Field leader: Rauno Parrila, Macquarie
Lead institution: Monash

Teaching & Teacher Education

Field leader: Sarah Prestridge, Griffith
Lead institution: UTS

Urban Studies & Planning

Field leader: Liton Kamruzzaman, Monash
Lead institution: Uni of Melbourne

Robyn Dowling

University of Sydney

Field leader in Geography & Cartography

The term “smart city” carries with it an inference of master planning, of a thought out and organising principle, but Robyn Dowling contends that is only half the story.

Dowling, professor of urbanism and dean of the University of Sydney's school of architecture, design and planning, says becoming “smart” can seem like an ad hoc process.

“Smart cities are about the deployment of communication technologies to make cities more efficient or more equal or just better run,” Dowling says.

“I've been interested in how technology disrupts how we ‘do’ cities, how we create cities.

“I'm not a technology sceptic, but technology always needs to become part of what we do. You can't just put it on top of things, it has to become part of everyday activities.”

So her recent research looked at how local governments were rolling out the idea of the smart city. Often “it's just what's happening at the local level, really small scale things. The smart city is quite ordinary in Australia.”

Think smart rubbish bins that can send a message to the council, signalling they are ready to be emptied; or carparking apps that let drivers know what spaces are available and where.

“There are lots of little things that make up a bigger movement, but we need to start to pay attention to those little things,” Dowling says.

“We called it incremental – some of the literature talks about the ‘accidental’ smart cities – and cities are often like that. We have this desire to plan cities but sometimes they just accrete.”

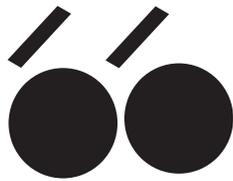
However, developments like Sydney's Digital Western Parklands City are also in her sights. “What my



John Feder

research is also showing is that the only way smart cities on that scale can occur is through collaboration and integration with a whole series of different government actors and other private and community stakeholders. What's interesting is how those collaborations and networks are actually going to make that happen."

But the fascination with the micro is an enduring one. Dowling's PhD and other early work took in subjects as diverse as how, and why, mothers drive in cities, car-sharing and something that took on a life of



Sometimes cities just accrete

its own in the world of general rather than scholarly publishing: the idea of home.

In 2006 she and English-based colleague Alison Blunt wrote a book called *Home*. "I've always been fascinated by what happens behind the doors of houses – how people create alternate cultures and what it means to make a home out of a house," she says.

Last year the pair worked on a second edition taking in living in the time of Covid-19.

"Covid challenged us to rethink home as just a private and domestic

space. Home became where education happened, where work happened, where shopping happened. Home was a site of civic life, as thousands of ANZAC ceremonies took place in driveways across Australia. And Covid also created new spaces of the city that feel like, and act like, home: the spaces of the city – like parks, public spaces, footpaths – became more homelike.

"It was in these spaces that people congregated with friends and family, rather than inside a house," she says.

Jill Rowbotham

As researchers, we're always looking for ways our insights can make a difference. Sometimes scenes of challenge and trauma from across the globe can make us feel powerless.

As the American withdrawal from Afghanistan culminated in the tragic scenes at the Kabul airport in late August, Australians were riveted to the stories of how many families were placed in limbo status. Many Afghan families chose to attempt escape via border crossings into Pakistan, and others pleaded with the Australian government to be among those who were allowed to obtain emergency visas. For many Australians, the horror in Afghanistan reminded us of the privilege we have but also how many families around the world are vulnerable.

In our new book, *Creating Spaces of Wellbeing and Belonging for Refugee and Asylum-Seeker Students*, we write about schools as places for caring for young people who come to new countries dealing with trauma and forced migration.

Around the world more than 80 million people are listed as displaced from their homes, with more than 26 million of those classified as refugees. Since 1945, Australia has resettled about 945,000 refugees who were displaced from their home countries. The current government policy is to relocate 13,750 people a year from mostly war-torn countries to Australia. About 3000 humanitarian visas are anticipated to be issued to Afghan refugees this year to come to Australia. Half of them will be children. That number could grow to 20,000 in the next few years.

Many Australian educators report feeling unprepared to serve refugee students. Our research suggests school principals and their staff are vital to the successful integration of refugee families into society.

Refugee students often have limited English and little or no formal prior schooling experiences. Some may be well behind their age-group peers academically, and much of the curriculum may appear completely foreign which can lead to more insecurity. Many come from families with few resources and parents who are also dealing with the mental health issues associated with forced migration and tremendous loss. The difference between the students' lived experiences and that of their hosts are great. The principal of one Australian school whom we interviewed



Principals and teachers are vital to success for refugee families

reported that newly arrived students refused to play at recess because in their home country, kidnappers, “think parents are rich if the children can afford to play”. Another principal told of girls who refused to swim in the same pool with boys and mothers who didn't feel comfortable attending parent/teacher meetings with other men.

Our participants offered insights for addressing these challenges and creating safe and welcoming schools for children with refugee backgrounds. These include:

Welcoming the newcomers. At the first contact with families, the entire staff must be available, friendly, and committed to the process. School materials need to be in the appropriate language and interpreters must be present. Schools should provide families with everything they need, including culturally appropriate uniforms and all supplies so the students can feel belonging. A primary principal in England has developed a buddy system for all newly arrived students and an Australian principal has created a weekly coffee club for parents that he staffs with interpreters. He states, “At those coffee clubs they discuss different topics: they looked at how to buy furniture, how to make a healthy meal on a budget. Because they don't have access to those things.” A principal in New Zealand provides families with money so they can cook and share foods from their home countries with

the school community. For these principals, community building is a purposeful, consistent and time-intensive endeavour.

Understanding trauma.

Children who have been forcibly displaced, who have experienced loss and who have arrived in a new land, with a new language and new expectations are experiencing trauma. Trauma can manifest itself in delayed learning, erratic emotions, and unexpected behaviours.

Principals should educate themselves and their staff on ways to help students deal with trauma. A primary principal hired a teacher to engage students in art therapy stating, “There was one boy who drew mountain tops and explained to us the strategies that the Taliban use. It's this way that they were able to draw it and express it and to get it out. It has a therapeutic nature which allows them to have some self-expression. That allowed them a voice, when they didn't necessarily have the English.” A principal of a primary school in Northern Ireland is training teachers in “Play Therapy, Lego Therapy, and Drawing and Talking Therapy”.

Learning about new students and their families. A principal shared: “Kids will tell you about their parents, who are still missing in the country that they left, or how the house has been bombed three times by the Americans ... These are all the stories that come out but listening to the kids and you can see the healing that happens as a result of that.” Another primary principal encourages engaging with the community: “Go and visit the local mosque, go and ask some questions.”

Principals and teachers are among Australia's most important frontline workers. Over the past two years, they have helped communities deal with fires, floods, and Covid-19-forced lockdowns. Successfully integrating new families into our school communities benefits not only the newcomers but it also creates hope for all Australian families. Building a diverse society starts with caring and promoting the wellbeing of all children, particularly our newcomers who have been through so much to become part of our communities.

Associate Professor Scott Imig
Professor John Fischetti
Dr Maura Sellars

THE UNIVERSITY OF NEWCASTLE

Life Sciences & Earth Sciences

Australia's research field leaders

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



Sharon Robinson

University of Wollongong

Field leader in Biophysics

Plant physiologist Sharon Robinson has been monitoring plant health in Antarctica for more than 20 years and her findings are sobering.

After a successful pilot project, she marked a series of Antarctic sites with tags on rocks in 2003 for ongoing observation. She wanted to learn more about the endemic plants and how they survive in such extreme conditions.

Back then, the tags marked a series of lush, green moss beds. Some of the mosses had survived for centuries, coping with long months of snow and ice every year. When she returned to the sites in 2008, the moss had turned red, a sign of stress. After red comes grey and, usually, death. Climate change was at work, snow and ice were retreating, plants were dying.

"We were horrified," Robinson remembers. "So we increased the frequency with which we were assessing them and went back three years later."

The long-term monitoring project has since evolved from markers on rocks

Continued on P42

Agronomy & Crop Science

Field leader: Bhagirath Singh Chauhan, Uni of Qld

Lead institution: CSIRO

Animal Behaviour & Ethology

Field leader: Leigh Simmons, UWA

Lead institution: Macquarie

Animal Husbandry

Field leader: Jennie Pryce, La Trobe

Lead institution: Uni of Sydney

Atmospheric Sciences

Field leader: Pep Canadell, CSIRO

Lead institution: CSIRO

Biodiversity & Conservation Biology

Field leader: David Lindenmayer, ANU

Lead institution: Uni of Melbourne

Biophysics

Field leader: Sharon Robinson, UOW

Lead institution: Uni of Melbourne

Birds

Field leader: Leo Joseph, CSIRO

Lead institution: ANU

Botany

Field leader: Kadambot Siddique, UWA

Lead institution: UWA

Cell Biology

Field leader: Richard Kefford, Macquarie

Lead institution: Macquarie

Developmental Biology & Embryology

Field leader: Rebecca Lim, Monash

Lead institution: Uni of Qld

Ecology

Field leader: José Lahoz-Monfort, Uni of Melbourne

Lead institution: Uni of Melbourne

Environmental Sciences

Field leader: Huu Hao Ngo, UTS

Lead institution: Uni of Qld

Evolutionary Biology

Field leader: Robert Lanfear, ANU

Lead institution: ANU

Forests & Forestry

Field leader: David Tissue, Western

Lead institution: Uni of Melbourne

Geochemistry & Mineralogy

Field leader: Cristiana Ciobanu, Uni of Adelaide

Lead institution: Curtin

Geology

Field leader: Peter Cawood, Monash

Lead institution: Curtin

Hydrology & Water Resources

Field leader: Albert Van Dijk, ANU

Lead institution: CSIRO

Insects & Arthropods

Field leader: Geoff Gurr, CSU

Lead institution: CSIRO

Life Sciences & Earth Sciences (general)

Field leader: Terry Hughes, JCU

Lead institution: Uni of Qld

Marine Sciences & Fisheries

Field leader: Dirk Zeller, UWA

Lead institution: CSIRO

Microbiology

Field leader: Philip Hugenholtz, Uni of Qld

Lead institution: Uni of Qld

Mycology

Field leader: Tom May, Botanic Gardens Vic

Lead institution: CSIRO

Oceanography

Field leader: Pep Canadell, CSIRO

Lead institution: CSIRO

Palaeontology

Field leader: Guang Shi, UOW

Lead institution: Uni of Qld

Pest Control & Pesticides

Field leader: Bhagirath Singh Chauhan, Uni of Qld

Lead institution: UWA

Plant Pathology

Field leader: Bhagirath Singh Chauhan, Uni of Qld

Lead institution: CSIRO

Proteomics, Peptides & Amino Acids

Field leader: Richard Simpson, La Trobe

Lead institution: Monash

Soil Sciences

Field leader: Alex McBratney, Uni of Sydney

Lead institution: Uni of Sydney

Sustainable Development

Field leader: Robert Costanza, ANU

Lead institution: CSIRO

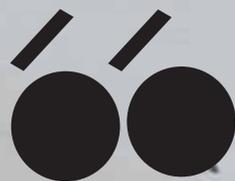
Zoology

Field leader: Sarah Legge, ANU

Lead institution: Uni of Sydney



Sharon Robinson, pictured at Wilkes Hut in Antarctica, has been monitoring plant health on the southern continent for more than 20 years



As Antarctica warms, endemic species are at risk

Jessica Bramley-Alves

Continued from P41

and still photography of the sites to GPS positioning systems and drone footage over larger areas. Robinson's research has documented a rapid decline in plant health in Antarctica, with centuries-old mosses drying and even dying.

"An individual core of moss, as big as a finger and up to 14 cm long, could be up to 500 years old," Robinson says. "We can date them by looking at radiocarbon down the stem. This drying out – it's something that hasn't happened to them in the last 500 years."

With a doctorate in plant physiology from University College, London, and post-doctoral work at Duke University in the US and at ANU in Australia, by the 1990s Robinson had developed an interest in the reddish pigments used by many types of plants to survive

changing conditions, like the red blush in certain cacti species and the red "sunscreen" in Antarctic mosses.

She accepted a position at the University of Wollongong in 1996 on the proviso she could use a grant from the Australian government to spend four months in Antarctica in that first year, researching endemic plant landscapes.

Now 60, a leading plant physiologist, a senior professor at the university and a member of the UN Environment Program's Environment Assessment Panel, Robinson has frequently returned to Antarctica over the years, using increasingly sophisticated technology to assess the plants in her sites and document their health.

"It's almost like a desertification of Antarctica," she says. "We had these amazing areas in the Australian Antarctic territory which were lush, green, beautiful sites. It's

really sad they're going grey and they're dying."

She and her team members now hope to return next year for the ongoing monitoring of the sites after their trip last year was cancelled because of the Covid-19 pandemic. The possible installation of monitoring towers which can store and then transmit open access data year-round is also now on the agenda.

Meanwhile, Robinson is concerned global warming will foster conditions that allow alien species to take root in Antarctica with potentially disastrous consequences.

"We're worried about seeds and spores," she says, adding that, until now, other types of plants have not generally been able to survive the extreme climate.

"But as it warms up, all the endemic species are at risk both from climactic effects but also competition from invasive species."

Sian Powell

Flinders Uni is working to avert the aged care crisis



Sue Gordon, Professor of Healthy Ageing at Flinders University. Professor Gordon has a co-funded role with ACH Group.

Flinders University's ongoing research endeavours in the aged care sector are small but crucial steps towards transforming the way we care for older Australians.

Flinders recently partnered with consultancy firm Wells Advisory to develop an operational model for a proposed \$34m Aged Care Centre for Growth and Translational Research that is set to radically boost the quality and depth of aged care research. This is the first step in achieving sector-wide improvements in workforce capability, models of care, care quality, as well as improvements in overall productivity, investment, commercialisation, and the uptake of new technologies.

The recent Royal Commission into Aged Care Quality and Safety exposed the urgency for a fundamental reform of our aged care system, and researchers at Flinders are striving towards the answers. A suite of research initiatives is already under way at Flinders and our researchers hold recognised expertise in aged care.

Some of them presented as expert witnesses at the Royal Commission, providing commentary and considerations relating to how we must deliver care.

One of those expert witnesses was Matthew Flinders Fellow Professor Julie Ratcliffe who has examined quality of life in aged care, creating measurement tools so that older Australians can receive the care they deserve.

Another is palliative care expert Professor Jennifer Tieman, who alongside other experts highlighted the urgent need for palliative care to become core business for aged care.

Then there's the work of the Flinders

Caring Futures Institute and its 226 research members who have a relentless drive to redefine care and seek change for how we care for ourselves and others.

Despite Flinders University's national leadership in the aged care policy arena, our efforts to transform care in ageing are still not without challenges. As Australia's ageing population continues to rise, our ageing community has more complex needs than ever before. Older people want to stay at home and avoid residential aged care for as long as possible. We have a greater severity of chronic health conditions and comorbidities, as well as rising polypharmacy. The cost of health care is also on the rise.

The aged care sector is struggling with an increased demand for services, workforce retention, and of course the Covid-19 pandemic. In response to the Royal Commission, the government announced a \$17.7bn package of aged care support, including \$650m towards growing and upskilling the workforce – a vital aspect to the sector's transformation.

Our aged care industry is task-focused, financially unattractive, and haunted by emotional failure, physical fatigue, and burnout. According to the latest workforce census, only two-thirds of our personal care workforce have a Certificate III or higher. Providing better training for aged care staff and addressing this urgent shortage of skills is vital to retaining current workers and attracting new staff.

The reality is, our aged care workforce is bleeding. In 2020, aged care facilities lost 29 per cent of their workers and there were 22,000 vacant direct care roles across the sector. Covid-19 has also halved the number of volunteers providing support in residential aged care. If a portion of our

aged care workers choose not to become vaccinated against Covid-19, we will lose more of our workforce.

Through our research, we will seek to make real and meaningful change to develop stronger workforce capability and translate research into best practice. We see a need for better career pathways that are attractive to the next generation of aged care workers.

Transferable skill sets and specialist skills, specifically around dementia and palliative care, are also crucial to equipping the workforce with the tools required to allow all Australians to enjoy healthy and well-supported ageing.

Our workforce must also be technology literate. Technology in care is not about robots replacing nurses or carers or taking away jobs from humans. Rather, it's about reducing the manual load for our workforce by adopting software to assist in the management of staff rostering, medication, and clinical information management, and unlock more time to deliver person-centred, individualised, and holistic care.

Despite the current aged care crisis, our health and care researchers see hope. The future of aged care is a thriving, data-informed and technology-engaged sector. It's a sector providing sought-after career pathways and evidence-based, person-centred quality care and services.

We're up to the challenge.

Sue Gordon

**PROFESSOR OF HEALTHY AGEING,
FLINDERS UNIVERSITY**



Business, Economics & Management

Barry Fraser
Curtin University
Educational Administration

A John Curtin Distinguished Professor in Curtin University's school of education, he has a particular interest in science education, learning environments and educational evaluation. His research includes assessing students' and teachers' perceptions of classroom or school environments and the effects of classroom environments on student outcomes.

Paresh Narayan
Deakin University
International Business

Sara Dolnicar
University of Queensland
Tourism & Hospitality

Neal Ashkanasy
University of Queensland
Human Resources & Organisations

Sharon Parker
Curtin University
Human Resources & Organisations

Engineering & Computer Science

Rajkumar Buyya
University of Melbourne
Computing Systems

He is a Redmond Barry Distinguished Professor and director of the University of Melbourne's Cloud Computing and Distributed Systems laboratory. "My interest is in resource management and scheduling algorithms and software systems for cloud computing and distributed systems and enabling their adoption for industrial and societal benefits worldwide."



Dacheng Tao
University of Sydney
Computer Vision & Pattern Recognition

Yi Yang
University of Technology Sydney
Computer Vision & Pattern Recognition

Peng Shi
University of Adelaide
Automation & Control Theory

Dietmar Hutmacher
Queensland University of Technology
Biomedical Technology



Chemical & Material Sciences

Shaobin Wang
University of Adelaide
Chemical Kinetics & Catalysis

Based at the University of Adelaide's school of chemical engineering and advanced materials, his research interests lie in nanomaterial synthesis and analysis and their applications in adsorption and catalysis, focusing on developing novel structured particles and engineering green processes for sustainable energy conversion and environmental remediation.

Shi Zhang Qiao
University of Adelaide
Materials Engineering

Yusuke Yamauchi
University of Queensland
Materials Engineering

Wang Guoxiu
University of Technology Sydney
Materials Engineering

Dmitri Golberg
Queensland University of Technology
Materials Engineering

Physics & Mathematics

Andrey Miroshnichenko
UNSW
Optics & Photonics

His research interests at UNSW Canberra, where he is UNSW Scientia Fellow, include nanophotonics, metamaterials, nonlinear optics, and dynamical systems. "I'm still learning new things every day. It's that excitement that drives me to advance our optical technologies to make them smaller, thinner, and smarter."



John Carlin
Murdoch Children's Research Institute
Probability & Statistics with Applications

Hussein Mohammed
Curtin University
Thermal Sciences

Benjamin Eggleton
University of Sydney
Optics & Photonics

Ping Koy Lam
Australian National University
Physics & Mathematics (general)

Research

These are Australia's top 40 researchers, measured by their performance over their career



Health & Medical Sciences

Sarah Medland
QIMR Berghofer
Psychiatry

She is a psychiatric and statistical geneticist, and group leader of psychiatric genetics and co-ordinator of QIMR Berghofer's mental health program. "My research focuses on improving our understanding of the genetic and environmental mechanisms involved in psychiatric disorders, response to treatment and the structure and function of the brain."

Richard Ryan
Australian Catholic University
Social Psychology

Peter Gething
Telethon Kids Institute
Tropical Medicine & Parasitology

Grant Montgomery
University of Queensland
Genetics & Genomics

Louisa Degenhardt
UNSW
Addiction

Humanities, Literature & Arts

Marika Tiggemann
Flinders University
Gender Studies

Her major psychological research at Flinders University concerns body image, "from the sexualisation of girls, the perils of dieting, men's muscularity concerns, to middle-aged women's attitudes to cosmetic surgery". Now she is studying the "unrealistic nature of social media and its resulting impact on body image".



Axel Bruns
Queensland University of Technology
Communication

Sarah Pink
Monash University
Communication

Yin Paradies
Deakin University
Ethnic & Cultural Studies

Jean Burgess
Queensland University of Technology
Communication



Social Sciences

Philip Parker
Australian Catholic University
Educational Psychology & Counselling

He is deputy director of the Australian Catholic University's Institute for Positive Psychology and Education. His research interests include educational inequality, developmental transitions, and educational attainment. "I aim to help reduce the educational barriers that limit children's access to the broadest possible set of choices for now and for their future."

Herbert Marsh
Australian Catholic University
Educational Psychology & Counselling

Julie Henry
University of Queensland
Cognitive Science

Andrew Martin
UNSW
Educational Psychology & Counselling

Katie McMahon
Queensland University of Technology
Cognitive Science

Life Sciences & Earth Sciences

Lidia Morawska
Queensland University of Technology
Environmental Sciences

She was a leader in understanding Covid-19's aerosol transmission and the importance of ventilating buildings. Her childhood interest in nuclear physics led to a career taking in atmospheric, building and human exposure science. "The need for a purpose of my work, beyond satisfying curiosity, is what motivates me every day."



Ben Hayes
University of Queensland
Animal Husbandry

William Laurance
James Cook University
Biodiversity & Conservation Biology

Wenshan Guo
University of Technology Sydney
Environmental Sciences

Zhiguo Yuan
University of Queensland
Environmental Sciences

If you'd asked my 16-year-old self what an engineer does, I wouldn't have been able to tell you. Fast forward to 2021 and I marvel at the places my career in engineering and physics has taken me. 16-year-olds today can't possibly predict the careers of the future. But it's vital they're aware of the exciting opportunities that science, technology, engineering and mathematics (STEM) careers offer.

One way to do this is to ensure that parents and teachers understand the range of diverse, interesting and fulfilling career paths that are available to STEM-trained students. The STEM pipeline is famously "leaky", with students turning away from STEM as early as primary school.

Defence has a large stake in building the national STEM talent pool. With approximately 30 per cent of civilian roles and more than 40 per cent of military roles being STEM-enabled, our requirement for STEM capable people will only continue to grow. We must raise awareness of the career opportunities in defence industry and support national efforts to improve uptake of STEM studies and careers.

Defence industry businesses need to attract the brightest minds and grow their workforces. Once people are in the industry, there is ongoing work needed to train and retain them. Defence is helping businesses through programs such as the Schools Pathways Program, the Defence Industry Internship Program, the Defence Industry Secondment Program and the Skilling Australia's Defence Industry Program.

But we can't be complacent. We need to keep working across government, the education sector and industry to ensure that Australian businesses can meet Defence's capability needs, drive innovation, grow and remain competitive.

There is greater demand than supply across the sector, particularly for people with advanced STEM skills. There is fierce competition for people with relevant qualifications and experience – the demand is only rising. The key to attracting top-level professionals is creating environments where the work they're doing is interesting and has a clear path to impact.

In a number of critical technology areas, such as cyber security, the mismatch in salaries is a significant disincentive. We need to look at other incentives in those areas. We have to collaborate to improve



Dr David Kershaw

Sovereign capability ... it starts in the classroom

understanding of emerging technologies in order to predict future workforce needs.

We know that women continue to be under-represented in STEM fields, which was borne out in the Office of the Chief Scientist's 2020 STEM Workforce Report.

It found that women continue to be under-represented in management roles, have higher unemployment rates and lower incomes than men. Disappointingly, there have only been small improvements in the experiences of women in STEM. In 2006, 27 per cent of STEM university graduates in the labour force were women, increasing to just 29 per cent in 2016.

This change must be accelerated if we are to be truly competitive. The Lead The Way: Defence Transformation Strategy outlines the need for gender equality and women's empowerment as part of Defence's mission in national and global security.

Defence is committed to addressing gender inequity in its STEM workforce, recognising that by accessing the best talent from all parts of our diverse community, we gain a competitive edge. Our newly launched NAVIGATE program aims to

bolster female representation in our STEM workforce, particularly at more senior levels, as well as enable STEM professionals from the broader science-and-technology ecosystem to transition into Defence, and facilitate career mobility for those already within Defence. We are aiming for an intake that represents the diversity seen in society, and are keen for people who have taken a mid-career break to apply.

Increasing the number of women in leadership roles will help create a pathway for quality female candidates to feed into our senior leadership positions, which have historically had poor female representation.

Defence sponsors "The Future Through Collaboration" program, which provides networking, mentoring and learning opportunities for women in STEM working in the Defence sector. The goal of this program is to grow and enhance capability by increasing the representation and development of women.

Building, expanding and strengthening our STEM workforce is key to achieving sovereign capability. It is only through our STEM workforce that we will gain access to or control over the skills, technology and intellectual property, financial resources and infrastructure we require to support and maintain our defence industrial base.

This is why Australia's recently announced Sovereign Industrial Capability Priorities and their supporting plans are so important in guiding Defence and defence industry. The new Priorities are:

- Robotics, Autonomous Systems, and Artificial Intelligence
- Precision Guided Munitions, Hypersonic Weapons, and Integrated Air and Missile Defence Systems
- Space
- Information Warfare and Cyber Capabilities

Realising truly sovereign capabilities comes with many challenges. With commitment and determination, I firmly believe we can overcome these challenges to ensure our highly capable STEM workforce is strong both now and in the future.

Dr David Kershaw
CHIEF, SCIENCE IMPACT AND
ENGAGEMENT DIVISION,
DEPARTMENT OF DEFENCE

Homegrown inquiry

Analysing Australia's research journals

Research is now more international than ever. But when it comes to investigating topics of priority to Australia, local journals assume immense importance

All too often, Australia's homegrown research is overlooked because, in this era of internationalised academia, it is work that is published in the most prestigious international journals which gains most attention. And when it comes to building an international academic reputation, it is papers published in world-recognised journals which count the most.

The problem is that this often leaves research on distinctly Australian topics out in the cold. Whether it be research on the Australian environment, Indigenous issues, topics which are important to Australian industry, social issues that are unique to Australia, or Australian law; these areas are often not of interest to the top international journals.

Researchers have the alternative of submitting their work to one of the many high quality Australian journals. But unfortunately most of them do not have the same level of international recognition, and thus do not earn the researcher, and their university, the same reward in raising their international reputation and rankings. But local journals are important, and deserve equal profile, when they tackle issues of prime importance to Australia.

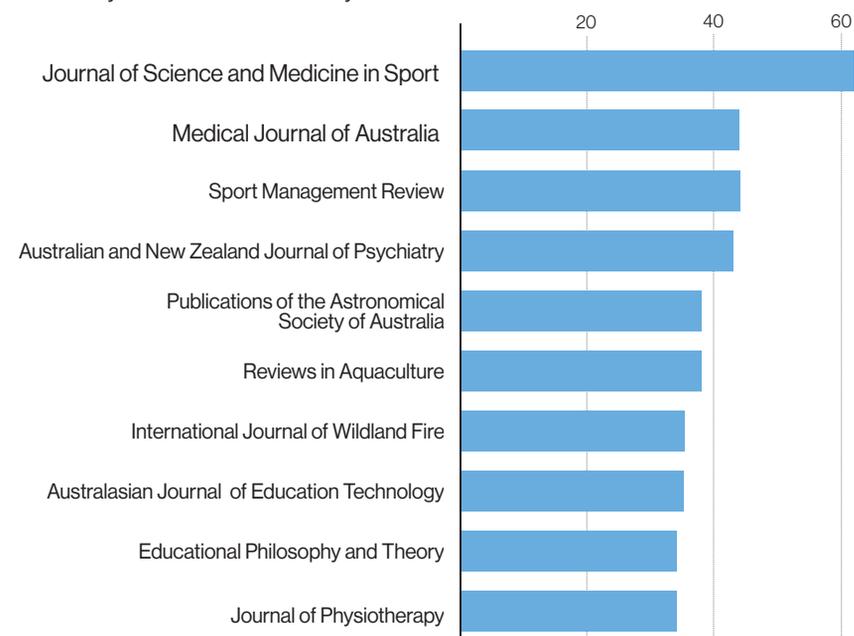
The graph shows the top 10 Australian academic journals ranked by their H-index over the past five years. (An H-index of 50, for example, means that the journal has published 50 papers each with at least 50 citations. The higher the H-index, the higher the impact of the journal.)

Research by League of Scholars shows that, since 1980, there have been 186 Australian academic journals which have published 119,933 papers. These are journals whose publisher or sponsor is based in Australia and which focus on Australian concerns and reflect Australian perspectives.

Some of them are very well known and long established, such as the Medical Journal of Australia (est. 1914), Oceania (est. 1930) which covers the social and cultural anthropology of the peoples of Oceania, Australian Historical

Top 10 Australian Journals

Ranked by H-index over last five years



Studies (est. 1940), and the Australian Journal of Chemistry (est. 1948).

Research on Australian legal topics is one obvious field in which there is strong local demand but far less international interest. See for example, two of the most highly cited recent Australian papers on legal topics published in the *Alternative Law Journal*: The disqualification of dual citizens from Parliament, and Digital justice in Australian visa application processes.

Some local law journals – such as the *UNSW Law Journal*, the *Melbourne University Law Review*, and the *Melbourne Journal of International Law* – are run by students.

Not all Australian journals are focused on domestic matters. For example the *International Journal of Wildland Fire*, published by the CSIRO, is highly recognised internationally. Given the topic, it's not

surprising that it's Australian.

Other journals cover areas in which Australia is a focus of international interest. One such journal is *Rock Art Research*, edited by independent Australian archaeologist Robert Bednarik and co-published by the Australian Rock Art Research Association.

The most cited paper in an Australian journal is *Understanding plant responses to drought*, published in the CSIRO journal, *Functional Plant Biology*, and cited more than 3500 times.

Another paper, *A handbook of protocols for standardised and easy measurement of plant traits worldwide*, published by the CSIRO's *Australian Journal of Botany*, has been cited more than 3000 times.

Tim Dodd

Next page: a map of Australian research journals

The great universities all over the world are defined by their ability to not only incubate new knowledge through their research activities – but also to translate their research into societal, economic and environmental impact.

At The University of Queensland (UQ), we have a long history of sharing the new knowledge that's generated from our research programs – and translating it into progressive ideas, better services and new products for the benefit of society.

Our strong track-record in research translation and commercialisation can be largely attributed to a decision taken in 1984 to establish our technology transfer company, UniQuest.

Today, almost four decades later, UniQuest is widely regarded as Australia's leading technology transfer company. It remains deeply embedded across all of our research programs and active in protecting our intellectual property, licensing our technology, negotiating terms with our commercial partners and engaging with industry.

The flagship example of research translation that UniQuest has been involved in over that period involves the Gardasil cervical cancer vaccine.

An exemplar of the life-changing discoveries that are occasionally incubated at Australian universities, that vaccine was originally developed by Professor Ian Frazer AC and the late Jian Zhou in a UQ laboratory in the early 1990s.

Other examples of UQ research that have been successfully translated and had a global impact include the image correction technology that's now used in two-thirds of the world's MRI machines and the internationally acclaimed "Triple P" Positive Parenting Program.

More recently, UQ has been directly involved in the two highest-value biotech deals ever completed by an Australian university – with the acquisition of Inflazome and Spinifex Pharmaceuticals by major global drug companies. In both cases, the initial drug discovery research was conducted at UQ and UniQuest played a key role in the commercialisation of those scientific discoveries.

While there are many success stories, we also know that there's still enormous



Deborah Terry, Vice-Chancellor of The University of Queensland

Stepping up for the innovation tango

potential for our universities to make an even greater contribution to national prosperity through improving research translation.

In the 2021 Global Innovation Index that ranks national economies according to their innovation performance, Australia ranked just 25th in the world, despite punching well above our weight on a range of innovation inputs, such as research performance.

The only way of interpreting this is that we are global leaders at the front-end of innovation – in research and discovery science. However, we're still underperforming when it comes to translating that research excellence into commercial benefits and societal impact.

This is a missed opportunity for the nation because the translation of our homegrown R&D has the potential to generate wide-ranging societal benefits, including the creation of new industries and new jobs for Australians.

Thankfully, though, there's increased recognition currently – across government, industry and academia – that this is something we need to address.

To me, there appears to be a groundswell of activity, right now, directed at creating a

more joined-up innovation ecosystem that will help to drive Australia's economic growth as we emerge from the pandemic.

Prime Minister Scott Morrison made this point in an important speech last October as he launched the government's Modern Manufacturing Strategy.

In that speech, the PM said: "A lesson is don't try to do everything. It's all about alignment, across different levels of government, with industry and with the research and education sectors."

Or, as our former chief scientist Ian Chubb once said, when it comes to innovation: "It

takes three to tango." The three dance partners in this "innovation tango" are, of course: (1) our universities; (2) business and industry; and (3) the government.

Governments need the right policy settings, incentives and messaging to foster entrepreneurship and innovation in our economy.

Business and industry need to appreciate the sheer capacity that exists within our research institutions – and embrace the potential of R&D, at scale.

And our universities need to be accessible, open to collaboration, and willing to establish new models for working in partnership with government, business and industry.

This has been a high priority for all of us at UQ (and UniQuest) for decades now.

We want to play our role in boosting national productivity and creating new industries and jobs. But it goes much further than that. It's also about enriching the communities in which we're embedded – and improving the quality of life for people right across our community.

Importantly, we now have a growing list of willing partners, from across industry and government, who share our enthusiasm for research translation, commercialisation and innovation.

Increasingly, our views are aligned, and our interests are in lock-step.

It suddenly feels like the "innovation tango" is afoot – and it's gaining pace.

Professor Deborah Terry AO

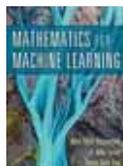
**VICE-CHANCELLOR AND PRESIDENT,
THE UNIVERSITY OF QUEENSLAND**

Read all about it

Australia's top 10 academic books

In 2020, 186 first edition academic books were published with at least one Australian affiliated author. Here are the top 10, based on the number of citations they have received.

1



Mathematics for Machine Learning

M.P. Deisenroth, A.A. Faisal, C.S. Ong
Cambridge University Press, 2020

172 citations

Bridges the gap between mathematical and machine learning texts, a one-stop shop providing all the background needed for efficient learning. It includes worked examples and subjects such as linear regression and principal component analysis.

2



Too Smart: How Digital Capitalism is Extracting Data, Controlling Our Lives, and Taking Over the World

J. Sadowski
The MIT Press, 2020

72 citations

Argues that nothing is safe from "smartification" in our modern society and asks who really benefits from smart technology, whose interests are served when we trade our personal data for convenience and connectivity?

3



Understanding Mobility as a Service (MaaS): Past, Present and Future

D. Hensher, C. Mulley et al
Elsevier, 2020

55 citations

Adoption of smartphones, ridesharing and carsharing have disrupted the transport sector and given rise to an ecosystem (MaaS) that aims to deliver collaborative and connected mobility services. Topics include governance, contracts and consumer and supplier preferences.

4



The Handbook of Behavior Change

M.S. Hagger et al (Ed)
Cambridge University Press, 2020

50 citations

Behaviour change is necessary because so many social problems, including health, education, social relationships, and the workplace, have their origins in human behaviour. This collection covers contemporary theory, research, and practice from multiple disciplines.

5



Geometric Singular Perturbation Theory Beyond the Standard Form

M. Wechselberger
Springer, 2020

32 citations

Analyses the mathematical models of physical and biological systems that evolve on disparate time- and/or length-scales (multiple-scale systems) known as singular perturbation problems. Includes canard theory and concrete applications.

6



Data Journalism in the Global South

B. Mutsaers et al (Ed)
Springer, 2019

16 citations

Examines the trends, developments and also the opportunities for the emerging wave of data journalism across the Global South including in Chile, Argentina, the Philippines, South Africa and Iran. Seeks to fill the gap in knowledge about data journalism as it operates in less developed regions of the world.

7



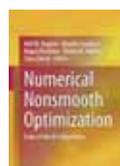
Revivalistics: From the Genesis of Israeli to Language Reclamation in Australia and Beyond

G. Zuckermann
Oxford University Press, 2020

15 citations

This introduces the new transdisciplinary field surrounding language reclamation, revitalisation, and reinvigoration – revivalistics – and the example of Hebrew, revived as Israeli in the late 19th and early 20th centuries.

8



Numerical Nonsmooth Optimization

A.M. Bagirov et al (Ed)
Springer, 2020

13 citations

The big challenges in mathematical programming include nonsmooth optimisation. For the first time, the founders of various NSO methods appear together. Methods presented apply in fields such as physics, medicine, economics, data mining, machine learning and computational chemistry.

9



God is Samoan: Dialogues Between Culture and Theology in the Pacific

M. Tomlinson
University of Hawaii Press, 2020

10 citations

Explores how both the Pacific Islands culture and Christianity shape theology there. It includes radical criticisms of biblical stories as inappropriate for Pacific audiences, and celebrations of traditional gods such as Tagaloa as inherently Christian figures.

10



The Language of Hunter-Gatherers

T. Guldemann, P McConvell, R.A. Rhodes (Ed)
Cambridge University Press, 2020

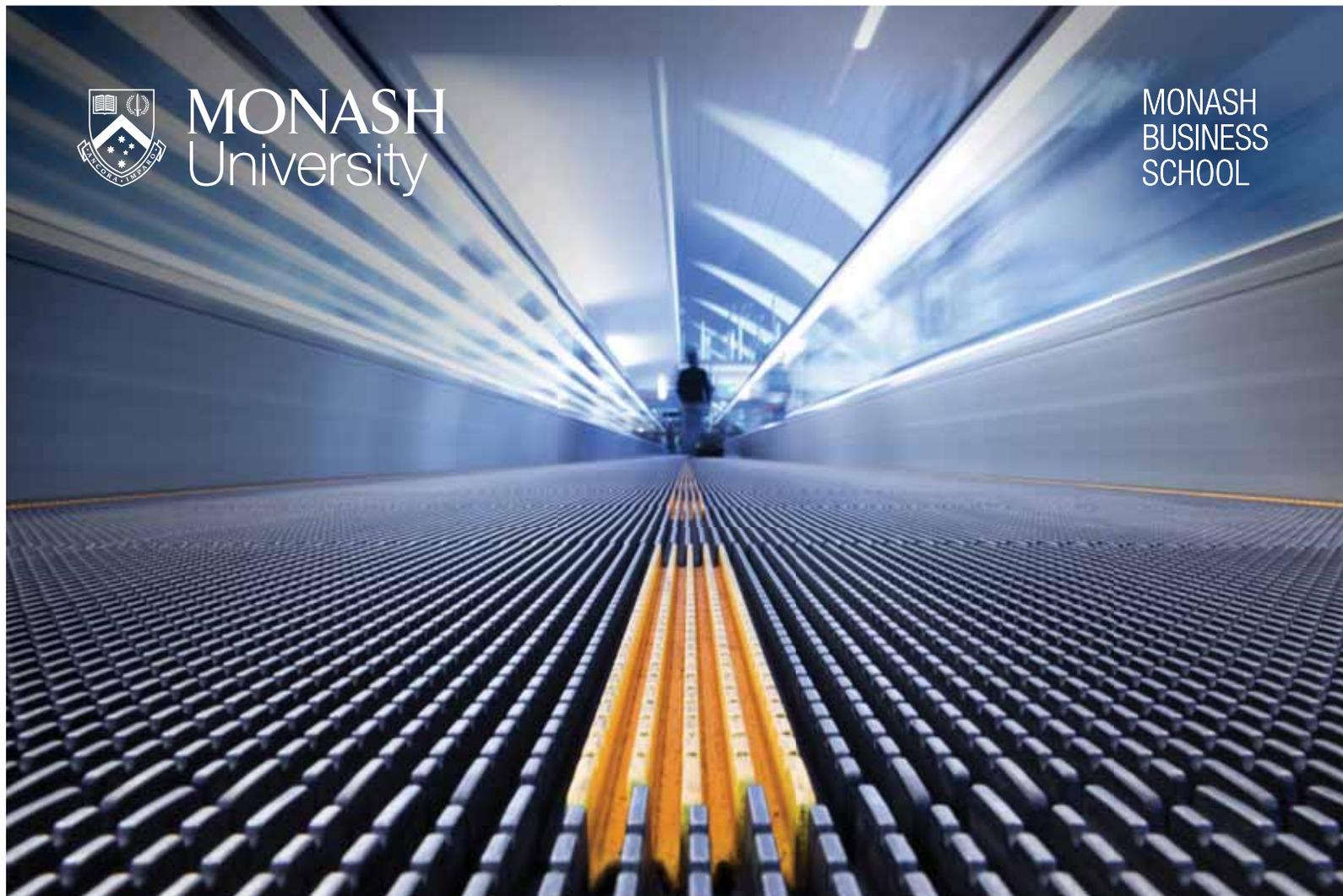
7 citations

A window into the inner workings of 21st-century hunter-gatherer societies: how they survive and relate to societies that produce more. The editors hope to inspire deep study of the languages and linguistic history of forager populations the world over.



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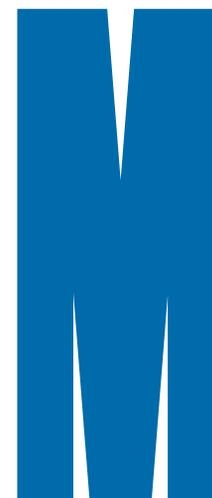
IMPACT

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Our globally renowned researchers strive to create meaningful solutions to the world's most complex challenges in business and economics.

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www.monash.edu/impact





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Prepared for rapid response to the next pandemic

COVID-19 has demonstrated the importance of mRNA vaccines to protect against emerging disease threats.

The new BASE pilot facility at The University of Queensland (UQ) is biomanufacturing synthetic RNA and DNA – producing high-quality, high-purity nucleic acids to support the work of researchers across Australia.

Through BASE, which is hosted at the Australian Institute for Bioengineering and Nanotechnology, UQ will connect R&D organisations, pharmaceutical companies and large-scale manufacturers, who can use these revolutionary technologies to rapidly design vaccines that protect against new COVID-19 variants and other emerging diseases.

BASE is jointly funded by the University and our funding partner Therapeutic Innovation Australia.

UQ research has global impact.

Discover more at research.uq.edu.au



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