

THE AUSTRALIAN*

RESEARCH 2020

Historian
Agnieszka Sobocinska
dissects our
idealism **P33**



Robot expert
Inkyu Sa
makes autonomous
vehicles safer **P24**



VITAL
TO OUR
FUTURE

Geophysicist
Dietmar Müller
uncovers earth's
secrets **P21**



Vision scientist
Fiona Stapleton
prevents eye
disease **P30**



Foreword



Pre-COVID-19, one of the great joys of being Education Minister was visiting Australia's universities to see firsthand the world-leading research taking place in our backyard. Whether it is research to improve ethical machine decision making, the development of a new breed of pineapple that is resistant to premature flowering or unlocking the secrets of the universe by studying Dark Matter, the breadth, depth and quality of Australian research demonstrates the strength of the sector.

Research can save lives, make us healthier and protect our communities and the environment. It also helps us understand more about ourselves, our history and our future. Research will be essential to help power Australia's coronavirus recovery. The productive capacity of our nation will rely on educated workers, able to access innovation and research, to drive opportunity.

This means strengthening the link between research and outcomes. As we have seen through the global research effort to find a vaccine for COVID-19, Australians are best served by encouraging international research collaborations that are in our national interest.

It is also important that international research collaborations are carefully balanced against Australia's national interests, including our national security, values and ethical standards. The Morrison Government takes the threat of foreign interference seriously and we are taking action to protect Australian research. Our Government wants universities working with industry and other organisations to commercialise research, turn ideas into jobs, and deliver economic growth.

The stories of the researchers in these pages are wonderful examples of the innovation and collaboration that takes place across the research sector.

Everyone in higher education must get better at telling these stories and making them relevant for every Australian.

By demonstrating the value of our research, we continue to make the case for investment and we also inspire the next generation of scientists and researchers.

Dan Tehan

FEDERAL MINISTER FOR EDUCATION

THE AUSTRALIAN

RESEARCH

Editor Tim Dodd

Art Director Samantha Yates

Sub-editors Justine Costello, Michael Ellis

Writers Tim Dodd, Jill Rowbotham, Julie Hare, Sian Powell

Advertising Marion Leddy

+61 2 9288 2458 marion.leddy@news.com.au

Printed by PMP Print, 31 Heathcote Road, Moorebank 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 September 23, 2020

Contents

8

How we chose the best

Using data analytics, we found Australia's best researchers in more than 250 fields

10

Top of the world

These nine researchers lead the world, among them Caroline Homer.

11

Lifetime achievers

Australia's top 40 researchers who've made a difference through their career long contribution

16

Business, Economics & Management

Sharon Parker, improving the design of work

19

Chemical & Material Sciences

Maria Forsyth, creating the batteries of the future

20

Physics & Mathematics

Dietmar Müller, uncovering earth's past secrets

24

Engineering & Computer Science

Inkyu Sa, making autonomous vehicles safer

28

Health & Medical Sciences

Patrick McGorry, improving youth mental health
Fiona Stapleton, preventing eye disease

32

Humanities, Literature & Arts

Agnieszka Sobocinska, dissecting our idealism

34

Social Sciences

Charles Hunt, creating conditions for peace
Alina Morawska, helping parents do better

39

Life Sciences & Earth Sciences

Nigel Cook, building the minerals industry

43

Rising stars

Australia's top 40 early career researchers, the leaders of the future

48

Global research collaborations

The universities which do best in working with global elite institutions

49

Business research collaborations

The universities which do best in working with business

50

Top ten books

The academic books with the most impact in the last decade

A year like no other

In the most challenging year Australia has faced in nearly a century, our researchers continue to demonstrate their excellence and their commitment to solving real problems

This year, 2020, has been like no other. First came the bushfire disaster, then the COVID-19 crisis. One consequence was that the value of the research which Australia's scientists, academics and other specialists carry out in our universities and research institutions became clearer than ever. Much of the research community was mobilised to carry out vital work, often under intense pressure in emergency conditions.

People from across the spectrum of research fields – immunologists, biochemists, epidemiologists, public health specialists, legal experts, economists, psychologists, educators, social workers and more – came together to deal with complex problems in a pandemic situation, the scope and intensity of which no one living alive today has ever dealt with.

This year in The Australian's Research 2020 magazine, we salute our researchers, who have proved their value to Australia as never before. Given the debt we owe to our research community, this year's edition of the Research magazine is more relevant than ever.

Again we name Australia's top researchers in 255 individual fields of research. We make this choice objectively, using data analytics based on where individual researchers publish and how many citations they have. We also name the Australian university, or other research institution, which leads in each of these fields, and this choice is also determined by the data. The winning institution is the one whose researchers' papers – published in the top 20 journals in the field in the past five years – has the most citations.

In a few cases, well-known names appear as the leading researchers. For example, psychiatrist Patrick McGorry, a tireless campaigner for improving youth mental, who was named as Australian of the Year in 2010, is the leader in the field of psychiatry.

But the vast majority of the researchers whose names are revealed in these pages are not widely known, except to their peers.

This magazine is an opportunity for their excellence to be recognised, and for us all to learn about fascinating avenues of inquiries and important discoveries which would otherwise be little noticed by the wider public.

It is also an opportunity to shine a light on the research work of lesser-known universities and institutions. While the Group of Eight universities carry most of Australia's research load, many other institutions shine. For example, we find that the University of Wollongong is Australia's leading research institution in algebra, while the University of Southern Queensland leads in the field of composite materials.

Just as we have found Australia's top researcher in each field, we have also looked globally to identify the world's best in each of the 255 fields of research we examine. In nine of these fields, the top researcher in the world is in Australia (see page 10).

This is the third year that The Australian and League of Scholars



At the University of Queensland a team led by (from left) Trent Munro, Paul Young, and Keith Chappell, are now testing a COVID-19 vaccine based on their revolutionary "molecular clamp" technology

have worked together to publish the Research magazine in this format, and each year we look for new stories, relevant to the Australian research community, which can be drawn from the data.

This year we've chosen to examine the research collaboration which Australian universities undertake with industry, and with the world's top universities (see pages 48, 49). We also looked at academic books, and have built a top 10 list (see page 50).

There's one final important thing to say about this year's Research magazine: We also honour Australia's 40 top researchers, who have made an outstanding contribution to their discipline over the course of their careers (in contrast to the research leader named in each field, who is there because of their recent performance).

And, also, we name 40 promising early career researchers who are strong candidates to be Australia's research leaders of the future.

In the current environment, in which we may see major cuts to research funding that could hamper the prospects of our future research stars, it's critical for universities and government to look to the future and plan how Australia's coming generation of research talent can fulfil its potential.

TIM DODD, HIGHER EDUCATION EDITOR, THE AUSTRALIAN
doddt@theaustralian.com.au

PAUL MCCARTHY, CEO, LEAGUE OF SCHOLARS
paul@leagueofscholars.com



From left: Paul McCarthy and Rasika Amarasiri

How we did it

We use data science to analyse the world's research output

We've taken the data-driven route to analyse and profile the best researchers and research institutions in Australia.

It is an approach that is now possible because of the volume and quality of information available online about research.

We turned to talent discovery and research analytics firm League of Scholars to help us gather publicly accessible data. League of Scholars co-founders Paul McCarthy and Rasika Amarasiri are pioneers of this approach, compiling information on the world's research papers, including authorship, when papers were published, where they were published and numbers of citations.

This rich trove of data can be mined in many ways and we've used it here to present as full a picture as possible of Australian research.

The core of the magazine is the lists of top researchers and top research institutions in each of eight major discipline areas. Each discipline is divided into granular research fields which largely follow the taxonomy used by Google Scholar. (We have left out a handful of fields where Australian research is not strong.)

In each of 255 fields we name the Australian-based researcher whose papers published in the 20 top journals in their field in the past five years have had the most citations by other researchers.

The number of citations is, of course, an excellent indicator of the impact and quality of

their work.

We also name the top Australian institution in each field of research, which is determined in a similar way. The top institution is the one which has the most citations from research published in the top 20 journals in that particular field in the last five years. Non-university organisations such as the CSIRO and medical research institutes are also in the mix.

We also saw a need to recognise research excellence in other ways, honouring both those who have made an outstanding contribution to their discipline through their career, and the up-and-comers who will be the top researchers of the future.

We do this by naming 40 lifetime achievers and 40 distinguished early career researchers.

These are selected using a methodology based on the annualised h-index – that is, the researcher's h-index divided by the number of years in their career. This approach rewards both excellence and consistency, and research by eminent bibliometrics scholar Anne-Wil Harzing shows that the annualised h-index is the best way of comparing different researchers at different career stages, and those who work in different fields.

League of Scholars' data pool on research is deep, and this year we've used it to present information in three new areas.

We show which universities and research institutions collaborate most with the world's top 10 research universities (as listed by the Academic Ranking of World Universities), and we show which universities and research institutions collaborate most with business. Both of these measures are based on the number of co-authorships of research papers. Finally, we reveal the top 10 scholarly books published by Australian academics in the past 10 years, based on the number of citations they have received.

Our results, of course, are dependent on the data sources used (in our case mainly Google Scholar) and the algorithms used. One acknowledged drawback of the use of global information is that fields of research which are focused on Australia can be underemphasised.

But we also believe the approach we have used yields advantages. For example, it gives more attention to humanities and social sciences than many other measures of research impact, it reveals which Australian scholars are having global impact and it is up to date.

We welcome your feedback.

TIM DODD

Institution abbreviations

Austin Health Austin
Australian Catholic University ACU
Australian Defence Force Academy ADFA
Australian National University ANU
Australian Nuclear Science and Technology Organisation ANSTO
Baker Heart and Diabetes Institute Baker
Bond University Bond
Bureau of Meteorology BoM
Burnet Institute Burnet
Charles Darwin University CDU
Charles Sturt University CSU
Commonwealth Scientific and Industrial Research Organisation CSIRO
Curtin University Curtin
Deakin University Deakin
Edith Cowan University Edith Cowan
Flinders University Flinders
Griffith University Griffith
James Cook University JCU
La Trobe University La Trobe
Macquarie University Macquarie
Monash University Monash
Murdoch University Murdoch
Peter MacCallum Cancer Centre Peter Mac
QIMR Berghofer Medical Research Institute QIMR Berghofer
Queensland University of Technology QUT
RMIT University Melbourne RMIT
Royal Botanic Gardens Victoria RBG Victoria
Royal Children's Hospital Melbourne RCH Melbourne
Swinburne University of Technology Swinburne
University of Adelaide Uni of Adelaide
University of Canberra Uni of Canberra
University of Melbourne Uni of Melb
University of Newcastle Uni of Newcastle
University of New England UNE
University of New South Wales UNSW
University of Queensland Uni of Qld
University of South Australia UniSA
University of Southern Queensland USQ
University of the Sunshine Coast USC
University of Sydney Uni of Sydney
University of Tasmania Uni of Tasmania
University of Technology Sydney UTS
University of Western Australia UWA
University of Wollongong Uni of Wollongong
Victoria University VU
Walter and Eliza Hall Institute of Medical Research WEHI
Western Sydney University Western

Top of the world

Nine researchers in Australian institutions are not only leaders in their field in this country, but they also hold the remarkable distinction of being the top researchers in their field globally. This means that no other researcher in the world has a higher number of citations from papers published in the last five years in the 20 top journals in that particular field.



Caroline Homer Midwifery researcher, Burnet Institute Leading researcher in the world in the field of pregnancy and childbirth

Her year in a Malawi mission hospital in 1992 showed Caroline Homer the difference between midwifery in the advanced and developing worlds, and gave her the sense of purpose that has propelled her ever since.

“That sorted me out, really, as a midwife, because the need for what midwives can do all over the world became so clear: our capacity to make a difference to women’s lives, poor women but also rich women,” says Professor Homer, who is co-program director of maternal, child and adolescent health at Melbourne’s Burnet Institute.

AARON FRANCIS

Homer began developing her scholarly skills while working as a clinical trials nurse with HIV patients at St Vincent’s Hospital in Sydney. “Suddenly I worked out there were other things to think about ... not just medications and treatments and models of care,” she says. “I had some good research training at that time.”

Homer returned to midwifery at St George Hospital under the mentorship of one of the early researchers in the field, Lesley Barclay.

“As a midwife, I wanted to make a difference to all women, not just one woman at a time,” Homer says. “So that’s the research endeavour. The opportunity to influence more broadly, both at an educational level and other systems level, was incredibly inspiring, and what I wanted to do for the rest of my career.”

In a 15-year stint at the University of Technology, Sydney, continuity of care was a major research theme, after a major review established that pregnant women preferred to deal with a small number of practitioners, be cared for in the community and see midwives throughout.

While Homer’s academic career grew, she continued to practise – two years ago she delivered the fourth child for one patient.

International work in developing countries has been another strand of her scholarship. Her most influential papers, she thinks, were part of a 2014 Lancet series on midwifery. “One of them showed that if you implement this whole package of interventions ... you’ll reduce your maternal death rate, your still-birth rate and your neonatal death rate considerably, somewhere between 50 and 80 per cent,” Homer says. “That work is used now in the World Health Organisation and the United Nations Population Fund.”

Now she is studying the indirect effects of COVID-19 in Australia and internationally, with many mothers and children expected to die, not from the disease but because they are no longer accessing maternal health services.

JILL ROWBOTHAM

Australian-based researchers who lead the world

Field Chemical Kinetics & Catalysis
Global field leader
Shaobin Wang,
Uni of Adelaide

Field Mechanical Engineering
Global field leader
Jie Yang, RMIT

Field Mining & Mineral Resources
Global field leader
Ranjith Pathegama Gamage,
Monash

Field Developmental Disabilities
Global field leader
Cheryl Dissanayake, La Trobe

Field Plastic & Reconstructive Surgery
Global field leader
Anand Deva, Macquarie

Field Pregnancy & Childbirth
Global field leader
Caroline Homer, Burnet

Field Asian Studies & History
Global field leader
Vedi Hadiz, Uni of Melbourne

Field Educational Psychology & Counselling
Global field leader
Andrew Martin, UNSW

Field Higher Education
Global field leader
David Boud, UTS

Lifetime Achievers Leaderboard

Research superstars

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

This Lifetime Achievers Leaderboard lists the five top researchers from Australian universities and research institutions in each of the eight major discipline areas. To identify the five top researchers in each area we calculate an annualised H-index for each of them. The H-index, named for physicist Jorge Hirsch who suggested it in 2005, is defined at the highest number H such that a given researcher has published H papers which have been cited H times. It measures both productivity and impact. For example, if a researcher has published 50 papers each with at least 50 citations, but has not managed to go one better and publish 51 papers each with at least 51 citations, then their H-index is 50. We then divide the H-index by the number of years that a researcher has been active (since their first citation) to obtain an annualised figure.

Business, Economics & Management



Sara Dolnicar
Tourism & Hospitality

At the University of Queensland, her research interests include market segmentation methodology and survey measures.



Neal Ashkanasy
Human Resources & Organisations

At the University of Queensland, he researches leadership, organisational culture, ethics and emotions.



Rob Raven
Business, Economics & Management

At Monash University, he researches dynamics and governance of sustainability transitions.



Sharon Parker
Human Resources & Organisations

At Curtin University, she researches job and work design, proactive behaviour, wellbeing and job performance.



Ian Phau
Marketing

At Curtin University, his research interests include country image, luxury branding, brand counterfeiting and piracy.

Chemical & Material Sciences



Shizhang Qiao
Materials Engineering

At the University of Adelaide, his research interests are synthesis and characterisation of nanomaterials.



Yusuke Yamauchi
Materials Engineering

At the University of Queensland, he researches design of nanocrystals and nanoporous materials.



Shaobin Wang
Chemical Kinetics & Catalysis

At the University of Adelaide, his research includes nanomaterial synthesis and application for adsorption and catalysis.



Hongqi Sun
Chemical Kinetics & Catalysis

At Edith Cowan University, his research includes novel catalysis and advanced oxidation processes.



Yoshio Bando
Materials Engineering

At the University of Wollongong's Australian Institute for Innovative Materials he researches nanomaterials and electron microscopy.

Lifetime Achievers Leaderboard **Research Superstars**

Engineering & Computer Sciences



Dacheng Tao
Computer Vision & Pattern Recognition

At the University of Sydney, his research focus is artificial intelligence.



Peng Shi
Automation & Control Theory

At the University of Adelaide, he researches systems and control theory, and computational intelligence.



Dietmar Hutmacher
Biomedical Technology

At the Queensland University of Technology, he researches biomaterials, biomechanics, medical devices and tissue engineering.



Qing-Long Han
Automation & Control Theory

At the Swinburne University of Technology, he researches power system stability and control, and wireless communication.



Chunhua Shen
Computer Vision & Pattern Recognition

At the University of Adelaide, his research interests are statistical machine learning and computer vision.

Health & Medical Sciences



Sarah Medland
Genetics & Genomics

At the QIMR Berghofer Medical Research Institute, she researches genetic and environmental factors influencing mental health.



Richard Ryan
Social Psychology

At the Australian Catholic University, his research includes human motivation and personality development and well-being.



Louisa Degenhardt
Addiction

At UNSW Sydney, her diverse epidemiological studies include analysis of large-scale community and clinical population surveys.



James Sallis
Public Health

At the Australian Catholic University, he researches promoting physical activity, and policy and environmental influences upon it.



Grant Montgomery
Genetics & Genomics

At the University of Queensland, his research includes genomic mapping for risk of endometriosis and melanoma.

Humanities, Arts & Literature



Michael Haugh
Communication

At the University of Queensland, his linguistics research in pragmatics includes analysing face, (im) politeness and teasing.



Larissa Hjorth
Communication

At RMIT University, her research fields include mobile media and mobile art.



Fengyi Jin
Sex & Sexuality

At UNSW Sydney, his research includes epidemiology of sexually transmitted infections and HPV-related anal cancer.



Alastair Pennycook
Foreign Language Learning

At the University of Technology, Sydney, his research includes implications of the global spread of English.



Adrian North
Music & Musicology

At Curtin University, his research includes music and wellbeing in specific and general populations.

Life Sciences & Earth Sciences



Lidia Morawska
Environmental Sciences

At the Queensland University of Technology, she researches air quality's impact on health and the environment.



Wenshan Guo
Environmental Sciences

At the University of Technology, Sydney, she researches innovative water and wastewater treatment, and reuse technologies.



William Laurance
Biodiversity & Conservation Biology

At James Cook University, his research includes impacts of intensive land uses on tropical forests.



Ben Hayes
Animal Husbandry

At the University of Queensland, he researches genetic improvement of livestock, crop and pasture and aquaculture species.



Ian Paulsen
Life Sciences & Earth Sciences

At Macquarie University, his research interests include microbiology and microbial genomics.

Physics & Mathematics



Ray Frost
Spectroscopy & Molecular Physics

At the Queensland University of Technology, his research interests include vibrational spectroscopy.



Benjamin Eggleton
Optics & Photonics

At the University of Sydney, his research interests include optical communications technology.



Shi Xue Dou
Condensed Matter Physics & Semiconductors

At the University of Wollongong, his research interests include energy materials research.



Andrey Miroshnichenko
Optics and Photonics

At UNSW Sydney, his research interests include nonlinear optics and nanophotonics.



Ping Koy Lam
Physics & Mathematics

At the Australian National University, his research includes quantum optics, optical metrology and nonlinear optics.

Social Sciences



Herbert Marsh
Educational Psychology & Counselling

At the Australian Catholic University, his research includes self-concept and motivation.



Julie Henry
Cognitive Science

At the University of Queensland, she researches how social cognition and prospection are disrupted by normal adult ageing and clinical illness.



Tan Yigitcanlar
Urban Studies and Planning

At the Queensland University of Technology, he researches contemporary urban planning and development challenges.



Andrew Martin
Educational Psychology & Counselling

At the UNSW Sydney, he researches educational motivation, engagement and achievement.



David Treagust
Science & Engineering Education

At Curtin University, his research interests include how interventions can enhance students' understanding of science.

Business, Economics & Management

Australia's research field leaders

These 16 scholars are Australia's leading researchers in business, economics and management – one selected from each of the 16 fields in this discipline. They are the researchers with the highest number of citations from papers published in the last five years in the 20 top journals in their field. In each field we also name Australia's top research institution, the one with most citations in the top 20 journals in the field in the last five years.

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

Field Business, Economics & Management (general)
Field leader Rob Raven, Monash
Lead institution Monash

Field Development Economics
Field leader Emilia Tjernstrom, Uni of Sydney
Lead institution Monash

Field Economic History
Field leader Laura Maran, RMIT
Lead institution Uni of Melbourne

Field Economic Policy
Field leader Debdulal Mallick, Deakin
Lead institution QUT

Field Economics
Field leader Paul Raschky, Monash
Lead institution Monash

Field Educational Administration
Field leader Bob Lingard, Uni of Queensland
Lead institution Deakin

Field Emergency Management
Field leader Douglas Paton, CDU
Lead institution CDU

Field Entrepreneurship & Innovation
Field leader Allan O'Connor, UniSA
Lead institution Macquarie

Field Finance
Field leader Dirk Baur, UWA
Lead institution Macquarie

Field Game Theory and Decision Science
Field leader Haris Aziz, UNSW
Lead institution Monash

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

Field International Business
Field leader Bo Bernhard Nielsen, Uni of Sydney
Lead institution Monash

Field Marketing
Field leader Tom Chen, Uni of Canberra
Lead institution Griffith

Field Strategic Management
Field leader Morgan Miles, CSU
Lead institution Uni of Newcastle

Field Tourism & Hospitality
Field leader Noel Scott, USC
Lead institution Griffith



Sharon Parker Organisational behaviour expert Curtin University Research leader in the field of human resources and organisation

Back in 1930, John Maynard Keynes, one of the most influential thinkers of the 20th century, wrote in an essay predicting the future of work: "For the

first time since his creation, man will be faced with his real, his permanent problem; how to occupy the leisure (time)." Keynes' utopian 15-hour week hasn't eventuated. The opposite is true.

"Greedy jobs" eat up 15-hour days for some; the gig economy depletes financial security for others.

What is common in a surprising number of jobs – not matter how elite or pedestrian – is how badly designed they are, says Sharon Parker, an Australian Research Council Laureate Fellow and professor of organisational behaviour at Curtin University's Future of Work

Institute. Her central focus is on the design of work: what makes jobs rewarding, meaningful, healthy, productive and stimulating.

"From a psychological perspective, when work is well-designed, workers have interesting tasks, autonomy over those tasks, a meaningful degree of social contact with others and a tolerable level of task demands," Parker says.

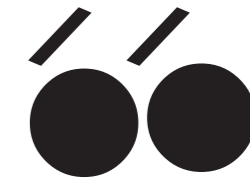
For many, jobs are tedious, uninspiring, repetitive, dull and exhausting – whether we work in a high-end consultancy firm or an

Amazon warehouse.

"Our research suggests, if you give people autonomy and agency and you trust them, they usually do a good job. They will be trustworthy and they will deliver on expectations."

She says most jobs are a hangover from history – including the nine-to-five work day. Rarely, however, do managers ask the question: Could this job be done in a different, more efficient, more creative and better way?

To address the lack of design, Parker and her team have designed a framework called SMART. It embodies



If you give people autonomy and agency and you trust them, they usually do a good job

five key principles – stimulating, mastery, agency, relational and tolerable – that if adopted can guarantee fulfilling and rewarding work.

Parker's research interests are now branching out into neuroscience: how different work design combinations impact cognitive functioning and whether SMART jobs can protect against Alzheimer's.

Next year, she will launch what she hopes will be a 20-year study to track 10,000 individuals' work experiences, with a particular focus on the impact of automation on jobs. It's called WALC (Work Across Life and Careers).

Of course, the work revolution thrust upon almost the entire economy by the pandemic is rich pickings for Parker and her team. Their recent article in the Harvard Business Review explored how managers are coping with having staff working remotely during COVID. For many, not so well.

Parker and her co-authors found that 40 per cent of the 215 managers surveyed had low self-confidence in their ability to manage staff who were working remotely, and a similar number thought staff were slacking off, incompetent or lacked essential skills compared to in-office colleagues.

"The picture is a not a rosy one," they write, with staff feeling distrusted and micromanaged by bosses who don't feel in control.

JULIE HARE



Universities play pivotal roles in the economic, social and cultural development of Australia. We do this not just by educating the next generation of leaders, but by problem-solving and helping realise opportunities for stronger, more resilient economies and communities.

As we begin to take stock of the impact of COVID-19, it is clear the research expertise and innovation enterprise offered by universities will be essential parts of the post-pandemic recovery.

The University of Southern Queensland (USQ) has a long history of providing reliable and independent advice to governments, industry and the general community on a range of global issues and we are well equipped to contribute to the recovery effort. Our targeted, applied research is complemented by purposeful engagement with local communities through to global communities of practice, government and business.

Improving food security and increasing the resilience of our agricultural sector are two areas of focus for researchers from USQ's Institute for Life Sciences and the Environment through engagement with agricultural end-users to deliver innovative solutions in crop health, natural resource management and climate science.

The institute's Centre for Crop Health is partnering with the Grains Research and Development Corporation (GRDC) to improve the profitability and productivity of globally important crops such as wheat, barley, lentils, oats and sorghum. USQ is giving Australian farmers access to pathogen-resistant varieties of key crops combined with proven expertise in controlling pests and disease, increasing yield performance and minimising production costs. Through meaningful on-farm engagement, USQ's Centre for Applied Climate Science is delivering improved climate prediction tools to strengthen farm management and resilience to drought. Our research is ensuring the profitability of Australian grain growers and livestock industries and shaping the future of global food production.

USQ's Centre for Astrophysics has established a reputation as a world leader in space sciences. We are renowned for our Mount Kent Astronomical Observatory, the only professional astronomical research facility in Queensland.



Research expertise is key to post-pandemic recovery

This unique facility is enabling USQ to work with global partners to bring light to new worlds and advance our understanding of the solar system.

The Mount Kent observatory is the only facility in the southern hemisphere providing dedicated ground-based support for NASA's Transiting Exoplanet Survey Satellite (TESS). Our observatory is contributing to the discovery and characterisation of nearby exoplanetary systems using a state-of-the-art array of 0.7m aperture telescopes and a specialised spectrograph.

In partnership with the German Aerospace Centre (DLR), Mount Kent is the base for a SMARTnet geostationary space debris monitoring telescope that helps to track and record space junk.

With a focus on hypersonic propulsion systems, machine learning and machine vision technologies and a rocket fuel development facility, USQ is making significant developments in automated agricultural infrastructure and advanced materials engineering. USQ's Institute

for Advanced Engineering and Space Sciences houses a long duration hypersonic wind tunnel that delivers hypersonic flows of up to Mach 7.

Researchers from the institute are working with more than 70 aerospace, defence, agriculture machinery and civil engineering companies to deliver knowledge, cutting-edge technologies and industry solutions at the forefront of discovery.

USQ's Institute for Resilient Regions works with regional communities to build an innovative and thriving regional Australia that is a great place to live and work. A long-term collaboration between the institute's Centre for Health Research and Cancer Council Queensland is addressing the significant disparities in five-year cancer survival rates between urban and rural patients by conducting a comprehensive examination of the journey from diagnosis through to treatment.

The partnership is driven by a shared commitment to promoting the health and wellbeing of Queenslanders, specifically through research that addresses fundamental issues in policy development and the delivery of social and economic infrastructure accessible to all Australians.

While USQ's research and its translation into real-world applications is crucial to the future of Australia's communities, and the creation of new industries to support our post-COVID economy, the challenges and opportunities do not stop there.

USQ understands innovation and change can be achieved only by standing beside our partners, local industries and communities and exciting the next generation to tackle these opportunities.

USQ researchers are working collaboratively (including internationally), finding solutions where others see problems, and building partnerships along the value chain. The University of Southern Queensland's track record shows universities can build value, create opportunities and to inspire young Australians wanting to shape their own futures.

To find out more visit usq.edu.au/research.

Professor John Bell
DEPUTY VICE-CHANCELLOR
(RESEARCH & INNOVATION)
UNIVERSITY OF SOUTHERN QUEENSLAND

Chemical & Material Sciences

Australia's research field leaders

These 17 scholars are Australia's leading researchers in chemical and material sciences – one selected from each of the 17 fields in this discipline. They are the researchers with the highest number of citations from papers published in the last five years in the 20 top journals in their field. In each field we also name Australia's top research institution, the one with most citations in the top 20 journals in the field in the last five years.



Maria Forsyth **Chemist, Deakin University** **Research leader in the field of electrochemistry**

It took Maria Forsyth a while to settle on her real research interests. Beginning with a broad foundation of study in materials engineering and chemistry, she sailed through her doctorate at Monash University. With a questing mind, she worked on materials for new optic fibres and chemistries for improved in-vitro fertilisation methods, before her focus moved to polymer electrolytes in safer solid-state capacitors for implantable defibrillators.

Finally, she settled in her long-term field of expertise: energy storage and corrosion. Forsyth is now an acclaimed expert in the field. Deakin University built a lab in Melbourne according to her specifications. She leads collaborative global research into novel types of batteries and corrosion inhibitors, and is working with industry to bring environmentally sound and ethical battery manufacturing to Australia.

Continued next page

Field Analytical Chemistry
Field leader Nam-Trung Nguyen, Griffith
Lead institution UNSW

Field Biochemistry
Field leader David Komander, WEHI
Lead institution Monash

Field Ceramic Engineering
Field leader Inna Karatchevtseva, ANSTO
Lead institution UNSW

Field Chemical & Material Sciences (general)
Field leader Philip Gale, Uni of Sydney
Lead institution Uni of Adelaide

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

Field Combustion & Propulsion
Field leader Evatt Hawkes, UNSW
Lead institution UNSW

Field Composite Materials
Field leader Yiu-Wing Mai, Uni of Sydney
Lead institution USQ

Field Crystallography & Structural Chemistry
Field leader Stuart Batten, Monash
Lead institution UNSW

Field Dispersion Chemistry
Field leader Rico Tabor, Monash
Lead institution Uni of Queensland

Field Electrochemistry
Field leader Maria Forsyth, Deakin
Lead institution Uni of Wollongong

Field Inorganic Chemistry
Field leader Peter Junk, JCU
Lead institution Curtin

Field Materials Engineering
Field leader Shizhang Qiao, Uni of Adelaide
Lead institution Uni of Wollongong

Field Medicinal Chemistry
Field leader Vicky Avery, Griffith
Lead institution Griffith

Field Nanotechnology
Field leader Hoe Tan, ANU
Lead institution Uni of Wollongong

Field Oil, Petroleum & Natural Gas
Field leader Zhejun Pan, CSIRO
Lead institution Curtin

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

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

Continued from previous page

With her research teams around the world, Forsyth is calibrating, testing and refining prototype batteries, looking for ideal combination of strengths.

“The holy grail for batteries is a high-energy density battery, which means it has a lot of juice in it, you can drive a car a long way – the battery will last for a week or more between charges,” she says. “And you want a battery that will run for thousands of cycles before you have to throw it out.”

Such a battery would not only be a boon for renewable energy storage and the electric machines of the future, but also for remote and impoverished communities in the developing world, where charging a smartphone to stay abreast of market prices and find buyers can make all the difference to people’s lives.

Forsyth’s fascination with the field matured during her Fulbright scholarship postdoctoral research at Northwestern University in the US. She was interested in new energy technologies, and whether electrolyte materials could be used in devices. “Back then, you didn’t have to make a device,” Forsyth says. “You just had to make a material, measure its properties and say, ‘this could be useful for a device.’”

In the years since her early research, she and her collaborators have found a novel salt-based electrolyte increases the efficiency of lithium-ion batteries and prevents them burning or exploding. They are now working on new sodium-ion batteries and new battery electrode materials using nickel and manganese, as well as biomass carbon from organic waste, while trying to steer away from cobalt, mostly mined in Africa – often in a particularly unethical way.

Growing up in a traditional Greek family wasn’t an easy ride for a gifted daughter. Neither of Forsyth’s parents had much education and she was expected to get married and perhaps find a secretarial job.

Forsyth did get married, and she did have two children, but she insisted on following an academic path. “I was a geek,” she recalls.

“I always wanted to know how things work. How the electricity gets to the pole.”

Her field continues to expand in new and unexpected ways. A year ago the federal government funded the Future Batteries Industries Co-operative Research Centre, led from Western Australia, and industries are collaborating with Forsyth and her colleagues to develop future electrolyte systems for next-generation batteries.

“The idea is to establish an ecosystem of industries here in Australia, to not just dig resources up and sell them, but actually add value to the product and add value to the resource,” Forsyth says.

“And to actually make batteries here.”

SIAN POWELL

Physics & Mathematics Australia’s research field leaders

These 21 scholars are Australia’s leading researchers in chemical and material sciences – one selected from each of the 21 fields in this discipline. They are the researchers with the highest number of citations from papers published in the last five years in the 20 top journals in their field. In each field we also name Australia’s top research institution, the one with most citations in the top 20 journals in the field in the last five years.

Field Acoustics & Sound

Field leader Nicole Kessissoglou, UNSW

Lead institution UNSW

Field Algebra

Field leader Aidan Sims, Uni of Wollongong

Lead institution Uni of Wollongong

Field Astronomy & Astrophysics

Field leader Joss Bland-Hawthorn, Uni of Sydney

Lead institution ANU

Field Computational Mathematics

Field leader Fawang Liu, QUT

Lead institution Monash

Field Condensed Matter Physics & Semiconductors

Field leader Cornelius Hempel, Uni of Sydney

Lead institution Monash

Field Discrete Mathematics

Field leader David Wood, Monash

Lead institution Monash

Field Electromagnetism

Field leader Yingjie Jay Guo, UTS

Lead institution Macquarie

Field Fluid Mechanics

Field leader Ivan Marusic, Uni of Melbourne

Lead institution Uni of Melbourne

Field Geometry

Field leader Brett Parker, Monash Uni

Lead institution Monash

Field Geophysics

Field leader Dietmar Müller, Uni of Sydney

Lead institution Uni of Melbourne

Field High Energy & Nuclear Physics

Field leader Bruce Yabsley, Uni of Sydney

Lead institution Uni of Sydney

Field Mathematical Analysis

Field leader Yihong Du, UNE

Lead institution UNSW

Field Mathematical Optimisation

Field leader Guoyin Li, UNSW

Lead institution UNSW

Field Mathematical Physics

Field leader Ian Marquette, Uni of Queensland

Lead institution Uni of Queensland

Field Nonlinear Science

Field leader Tonghua Zhang, Swinburne

Lead institution UWA

Field Optics & Photonics

Field leader David Moss, Swinburne

Lead institution ANU

Field Physics & Mathematics (general)

Field leader Kavan Modi, Monash

Lead institution UNSW

Field Probability & Statistics with Applications

Field leader Robert Kohn, UNSW

Lead institution Monash

Field Pure & Applied Mathematics

Field leader Lishan Liu, Curtin

Lead institution Monash

Field Spectroscopy & Molecular Physics

Field leader Daniel Kosov, JCU

Lead institution Uni of Melbourne

Field Thermal Sciences

Field leader Jiyuan Tu, RMIT

Lead institution Uni of Adelaide



But we are now pushing the tectonic reconstructions and the dynamic models of the Earth's interior much further back in time.

Dietmar Müller

Geophysicist, University of Sydney

Research leader in the field of geophysics

Dietmar Müller's primary research focus is the physical fabric of the world and how it has evolved over more than a billion years, reaching back to a time when life as we know it didn't exist.

Using the latest advances in machine learning and computing technology, the Sydney University geophysicist and his colleagues use the geophysical and geochemical signatures of preserved rock to reconstruct the way continents have formed, collided and disintegrated, and the implications for today's world.

Professor Müller and collaborating scientists around the world have built powerful interactive online tools to better visualise the Earth's plate tectonic evolution. Using 4D computer models, the movements of continents and the evolution of ocean basins can be seen in a time-lapse movie, with

BRITTA CAMPION

millennia passing in seconds. "I've spent much of my career looking at the evolution of the Earth in the last 200-250 million years, from the time when the Pangea supercontinent existed to today," Müller says.

"But we are now pushing the tectonic reconstructions and the dynamic models of the Earth's interior much further back in time. There was a previous supercontinent, Rodinia, that existed about 1.1 billion years ago."

He and his colleagues are now working on models that reach back that far. In one of his most-cited projects, Müller and his team used big data analysis to build the first digital map of the age of the world's ocean floor. They have also predicted – correctly – where opal deposits might be found in northern NSW, and uncovered a link between certain very large earthquakes and the structure of the Pacific Ocean's crust. They are now working with a large mining company to develop and apply new "deep time" data-analysis techniques that could help find copper deposits.

Müller first studied science at Christian-Albrecht University of Kiel in northern Germany, and with an undergraduate degree under his belt, he moved to the US, winding up at the renowned Scripps Institution of Oceanography at the University of California in San Diego.

In 1993, with a doctorate from one of the world's foremost oceanographic institutes, Müller began looking for a job. Sydney University responded to one of his applications and, after a phone interview, offered him work as a lecturer.

He had never been to Australia, but Müller bought a one-way ticket. He has worked the same university ever since and married an Australian fellow geologist.

Müller was in the US, though, at just the right time. In the mid-80s, the first computers were becoming useful scientific tools, and many of the huge computing advances were happening in Texas and California – to the delight of US-based scientists.

"There was a generation of 3D graphics computers that came out which didn't exist in Germany at all," Müller says, adding that with negligible power (about the same as a tablet today), one of these early computers had a graphics interface linked to a computer the size of a fridge. "It was really attractive, because at that time the first software was being developed to manipulate images of tectonic plates on a spherical surface: the globe," he says.

Müller was on hand when this revolutionary technology was first offered to geophysicists and he has used it ever since. "I was one of the few people who had this technology at my fingertips," he says.

"This is how I became truly fascinated by plate tectonics and deep geological time."

SIAN POWELL

Engineering & Computer Science

Australia's research field leaders

These 50 scholars are Australia's leading researchers in chemical and material sciences – one selected from each of the 50 fields in this discipline. They are the researchers with the highest number of citations from papers published in the last five years in the 20 top journals in their field.

Field Architecture Field leader Zhonghua Gou, Griffith Lead institution Uni of Melb
Field Artificial Intelligence Field leader Chee Peng Lim, Deakin Lead institution Monash
Field Automation & Control Theory Field leader Peng Shi, Uni of Adelaide Lead institution Swinburne
Field Aviation & Aerospace Engineering Field leader Michael Smart, Uni of Qld Lead institution Uni of Qld
Field Bioinformatics & Computational Biology Field leader Geoff Webb, Monash Lead institution Monash
Field Biomedical Technology Field leader Dietmar Hutmacher, QUT Lead institution Uni of Qld
Field Biotechnology Field leader Lars Keld Nielsen, Uni of Qld Lead institution ADFA
Field Civil Engineering Field leader Hao Hong, Curtin Lead institution RMIT
Field Computational Linguistics Field leader Timothy Baldwin, Uni of Melb Lead institution Macquarie
Field Computer Graphics Field leader Tim Dwyer, Monash Lead institution Monash
Field Computer Hardware Design Field leader David Bolland, Uni of Sydney Lead institution RMIT
Field Computer Networks & Wireless Communication Field leader Jinhong Yuan, UNSW Lead institution UNSW
Field Computer Security & Cryptography Field leader Jun Zhang, Swinburne Lead institution CSIRO
Field Computer Vision & Pattern Recognition Field leader Dacheng Tao, Uni of Sydney Lead institution UTS
Field Computing Systems Field leader Jinjun Chen, Swinburne Lead institution Swinburne
Field Data Mining & Analysis Field leader Hongzhi Yin, Uni of Qld

Lead institution Uni of Melb
Field Databases & Information Systems Field leader Marcello La Rosa, Uni of Melb Lead institution Uni of Melb
Field Educational Technology Field leader Dragan Gasevic, Monash Lead institution UniSA
Field Engineering & Computer Science (general) Field leader Subhas Mukhopadhyay, Macquarie Lead institution UNSW
Field Environmental & Geological Engineering Field leader Jinsong Huang, Uni of Newcastle Lead institution Monash
Field Evolutionary Computation Field leader Zbigniew Michalewicz, Uni of Adelaide Lead institution RMIT
Field Food Science & Technology Field leader Bhesh Bhandari, Uni of Qld Lead institution Uni of Qld
Field Fuzzy Systems Field leader Gleb Beliakov, Deakin Lead institution Deakin
Field Human Computer Interaction Field leader Frank Vetere, Uni of Melb Lead institution Uni of Melb
Field Library & Information Science Field leader Tina Du, UniSA Lead institution Curtin
Field Manufacturing & Machinery Field leader Sami Kara, UNSW Lead institution Deakin
Field Mechanical Engineering Field leader Jie Yang, RMIT Lead institution UNSW
Field Medical Informatics Field leader Farah Magrabi, Macquarie Lead institution Uni of Qld
Field Metallurgy Field leader Huijun Li, Uni of Wollongong Lead institution Uni of Wollongong
Field Microelectronics & Electronic Packaging Field leader Sima Dimitrijevic, Griffith Lead institution ANU
Field Mining & Mineral Resources Field leader Ranjith Pathegama Gamage, Monash Lead institution Monash

Inkyu Sa Computer Scientist CSIRO Data61 Research leader in robotics

A scientist with CSIRO's Data 61, Inkyu Sa, is an expert in deep learning, the technique that enables the computer brain of a robot to learn from experience.

The conventional way of programming a robot is to give it a set of instructions, laboriously written by human programs of the form "while this is happening, if you see this then do that".

Sa is going a step further, bringing deep learning to robots to give them the capacity to make new sets of instructions based on the success, or the failure, of the past. It means that robots can be trained, which will make them far more effective.

"The deep learning network does a really good job compared to the conventional approach," Sa says.

His expertise in this area attracted wide notice in 2016 when, as a post doctoral research fellow at Queensland University of Technology, he working on a deep learning robot that harvested fruit and vegetables. He was lead author on an influential paper, DeepFruits: A fruit detection system using deep neural networks, which was widely cited by other researchers. Harvey, the harvesting robot built by the QUT team, proved able to pick one capsicum every 30 seconds from a row of plants in a glasshouse.

Originally from South Korea, Sa worked at Samsung on the company's

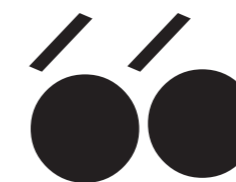
RUSSELL SHAKESPEARE



first Android smart phone before coming to Australia in 2010 to do his PhD at QUT.

He's now part of the CSIRO Data 61 team, which is competing in the DARPA Subterranean Challenge, a global competition between 11 invited teams run up by the US Defense Advanced Research Projects Agency. It tests the ability of robots to autonomously navigate underground tunnels and caves, and find objects inside them.

He's now working on techniques to improve a computer's reliability in identifying things in photographs. It's an important ability for autonomous vehicles to master. Can one, for example, distinguish between a tree



An autonomous car is driving in a very dynamically changing environment. Maybe it's raining, maybe there's lightning

or a human no matter the time of day or weather conditions?

Sa says he "respectfully" disagrees with Elon Musk, who has said that fully autonomous cars will be ready next year or the year after.

"We have to make sure everything works 100 per cent, which is a really big challenge," Sa says.

"An autonomous car is driving in a very dynamically changing environment. Maybe it's raining, maybe there's lightning. There's a bunch of different scenarios we have to handle.

"We don't want to drive over nine-year-old kids or 80-year-old grandmas and grandpas."

TIM DODD

Field Multimedia Field leader Jianfei Cai, Monash Lead institution UNSW
Field Ocean & Marine Engineering Field leader Ian Turner, UNSW Lead institution UNSW
Field Operations Research Field leader Ben Fahimnia, Uni of Sydney Lead institution UNSW
Field Plasma & Fusion Field leader Boyd Blackwell, ANU Lead institution ANU
Field Power Engineering Field leader Fengji Luo, Uni of Sydney Lead institution UTS
Field Quality & Reliability Field leader Paul Salmon, USC Lead institution USC
Field Radar, Positioning & Navigation Field leader Jinling Wang, UNSW Lead institution RMIT
Field Remote Sensing Field leader Jeffrey Walker, Monash Lead institution Uni of Melb
Field Robotics Field leader Inkyu Sa, CSIRO Lead institution QUT
Field Signal Processing Field leader Ba-Ngu Vo, Curtin Lead institution UTS
Field Software Systems Field leader Hongyu Zhang, Uni of Newcastle Lead institution Uni of Adelaide
Field Structural Engineering Field leader Qing Li, Uni of Sydney Lead institution Uni of Sydney
Field Sustainable Energy Field leader Robert Taylor, UNSW Lead institution Uni of Sydney
Field Technology Law Field leader Dan Svantesson, Bond Lead institution VU
Field Textile Engineering Field leader Lijing Wang, RMIT Lead institution Deakin
Field Theoretical Computer Science Field leader Sasha Rubin, Uni of Sydney Lead institution Monash
Field Transportation Field leader David Hensher, Uni of Sydney Lead institution QUT
Field Water Supply & Treatment Field leader Hokyoung Shon, UTS Lead institution UTS
Field Wood Science & Technology Field leader Warren Batchelor, Monash Lead institution Monash



Australia's future depends on being innovative enough to take advantage of global opportunities in space using advanced technologies such as artificial intelligence.

Innovation underpinned by research and development will stimulate economic growth and future-proof our economy.

Our universities and research institutions are fundamentally strong, and punch well above the norm in many areas. The economic impact of our research output, however, has not often been as visible and immediate in growing the economy. Indeed, universities are often criticised for not delivering industry value. Applied research through university-industry collaboration is needed now more than ever.

The Cooperative Research Centres program is one of the best mechanisms for large-scale university-industry collaboration.

With \$245 million of R&D investment over seven years, the SmartSat CRC is an enormous space industry research ecosystem with more than 100 partners — 30 Australian and international companies, 55 start-ups, 17 Australian universities, the CSIRO, and the Department of Defence.

Working closely with the Australian Space Agency, SmartSat aspires to make a strong contribution to the government's goal of tripling the size of the space sector to \$12 billion and 20,000 jobs by 2030.

SmartSat research focuses on incorporating artificial intelligence in telecommunications and IoT connectivity in next-generation smart

Australia's space industry lifting off through collaboration

satellite sensors, and in advanced analytics for earth observation products and services. Its priorities are water management, land and disaster management, and defence and national security.

AquaWatch is a key research project in water management. This program, developed in collaboration with the CSIRO, will explore opportunities for a network of ground-based sensors and satellites orbiting Earth to deliver real-time data for managing valuable water resources.

Building on existing ground monitoring networks, the AquaWatch Australia mission will integrate data from ground-based sensor networks with specially designed Earth observation satellite sensors. Data from these sources will be combined to deliver timely information to water agencies, communities and commercial water users, and will enable decision-makers to better manage ecosystem health, support industry and prevent human or animal health impacts.

AquaWatch Australia also involves a collaboration of research partners the CSIRO, Australian Space Agency, Bureau of Meteorology, Geoscience Australia, University of Queensland, UNSW Canberra, Curtin University, Frontier SI and SatDek.

A second high-impact project for emergency management is a joint mission with NASA's Search and Rescue office to provide next-generation satellite-aided location data to first responders in emergencies such as bushfires.

The project uses emergency beacon technology for satellites to track people in distress. It involves SmartSat partners, Safety from Space, Myriota, Black Art Technologies, UniSA, Flinders University and the Australian Maritime Safety Authority.

SmartSat is also helping with defence challenges. The Compact Hybrid Optical-RF User Segment (CHORUS) project is SmartSat's first collaborative mission with Defence Science and Technology.

The project involves a cross-sector team exploring ways of integrating laser-based optical and radio frequency (RF) communications in a single SATCOM terminal. By combining optical and RF communications, satellite operators will have more options to communicate. It will lead to hybrid optical-radio frequency SATCOM terminals in military aircraft, land vehicles and ships using technology developed through this project.

SmartSat's partners for CHORUS are EOS Space Systems, EM Solutions, Lyrebird Antenna Research, Shoal, ANU and UniSA.

These projects are just three of the 12 that have begun in SmartSat's first 12 months.

SmartSat is committed to developing capabilities in the space industry through education. It will support Australia's STEM initiatives by sponsoring 72 PhD students and more than 400 space engineers, scientists and technologists. Moreover, three professorial chairs have been appointed with universities. These experts will drive new-frontier research in artificial intelligence for satellite systems and space cybersecurity technologies.

SmartSat aims to help build an Australian sovereign space capability and support the Australian Space Agency. Through its partners, it is committed to develop the game-changing technologies that will transform key Australian industries, enhance economic prosperity and deliver national benefits.

Professor Andy Koronios
CHIEF EXECUTIVE OFFICER
SMARTSAT CRC

Health & Medical Sciences

Australia's research field leaders

These 66 scholars are Australia's leading researchers in health and medical sciences – one selected from each of the 66 fields in this discipline. They are the researchers with the highest number of citations from papers published in the last five years in the 20 top journals in their field. In each field we also name Australia's top research institution, the one with most citations in the top 20 journals in the field in the last five years.

Field Addiction
Field leader Louisa Degenhardt, UNSW
Lead institution UNSW

Field AIDS & HIV
Field leader Matthew Law, UNSW
Lead institution UNSW

Field Alternative & Traditional Medicine
Field leader Jon Adams, UTS
Lead institution Western

Field Anaesthesiology
Field leader Paul Myles, Monash
Lead institution Monash

Field Audiology, Speech & Language Pathology
Field leader Sharynne McLeod, CSU
Lead institution Uni of Queensland

Field Bioethics
Field leader Wendy Lipworth, Uni of Sydney
Lead institution Uni of Melbourne

Field Cardiology
Field leader John Beltrame, Uni of Adelaide
Lead institution Uni of Adelaide

Field Child & Adolescent Psychology
Field leader Liz Pellicano, Macquarie
Lead institution Macquarie

Field Clinical Laboratory Science
Field leader Samuel Vasikaran, UWA
Lead institution QUT

Field Communicable Diseases
Field leader David Paterson, Uni of Queensland
Lead institution Monash

Field Critical Care
Field leader Craig French, Uni of Melbourne
Lead institution Austin

Field Dentistry
Field leader Sašo Ivanovski, Uni of Queensland
Lead institution Uni of Adelaide

Field Dermatology
Field leader Adele Green, QIMR Berghofer
Lead institution Uni of Queensland

Field Developmental Disabilities
Field leader Cheryl Dissanayake, La Trobe
Lead institution Macquarie

Field Diabetes
Field leader Sophia Zoungas, Monash
Lead institution Monash

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

Field Endocrinology
Field leader Peter Ebeling, Monash
Lead institution Western

Field Epidemiology
Field leader Mary-Louise McLaws, UNSW
Lead institution Monash

Field Gastroenterology & Hepatology
Field leader Behzad Hajarizadeh, UNSW
Lead institution Burnet

Field Genetics & Genomics
Field leader Peter Visscher, Uni of Queensland
Lead institution QIMR Berghofer

Field Gerontology & Geriatric Medicine
Field leader Christopher Cleon Rowe, Austin
Lead institution UNSW

Field Gynaecology & Obstetrics
Field leader Sailesh Kumar, Uni of Queensland
Lead institution Uni of Queensland

Field Health & Medical Sciences (general)
Field leader Yohannes Kinfu, Uni of Canberra
Lead institution Monash

Field Heart & Thoracic Surgery
Field leader David Winlaw, Uni of Sydney
Lead institution RCH Melbourne

Field Hematology
Field leader Constantine Tam, Uni of Melbourne
Lead institution Monash

Field Hospice & Palliative Care
Field leader David Currow, UTS
Lead institution UNSW

Field Immunology
Field leader James McCluskey, Uni of Melbourne
Lead institution Monash

Field Molecular Biology
Field leader Debnath Ghosal, Uni of Melbourne
Lead institution Monash

Patrick McGorry Psychiatrist University of Melbourne Research leader in the field of psychiatry

Mental health has emerged as a major casualty of the COVID-19 pandemic.

“Young people are really in trouble because they are so much more precarious in terms of where they are in life,” says Patrick McGorry, executive director of youth mental health centre of excellence Orygen, and founder of the national network of headspace centres for young people.

“They’re on the threshold of their productive life and obviously much more vulnerable to becoming mentally ill. They’re more vulnerable to developing mental illness anyway, because that’s the major risk period.

“Their whole transition to adulthood is much more insecure and fragile than it ever has been.”

Professor McGorry was the 2010 Australian of the Year and is chair of youth mental health at the University of Melbourne. He is particularly concerned about surging youth unemployment rates in the pandemic and the huge disruption to secondary and tertiary education. “You’re looking down the barrel of a major recession, which is going to impact more severely on young people than any other age group,” McGorry says.

He is urging an attack on two fronts: prevention, by taking measures to revive the economy so that employment prospects can be improved, and secondary and tertiary education shored up; and strengthening the safety net of the mental health system, which “was already overwhelmed with demand even before COVID and now is experiencing a surge of at least 20 to 30 per cent increase in need for care.”

However, McGorry is not in the blame game. “Of all countries in the world, we have actually named the problem. We’ve had commissions of



Their whole transition to adulthood is much more insecure and fragile than it has ever been

enquiry and admitted failures, especially the Victorian government.”

His interest in young people’s mental health took root early, in the mid-80s, when as a trainee he established a research project at Melbourne’s Royal Park Hospital, focusing on people who had had their first episode of psychosis. Their average age was 22. “It was quite obvious that they were terrified by the experience of coming into psychiatric care for the first time,” McGorry says.

“They saw around them 45-year-olds with very severe chronic illnesses. Their needs were very different, yet they were presented with a very biased and pessimistic view of what their lives were going to be like.

“It was assumed by everyone that they were going to deteriorate and become chronically ill. What I have tried to do with a whole series of colleagues over the years is challenge that. I have a ‘recovery philosophy’.

“We have tried to develop treatments and interventions that would increase the chance of recovery. That meant shifting the focus to more community-based care and away from

inpatient care, and having a lot more research to develop better interventions and combinations of interventions.”

Orygen and the more than 100 headspace centres around the country – designed as safe places for young people experiencing mental health problems – are testament to that. “This area of research is absolutely cutting edge in psychiatry; it’s the earliest detection of serious mental illness,” McGorry says.

He describes the headspace network as the primary tier of mental health. The COVID-19 crisis means providing another level is even more urgent. “The next tier of care would be for the more complex problems, like more severe depression, borderline personality, anorexia or psychosis – these problems are also very common,” McGorry says.

“Governments have not built the second tier to the level it needs to be built. So that’s what the ongoing advocacy is about now. Australia’s in a better position ... to do this, but we have to make the decision to do it and it’s going to cost substantial amounts of money. It will take billions.”

JILL ROWBOTHAM

Field Natural Medicines & Medicinal Plants
Field leader Anthony Carroll, Griffith
Lead institution Griffith

Field Neurology
Field leader Glenda Halliday, Uni of Sydney
Lead institution Monash

Field Neurosurgery
Field leader Jeffrey Rosenfeld, Monash
Lead institution Monash

Field Nuclear Medicine, Radiotherapy & Molecular Imaging
Field leader Rod Hicks, Peter Mac
Lead institution Peter Mac

Field Nursing
Field leader Debra Jackson, UTS
Lead institution Griffith

Field Nutrition Science
Field leader Luc van Loon, ACU
Lead institution Monash

Field Obesity
Field leader John Dixon, Baker
Lead institution Monash

Field Oncology
Field leader Freddy Sitas, Uni of Sydney
Lead institution ANU

Field Ophthalmology & Optometry
Field leader Fiona Stapleton, UNSW
Lead institution Uni of Sydney

Field Oral & Maxillofacial Surgery
Field leader Omar Kujan, UWA
Lead institution UWA

Field Orthopaedic Medicine & Surgery
Field leader Chris G. Maher, Uni of Sydney
Lead institution Monash

Field Otolaryngology
Field leader Richard Harvey, Macquarie
Lead institution Uni of Sydney

Field Pain & Pain Management
Field leader Michael Nicholas, Uni of Sydney
Lead institution Uni of Sydney

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

Field Paediatric Medicine
Field leader Alicia Spittle, Uni of Melbourne
Lead institution Uni of Sydney

Field Pharmacology & Pharmacy
Field leader Daniel Hoyer, Uni of Melbourne
Lead institution Monash

Field Physical Education & Sports Medicine
Field leader Gavin Davis, Monash
Lead institution VU

Field Physiology
Field leader Jonathan M. Peake, QUT
Lead institution Monash

Field Plastic & Reconstructive Surgery
Field leader Anand Deva, Macquarie
Lead institution Macquarie

Health & Medical Sciences

Australia's research field leaders



Fiona Stapleton

Vision Scientist, UNSW

Research leader in the field of ophthalmology & optometry

They say that the eyes are the window to the soul. For Fiona Stapleton, they are far too often the site of disease and infection.

A world-renowned epidemiologist in eye disease, one of the avoidable issues Stapleton is addressing is the growing rate of infections across Asia caused by cosmetic and novelty lenses. They are designed to change iris colour and make them appear oversized – giving the wearer a Japanese anime character appearance. They are often made in unregulated settings, using materials such as car paint.

“We are trying to understand how often they are used in the community, and (for) the people who wear them to understand what the real risk factors are,” says Stapleton, who is working with researchers in nine countries. “With the research, we are trying to translate it into policy change and education, and working with practitioners to try and reduce the problem.”

One of the most influential women in optometry globally, the unassuming Scientia Professor in the School of Optometry and Vision Science at the University of NSW has published 247 peer-reviewed papers, 21 book chapters and one textbook.

She has also attracted a staggering \$11m

in funding from government, industry and non-government organisations.

Stapleton moved from the UK in 1993 to take up a role with the new Co-operative Research Centre for Eye Research at UNSW.

“Solving industry problems, which is also about developing jobs and technology in Australia, has been a bit of a feature of how I’ve worked over the years,” she says. This year Stapleton was named a lead researcher of a \$3m project to develop artificial intelligence to increase the accuracy of patient diagnoses and referrals – a project led by technology firm Big Picture Medical.

She has been credited with influencing clinical practice in the areas of contact lens-related disease and corneal infections across the globe, and has gained international recognition for her work on a condition known as dry eye.

“Dry eye can affect around 40-50 per cent of the population, with 5-10 per cent of cases being severe enough to require treatment,” Stapleton says. “It can be a costly and debilitating condition.”

She has a grant to look at the influence of the hormone estrogen on dry eye, as it is prevalent among post-menopausal women.

JULIE HARE

Field Pregnancy & Childbirth
Field leader Caroline Homer, Burnet
Lead institution Western

Field Primary Health Care
Field leader Nicholas Zwar, Bond
Lead institution Monash

Field Psychiatry
Field leader Patrick McGorry, Uni of Melbourne
Lead institution UNSW

Field Psychology
Field leader Richard Moulding, Deakin
Lead institution ACU

Field Public Health
Field leader Adrian Bauman, Uni of Sydney
Lead institution Uni of Sydney

Field Pulmonology
Field leader Peter Frith, Flinders
Lead institution Uni of Sydney

Field Radiology & Medical Imaging
Field leader Weidong Cai, Uni of Sydney
Lead institution Uni of Sydney

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

Field Reproductive Health
Field leader Helena Teede, Monash
Lead institution Uni of Adelaide

Field Rheumatology
Field leader Peter Nash, Griffith
Lead institution Uni of Sydney

Field Social Psychology
Field leader Luke Smillie, Uni of Melb
Lead institution Uni of Melb

Field Surgery
Field leader Mark Smithers, Uni of Queensland
Lead institution JCU

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

Field Transplantation
Field leader Daniel Chambers, Uni of Queensland
Lead institution St Vincent’s Hospital

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

Field Urology & Nephrology
Field leader Declan Murphy, Peter Mac
Lead institution Monash

Field Vascular Medicine
Field leader Bruce Campbell, Uni of Melbourne
Lead institution Monash

Field Veterinary Medicine
Field leader Navneet Dhand, Uni of Sydney
Lead institution Uni of Sydney

Field Virology
Field leader Peter Walker, Uni of Queensland
Lead institution UNSW

Humanities, Arts & Literature

Australia's research field leaders

These 24 scholars are Australia's leading researchers in humanities, arts and literature – one selected from each of the 24 fields in this discipline. They are the researchers with the highest number of citations from papers published in the last five years in the 20 top journals in their field. In each field we also name Australia's top research institution, the one with most citations in the top 20 journals in the field in the last five years.

Field African Studies & History
Field leader Victor Igreja, USQ
Lead institution UWA

Field Asian Studies & History
Field leader Vedi Hadiz, Uni of Melbourne
Lead institution ANU

Field Chinese Studies & History
Field leader Haiqing Yu, RMIT
Lead institution Deakin

Field Communication
Field leader Jean Burgess, QUT
Lead institution Monash

Field Drama & Theatre Arts
Field leader Luke Hopper, ECU
Lead institution QUT

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

Field Epistemology & Scientific History
Field leader David Kaplan, Macquarie
Lead institution Macquarie

Field Ethnic & Cultural Studies
Field leader Christina Ho, UTS
Lead institution Monash

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

Field Film
Field leader Craig Batty, UTS
Lead institution Macquarie

Field Foreign Language Learning
Field leader Alastair Pennycook, UTS
Lead institution Uni of Melbourne

Field French Studies
Field leader Amy Hubbell, Uni of Qld
Lead institution ANU

Field Gender Studies
Field leader Sam Winter, Curtin
Lead institution ACU

Field History
Field leader Agnieszka Sobocinska, Monash
Lead institution Uni of Melbourne

Field Humanities, Literature & Arts (general)
Field leader Daniel Black, Monash
Lead institution Uni of Sydney

Field Language & Linguistics
Field leader Kiwako Ito, Uni of Newcastle
Lead institution WSU

Field Latin American Studies
Field leader Luis Angosto Ferrández, Uni of Sydney
Lead institution Uni of Sydney

Field Literature & Writing
Field leader Kristine Moruzi, Deakin
Lead institution USQ

Field Middle Eastern & Islamic Studies
Field leader Benjamin Isakhan, Deakin
Lead institution Deakin

Field Music & Musicology
Field leader Emery Schubert, UNSW
Lead institution Uni of Melbourne

Field Philosophy
Field leader Richard Heersmink, La Trobe
Lead institution ANU

Field Religion
Field leader Robert Ross, Macquarie
Lead institution Monash

Field Sex & Sexuality
Field leader Anthony Lyons, La Trobe
Lead institution La Trobe

Field Visual Arts
Field leader Yoko Akama, RMIT
Lead institution QUT



It became less about the act of actually helping people and more about what young Westerners looked like

AARON FRANCIS



Agnieszka Sobocinska

Historian, Monash University

Research leader in the field of history

In 1961, a Gallup Poll in the US found that more Americans knew about the Peace Corps than about the Twist, a dance craze that was then taking the world by storm.

Volunteering in developing and post-colonial nations was hip. Ordinary people left the creature comforts of their homes to spend one, two or more years in unfamiliar countries in Africa, Asia and South America.

By the end of the 1960s, hundreds of thousands of Australians, Britons and Americans had responded to the call of development tourism, driven by idealism, a sense of adventure and a genuine desire to help others.

The outcomes were, however, mixed. Living in ex-pat ghettos, inexperienced and under-prepared and working in programs that often did not take local interests and wishes into account, “colonial cultures and mores were perpetuated”, says Agnieszka Sobocinska, a senior research fellow in the School of Philosophical, Historical and International Studies at Monash University. Dr Sobocinska's work has focused on how, from 1950s to the 1970s, ordinary people helped shape global relations through tourism, volunteering and international aid.

Pioneered largely in Australia, among a small group of well-meaning, Melbourne University-educated professionals in the 1950s, volunteering in third world countries would grow to eventually morph into “voluntourism” or “orphanage tourism, an aberration from early worthy intentions that has proven to be ultimately exploitative of both recipients and volunteers.

Sobocinska's interests lie at the intersection of public opinion and international relations.

“Volunteering clearly depended on ordinary people wanting to help in international diplomacy,” she says.

“I'm trying to see how government policies and diplomacy was enacted by the non-elite – by ordinary, well-

meaning people and their ideas about the world and how it should look.”

In an upcoming book, *Saving the World? Western Volunteers and the rise of the Humanitarian-Development Complex*, to be published by Cambridge University Press next year, Sobocinska examines how tens of thousands of Westerners left home to volunteer in far-flung corners of the globe.

“Aflame with optimism, they set out to save the world, but their actions were invariably intertwined with national and racial power in the overlapping contexts of decolonisation, globalisation and the Cold War,” she writes.

Over time, the popularity and “innocence” of volunteering became tarnished as volunteering organisations “sort of developed their own PR industry”, she says. “It became less about the act of actually helping people and more about what young Westerners looked like,” Sobocinska says.

These programs started to focus less on the impact of what the volunteers were doing and more on the media and the image of volunteering. “International development became a new form of neo-colonialism,” she says.

These days volunteering is de rigueur, with many schools and universities embedding it into their programs and curricula. But all too often these programs are run with little regard for what the recipient nations really need or want, Sobocinska says.

Her earlier focus was on travel and tourism and how it was a politically significant activity that contributed to broader understandings of Australia's relations with Asia. The experiences of ordinary people in Asian countries helped, for example, bring about an end to the White Australia Policy.

Travel, Sobocinska says, reshaped attitudes towards Asia, which facilitated both personal and societal reassessments of Australian relations with Asia.

JULIE HARE

Social Sciences

Australia's research field leaders

These 30 scholars are Australia's leading researchers in the social sciences – one selected from each of the 30 fields in this discipline. They are the researchers with the highest number of citations from papers published in the last five years in the 20 top journals in their field. In each field we also name Australia's top research institution, the one with most citations in the top 20 journals in the field in the last five years.

Field Academic & Psychological Testing
Field leader David Andrich, UWA
Lead institution Monash

Field Anthropology
Field leader Luca Fiorenza, Monash
Lead institution Uni of Adelaide

Field Archaeology
Field leader Sam Lin, Uni of Wollongong
Lead institution ANU

Field Cognitive Science
Field leader Scott Brown, Uni of Newcastle
Lead institution Uni of Newcastle

Field Criminology, Criminal Law & Policing
Field leader Martin Andresen, Griffith
Lead institution Monash

Field Diplomacy & International Relations
Field leader Shahar Hameiri, Uni of Qld
Lead institution Curtin

Field Early Childhood Education
Field leader Michelle Neumann, Griffith
Lead institution Macquarie

Field Education
Field leader Michael Henderson, Monash
Lead institution UniSA

Field Educational Psychology & Counselling
Field leader Andrew Martin, UNSW
Lead institution ACU

Field Environmental & Occupational Medicine
Field leader Alex Collie, Monash
Lead institution Monash

Field Environmental Law & Policy
Field leader Roc Shi, UTS
Lead institution Monash

Field Ethics
Field leader Colin Higgins, Deakin
Lead institution Monash

Field European Law
Field leader Moeen Cheema, ANU
Lead institution UNSW

Field Family Studies
Field leader Alina Morawska, Uni of Qld
Lead institution Uni of Qld



Some parties do not recognise the legitimacy of the UN. The UN is now being targeted for who it is, rather than just where it is.

DAVID GEPAGHTY



Charles Hunt

Political scientist RMIT University Research leader in military studies

Robust action by UN peacekeepers to calm or resolve conflicts comes with its own dangers, and is fertile ground for Charles Hunt's research.

Once, UN peacekeepers were strictly prohibited from using force for anything other than self-defence, no matter the provocation.

Dr Hunt, now an Australian Research Council DECRA Fellow at RMIT University, has investigated the UN's increased willingness to use force to protect civilians and stabilise conflicts, and its sometimes unfortunate results.

"International intervention may be well-meaning but sometimes has negative, unintended consequences," Hunt says, pointing to conflicts in which peace enforcement by UN "blue helmets" provoked reprisals against locals, or against humanitarian organisations with only distant connections to peace-keepers.

"It's where the UN is particularly vulnerable and also susceptible to being instrumentalised in that way."

The UN is now grappling with the difficult balance of permitting limited peacekeeper force in missions around the world, policed by often inadequately trained peacekeepers from donor nations. It's even harder when aggrieved parties including host states are doing everything in their powers to impede UN missions.

Groups in Mali, Somalia, Yemen, Syria do not recognise the legitimacy of the UN; they see it as part of an illegitimate global order, Hunt says.

"In Mali, for example, today it's very clear that some parties to the conflict do not recognise the legitimacy of the UN. The UN is now being targeted for who it is, rather than just where it is.

"It's much more difficult for the UN to stay the course in the face of

that kind of targeting than it may be for some other kind of military intervention, for example, in Afghanistan, with the Coalition of the Willing."

Hunt's research focus is Africa, particularly the post-colonial states of sub-Saharan Africa, nearly all of them troubled.

After undergraduate studies in political science, philosophy and economics at the University of Birmingham, he began work on a master's degree in international security, specifically on the role of the UN in conflict prevention, management and resolution.

During an internship at a UN-affiliated training centre in Ghana he came to know the complicated bureaucracy of the giant body, and the difficulty of making practical decisions according to wildly varying circumstances.

"That was instrumental in me becoming more aware of what was really going on, and I wanted to bring a research lens to that, to develop practical, policy-relevant research," he says.

Hunt spent three years in Africa, working in three countries and visiting many more for the UN with peacekeeping missions. In 2008 he began his doctorate at the University of Queensland.

"The idea was to bring back knowledge and experience from the field to the ivory tower and write the PhD," he says.

More recently Hunt's fieldwork has been on the UN's five biggest missions in Africa, in Mali, the Central African Republic, the Democratic Republic of Congo and South Sudan. Asked by the Australian government, he has written a handbook for peacekeepers. He has also been commissioned by the UN to plan for future mission scenarios of the future.

"Small wins," he says. "Having materials that reflect today's reality and raise the risks of both action and inaction, is useful, I think."

SIAN POWELL

Social Sciences Australia's research field leaders



Alina Morawska Psychologist, University of Queensland Research leader in family studies

Alina Morawska's most cited paper is about what influences binge drinking, written as part of her honours degree, but these days she writes other highly referenced papers about helping parents cope with the complex challenges of raising well-rounded human beings.

However, the deputy director of the Parenting and Family Support Centre at the University of Queensland, home of the highly regarded Triple P – Positive Parenting program, sees a clear link between that early work with setting an early course to good physical and mental health.

"Preschoolers can tell you what alcohol does to people and why people drink," Dr Morawska says. "Where do they get that? From their

parents, from their closest family.

"Prevention is really my passion, and ensuring that we can prevent some of society's major problems in terms of health and mental health."

This drew her away from her first career plan, medicine.

"I felt that that was very much about 'treating' and I was much more interested in how we can reduce some of the problems of society," Morawska says. "That is why I went into psychology. If you're going to prevent things, you have to start with children."

That is why another paper she wrote, in 2015, about parenting children with chronic illness, is particularly important to her.

"It frames the conversation around the importance of parenting

in a health context. It is something that's increasingly being recognised, I think, partially as a response to that paper," she says.

Research prowess runs in the family: Morawska's mother, Lidia, is recognised as a Lifetime Achiever this year.

Morawska's keen interests now are the importance of tooth brushing, nutrition, physical activity habits and screen time.

"The behaviours associated with good health outcomes are often established very, very early in childhood and have consequences throughout the lifespan," she says.

The challenge for parents is how to balance those things in their children's lives and what that means for their own behaviour, the examples they are setting.

"Sometimes parents can be quite ambivalent about whether change is even necessary or how to go about change. Lots of parents are concerned about children having excessive screen time, but they themselves have an awful lot of screen time and they also see the value and the benefit it can have for children.

"The bigger issue is what that displaces, what children aren't doing when they're spending much of their time in front of some screen."

Morawska also studies the efficacy of parenting programs.

"I've increasingly focused on very brief interventions — a two-hour session, a group session, or listening to a series of recorded podcasts for an hour or two can deliver very similar outcomes to a much longer, more intensive intervention," she says. "Sometimes a bite-sized chunk of intervention can nudge parents in the right direction, give them confidence to make further steps."

Now she has embarked on another line of inquiry that also promises to keep her busy: "I am particularly interested in the development of gender stereotypes in children and the extent to which they can be altered by differences in parenting."

JILL ROWBOTHAM

Field Forensic Science

Field leader Duncan Taylor, SA Govt

Lead institution UTS

Field Geography & Cartography

Field leader Robyn Dowling, Sydney

Lead institution Uni of Melb

Field Health Policy & Medical Law

Field leader Abby Haynes, Sydney

Lead institution Monash

Field Higher Education

Field leader David Boud, UTS

Lead institution Deakin

Field Human Migration

Field leader Loretta Baldassar, WA

Lead institution Monash

Field International Law

Field leader Heng Wang, UNSW

Lead institution UNSW

Field Military Studies

Field leader Charles Hunt, RMIT

Lead institution Monash

Field Political Science

Field leader Robert Thomson, Monash

Lead institution Uni of Sydney

Field Public Policy & Administration

Field leader Brian Head, Uni of Qld

Lead institution ANU

Field Science & Engineering Education

Field leader Rola Ajjawi, Deakin

Lead institution Monash

Field Social Sciences (general)

Field leader Akemi Takeoka Chatfield, Uni of Wollongong

Lead institution UNSW

Field Social Work

Field leader Anastasia Powell, RMIT

Lead institution UNSW

Field Sociology

Field leader Megan Woods, Uni of Tas

Lead institution Uni of Qld

Field Special Education

Field leader Pearl Subban, Monash

Lead institution Uni of Newcastle

Field Teaching & Teacher Education

Field leader Sarah Prestridge, Griffith

Lead institution Deakin

Field Urban Studies & Planning

Field leader Tan Yigitcanlar, QUT

Lead institution Uni of Melb



science gives us the tools to theorise, predict, observe and experiment. It allows us to extend our knowledge, solve problems and develop new technologies, to be curious,

and explore what may be possible. The best way to search for truth and solutions is together, to solve our problems cooperatively by harnessing our collective strengths and abilities.

The Department of Defence's Science and Technology Group (DSTG) is Australia's second-biggest national science agency, comprising a little more than 2000 staff. We bring together interdisciplinary expertise from across Australia, from universities, co-operative research centres, academies and industry.

Our award-winning scientists tackle a range of problems, from mine countermeasure technology temperatures to contributing to the whole-of-government response to the COVID-19 pandemic.

In July, the Prime Minister declared we were living in "one of the most challenging times we have known since the 1930s and early 1940s", which is why the government committed about \$3 billion towards innovation, science and technology in defence over the next decade.

In May 2020, Defence Minister Linda Reynolds released *More, together: Defence Science and Technology Strategy 2030*. *More, together* introduces a new concept for DST programs: Science, Technology and Research Shots (STaR Shots). These STaR Shots are inspirational and aspirational programs to focus strategic research and produce innovative outcomes.

This strategy provides the blueprint for Defence's science and technology research, and introduces three strategic pillars: One Defence science and technology capability; Brilliant people, collaborative culture; and Outstanding research infrastructure powering innovation.

These pillars will help DST scale up the national science and technology enterprise to tackle Australia's unique strategic challenges.

Through *More, together*, DST will help ensure the recently released *2020 Defence Strategic Update* and *2020 Force Structure Plan* will be driven by a comprehensive, coherent and agile innovation system that links Defence's plans with industry initiatives.



Problem solving in Defence must aim for the STaRS

More, together also outlines a shift in the way Defence science and technology will work. We will focus on agility and being technology agnostic so we are positioned to insert new technologies and solutions as they emerge. Our strategic effort will be directed towards a problem-oriented research agenda asking "what is the question we are trying to answer?" rather than the traditional applied research agenda.

Our partnerships with industry and universities are integral to giving Australia a technological and capability edge. We are strengthening our ties with Australia's university sector to enable greater collaboration. For the first time, the Defence Science Partnerships Program — a framework that helps Australian universities to work with Defence — involves every public university in Australia.

Defence is strengthening the innovation ecosystem by ensuring that the two signature innovation programs, the Next Generation Technologies Fund and the Defence Innovation Hub, are more joined up and give industry and academia clear pathways to connect to Defence.

The Next Generation Technologies Fund is the principal vehicle by which DST can pursue

the critical technology areas such as cyber, quantum technologies and enhanced human performance, which Australia must nurture.

The Next Generation Technologies Fund will make further investment of \$1.2 billion over the next decade.

The Defence Innovation Hub accepts proposals that are ready to enter the engineering and development stages, and has more than \$800 million of investment planned over the decade.

A new research initiative known as the Industry Competitive Evaluation Research Agreement (ICERA), was launched in August 2020 with successful applicants expected to be announced in October.

ICERA will offer small businesses opportunities to investigate innovative and visionary projects that contribute to Defence priorities.

The Defence Minister recently announced the Defence and Maritime Innovation and Design Precinct for Tasmania. This development will foster maritime solutions as well as a broad range of science and technology capabilities and connects academics from across the country to support Defence science and technology.

In addition, construction of a next-generation High Performance Computing Centre in Adelaide has begun. A supercomputer will support advanced research, modelling and experimentation in Defence, and stress-test its most expensive and sophisticated equipment in virtual creations of real-world environments.

By focusing on a smaller number of specific and challenging problems, scale and intensity can be increased to deliver transformational impact.

The emergence of new technologies — like hypersonic weapons, high-speed and long-range missiles, and artificial intelligence — is increasingly challenging traditional military capabilities.

Focusing our national science and technology enterprise on mission-directed research will ensure Australia is best positioned to realise its advantages in a rapidly evolving environment.

Professor Tanya Monro

CHIEF DEFENCE SCIENTIST
DEPARTMENT OF DEFENCE'S
SCIENCE AND TECHNOLOGY GROUP

ACU strives for world-leading standards in research quality



With a research strategy focused on areas of specialisation related to our mission and identity, the Australian Catholic University (ACU) has achieved research excellence in our priority areas of education, health, theology and philosophy, and other liberal arts. The recent establishment of two research institutes and a cluster of centres strengthens this strategic focus.

Given ACU's commitment to the humanities and social sciences, the university has invested strongly in the new research institutes, adding to earlier investment in health and education.

The Dianoia Institute of Philosophy commenced in 2019 and aims to achieve a world-leading position for philosophical research in the analytic tradition. Led by Professor Stephen Finlay, Dianoia aspires to excellence in the central areas of philosophical inquiry such as metaphysics, epistemology, ethics and metaethics, logic, social and political philosophy, aesthetics, history of philosophy, and the philosophy of mind, language, religion and science.

Dianoia has developed a strong profile by adding to existing staff a distinguished professoriate — John Hawthorne (metaphysics, epistemology, philosophy of language), Gillian Russell (logic, philosophy of language), Peter Fritz (logic, metaphysics, philosophy of language), Clayton Littlejohn (epistemology, ethics, metaethics) — who join our senior and junior scholars Sam Baron, Kyle Blumberg,

Renée Bolinger (part-time), Sam Carter, Nevin Climenhaga, Stephanie Collins, Christina Dietz, Dmitri Gallow, Simon Goldstein, Verónica Gómez, David Killoren, Tyler Paytas and Juhani Yli-Vakkuri.

The second institute to be developed in the past year commenced in January with the appointment of Professor Joy Damousi FAHA, FASSA, president of the Australian Academy of the Humanities, as director of the Institute for Humanities and Social Sciences. An award-winning historian of memory, war and migration, she also leads the Centre for Refugees, Migration, and Humanitarian Studies.

The institute has recruited an internationally renowned professoriate including Sheila Fitzpatrick FAHA (modern Russian history); Susan Broomhall FAHA (early modern gender and emotion, and director, Centre for Gender and Women's History); Iain McCalman AO, FAHA, FASSA, FRHist, FRSN (British and European history, environmental humanities); Kate Fullagar (comparative Indigenous history); Amanda Nettelbeck FAHA (colonial legacies); Paul Kenny (southeast Asian politics and populism); Bryan Turner FASSA (sociology of religion); Jack Barbalet (economic and political sociology, and director, Centre for Social and Political Change); and Peter Holbrook FAHA (literature, especially Shakespeare and English Renaissance, and director, planned Centre for Literary Criticism).

Other centres established this year include the Research Centre for Digital Data and Assessment in Education, which addresses a global knowledge gap in how new and emerging technologies are

transforming the practices and experience of education. The Research Centre for Sports Performance, Recovery, Injury and New Technologies (SPRINT) is advancing knowledge in performance, recovery and injury in the sporting domain. The Healthy Brain and Mind Research Centre aims to improve mental health, participation and wellbeing. The Research Centre for Studies of the Second Vatican Council will expand understanding of one of the most significant events in the history of the Catholic church in the 20th century.

The past 12 months also coincided with ACU's exceptional improvement in world university subject rankings. In nursing we are now ranked 18th globally in the Shanghai-based Academic Ranking of World Universities. In education, ACU ranks 56th in the world, in sport science we are 26th, and we continue to climb in the Times Higher Education rankings for psychology, and for arts and humanities. We are the top-ranked Australian university by proportion of high-quality papers in social sciences and the humanities, and in biomedical and health sciences, as shown by the CWTS Leiden rankings for 2020, the first year that we were ranked.

I congratulate our researchers whose outstanding achievements are demonstrated by our rankings, as well our Excellence in Research for Australia assessments.

Professor CWF McKenna
DEPUTY VICE-CHANCELLOR (RESEARCH)
AUSTRALIAN CATHOLIC UNIVERSITY

Life Sciences & Earth Sciences

Australia's research field leaders

These 30 scholars are Australia's leading researchers in the life sciences – one selected from each of the 30 fields in this discipline. They are the researchers with the highest number of citations from papers published in the last five years in the 20 top journals in their field. In each field we also name Australia's top research institution, the one with most citations in the top 20 journals in the field in the last five years.

Field Agronomy & Crop Science
Field Leader David Edwards, UWA
Lead institution CSIRO

Field Animal Behaviour & Ethology
Field Leader Leigh Simmons, UWA
Lead institution Uni of Sydney

Field Animal Husbandry
Field Leader Jennie Pryce, La Trobe
Lead institution UNE

Field Atmospheric Sciences
Field Leader Harry Hendon, BoM
Lead institution BoM

Field Biodiversity & Conservation Biology
Field Leader David Lindenmayer, ANU
Lead institution Uni of Sydney

Field Biophysics
Field Leader Marcus Pandy, Uni of Melb
Lead institution Griffith

Field Birds
Field Leader Leo Joseph, CSIRO
Lead institution ANU

Field Botany
Field Leader Belinda Medlyn, Western
Lead institution UWA

Field Cell Biology
Field Leader Robert Parton, Uni of Qld
Lead institution Monash

Field Developmental Biology & Embryology
Field Leader Rebecca Lim, Monash
Lead institution La Trobe

Field Ecology
Field Leader Jane Elith, Uni of Melb
Lead institution CSIRO

Field Environmental Sciences
Field Leader Huu Hao Ngo, UTS
Lead institution Uni of Qld

Field Evolutionary Biology
Field Leader Robert Lanfear, ANU
Lead institution Uni of Melb

Field Forests & Forestry
Field Leader Jason Sharples, UNSW
Lead institution Western

Field Geochemistry & Mineralogy
Field Leader Nigel Cook, Uni of Adelaide
Lead institution Uni of Adelaide

Field Geology
Field Leader Peter Cawood, Monash
Lead institution Curtin

Field Hydrology & Water Resources
Field Leader Albert van Dijk, ANU
Lead institution CSIRO

Field Insects & Arthropods
Field Leader Geoff Gurr, CSU
Lead institution Uni of Sydney

Field Life Sciences & Earth Sciences (general)
Field Leader Terry Hughes, JCU
Lead institution Monash

Field Marine Sciences & Fisheries
Field Leader Alistair Hobday, CSIRO
Lead institution CSIRO

Field Microbiology
Field Leader Philip Hugenholtz, Uni of Qld
Lead institution Uni of Adelaide

Field Mycology
Field Leader Tom May, RBG Victoria
Lead institution CSIRO

Field Oceanography
Field Leader Alexander Babanin, Uni of Melb
Lead institution CSIRO

Field Palaeontology
Field Leader Guang Shi, Uni of Wollongong
Lead institution UNE

Field Pest Control & Pesticides
Field Leader Bhagirath Singh Chauhan, Uni of Qld
Lead institution Uni of Melb

Field Plant Pathology
Field Leader Donald Gardiner, CSIRO
Lead institution Uni of Qld

Field Proteomics, Peptides & Aminoacids
Field Leader David Greening, Baker
Lead institution La Trobe

Field Soil Sciences
Field Leader Budiman Minasny, Uni of Sydney
Lead institution Uni of Sydney

Field Sustainable Development
Field Leader Robert Costanza, ANU
Lead institution UTS

Field Zoology
Field Leader Chris Dickman, Uni of Sydney
Lead institution Uni of Sydney



I became very interested in the role minerals have played in human history and culture ... and what gold, silver and other minerals have really meant for humankind

Nigel Cook **Geologist, University of Adelaide** **Research leader in the field of geochemistry & mineralogy**

As a boy holidaying in Cornwall, mineralogist and geochemist Nigel Cook would pick up stones on the beaches. “Then I started seeing shiny ones around the copper mines and tin mines — that really fascinated me,” says the professor in the School of Civil, Environmental and Mining Engineering at the University of Adelaide.

“My big love, apart from minerals, has always been history. I became very interested in the role minerals have played in human history and culture, all the way from the Stone Age, Bronze Age, pigments in Renaissance paintings and so on, and what gold, silver and other minerals

have really meant for humankind over the years.”

After training in his native England and working all over the world, he came to South Australia 11 years ago, attracted by its sizeable minerals industry and the university's world-class microanalytic laboratories.

“Having better and better facilities available to understand minerals of all kinds of scales has been instrumental in pushing the research limits,” Cook says.

He was also keen to keep teaching. “I enjoy getting other people excited about what I do, seeing the direct relevance for the economy,

for the minerals industry, but also just stimulating their curiosity as well.”

For the past decade, a range of projects, many linked to BHP's copper mine at Olympic Dam, and his stint from 2015-20 as director of the Australian Research Council's Research Hub for Australian Copper-Uranium, have given him scope for research that contributes to economic growth in South Australia.

He has investigated the distribution of uranium and what happens to the “daughter” products of uranium decay over time in mineral deposits, how they move around, and the implications for the processing and generation of clean concentrates.

“It's innovative in that nobody could really look at this in the kind of detail necessary at the micron to nanometre scale that we've been doing, tracking these distributions and how they change,” Cook says.

“It has scientific benefits in terms of developing the technologies to do this kind of diagnosis with enormous potential in other industries, but also practical implications for end users.”

Cook's most cited paper is 1990 research showing how gold may be present but invisible in common sulphides, but a close second is a 2009 paper on trace and minor elements in sphalerite, the first of a series on trace elements in a variety of common minerals.

These minor elements — including critical minerals such as rare earths cobalt, tellurium, indium and germanium — are a “big passion”. They have myriad purposes, from mobile phones, LED visual displays and semi-conductors, to “the fancy alloys in pushbikes” and defence technologies.

They are found in large mineral deposits but at generally low concentrations, and extracting them requires “a pretty sound understanding of where they're sitting, to enable innovative and viable extraction technologies to be developed”.

“I've always been interested in useful minerals,” Cook says.

Australia has huge potential, not only to mine and process critical minerals, but also to use them in manufacturing, keeping the value here. Working with partners, he says, “we could establish ourselves as a globally recognised centre of expertise in a sector requiring bold trans-disciplinary innovation across the whole value chain”.

JILL ROWBOTHAM



Flinders filling the breach in health and robotics

Next-gen robotics, a bespoke facemask that works, and better care for the aged. At first glance they have little in common, but they're united by Flinders University research, fuelled by robust industry engagement that is propelling some powerful collaborative projects.

With industrial transformation a fundamental challenge facing Australia's economy and society, Flinders is taking a leading role in shaping the future workforce. The university's research expertise is providing benefits for companies by delivering practical solutions through innovative thought and decisive action.

This is exemplified by a research partnership with BAE Systems/ASC Shipbuilding and the Innovative Manufacturing CRC at the Tonsley Innovation District. Joint research is being done on human factors that influence the uptake of advanced manufacturing technologies and processes.

"The purpose of the research is to support the development of world class 'digital' shipbuilding in Australia as part of the Hunter Class Future Frigate program," says Professor John Spoehr, director of the Australian Industrial Transformation Institute at Flinders University.

"Our 'factory of the future' facilities support testing of the latest manufacturing technologies

and provide training to help build advanced digital capabilities in our workplaces.

"To help ensure Australia is at the cutting edge of the advanced manufacturing revolution we are working with the best-of-breed research and development facilities globally, including the Advanced Manufacturing Research Centre in Sheffield, UK — the world's leading advanced manufacturing accelerator, funded by the British government's Industry Catapult Program — and the University of Strathclyde's Advanced Forming Research Centre," Spoehr says.

Another timely example of harnessing Flinders' research expertise for industrial progress and community need is the creation of a dedicated testing facility for personal protective equipment (PPE).

Researchers at the Medical Device Research Institute have established a testing facility that enables compliance testing of protective equipment such as surgical masks, respirators and medical gowns.

Flinders research has helped industry to diversify into their manufacture, enabling production to be ramped up.

"The serious disruption of PPE supplies during the COVID-19 pandemic has highlighted the importance of investing in local capabilities, both in manufacturing and testing. It is more important than ever to establish an Australian-based testing facility," MDRI director Karen Reynolds says.

"Flinders University swiftly stepped in and provided the required expertise that industry needs."

"To protect our frontline health workers, face masks and medical gowns need to be able to filter out bacteria, resist blood splatter, withstand wear and tear, and yet still be easy to breathe through.

"To ensure their safety and efficacy, these items must be tested to strict standards. Previously testing has been undertaken in the United States, but in the current environment, companies are experiencing lengthy delays in being able to obtain results. Through this facility, we have the capacity to perform the testing locally and support local industry."

The facility is also serving as a research hub for studies investigating the effects of fit and long-term wear on mask efficiency. Meanwhile, a trial is under way at Flinders Medical Centre to test 3D-printed face mask seals that are moulded individually to the faces of healthcare workers. The novel seals are designed to reduce the potential for infection caused by ill-fitting masks during high-risk procedures.

The Caring Futures Institute at Flinders University illustrates the strength of a multi-disciplinary approach to providing solutions for public health issues. Drawing on the research expertise of health science, medical, nursing and social welfare experts, the Caring Futures Institute is engaging with Australia's health-care industry in the wake of the Royal Commission into Aged Care Quality and Safety.

This holistic engagement with a broad industry sector will have sweeping influence and drive reform, informing government policy and industry best practice and delivering stronger models for the care of the elderly.

Within this dynamic sector, Professor Julie Ratcliffe leads a team that continues ARC-funded work on quality of life measures, collaborating with aged-care providers on a diagnostic tool being developed for commercial use.

The success of these endeavours underlines Flinders University's strategy to ensure its research addresses the needs of industry and plays a crucial role in shaping progress.

The depth and breadth of research that connects directly with the needs of industry shows how deeply committed Flinders University is to work in close partnership with industry.

It results in the types of innovation and transformation that benefit all of society.

Professor Robert Saint
DEPUTY VICE-CHANCELLOR (RESEARCH)
FLINDERS UNIVERSITY

Dugalunji Aboriginal Corporation employees harvest spinifex grass on the outskirts of Camooweal to use as part of their research collaboration with the University of Queensland. Picture: UQ



A

year ago, as we anticipated the dawn of a new decade, no one could have predicted the relentless challenges of 2020. Devastating bushfires, escalating

political tensions, social unrest and of course, a deadly global pandemic, have created such global disruption that we are likely to feel the aftershocks for decades.

Many are resting hopes on the swift rollout of a COVID-19 vaccine to restore the world to “normal”. While this is an essential step on the road to global recovery — and the University of Queensland (UQ) vaccine team is helping lead the way — the events of this year will impact far more than just global health.

“Normal” means something quite different to what it did 12 months ago, and rebuilding our economy may be our greatest, lasting challenge once an effective vaccine is available. But rather than returning to old ways, we should be taking what we have learned from this period — that innovation and collaboration at speed, and investment in key capabilities, essential — and using it to improve the world.

So, knowing this, how can research and innovation contribute to the hard work of recovery? The essential element to ensure research innovation translates into lasting impact is collaboration.

That word is almost a cliché, often perceived as a two-way process: parties sharing ideas to achieve an outcome, which can just as often mean securing a grant or publishing a paper as it can delivering a tangible solution to a situation where it’s needed.

However, powerful alliances formed by

Covid recovery will be only as strong as our alliances

harnessing the collective capability of corporations, start-ups, venture capitalists, research organisations and governments has the potential to offer sustainable solutions of lasting impact and myriad benefits.

Such multi-organisational research and innovation ecosystems offer diverse and complementary knowledge, infrastructure and strength. Critically, they can progress discovery past its traditional resting place in publications by offering, for example, manufacturing or distribution that translates innovation into commercial solutions quickly.

To achieve thriving research and innovation ecosystems like these, governments and research organisations must offer compelling calls to arms to mobilise the collective interest and investment of all parties.

Several organisations and governments are already acting on this.

The CSIRO’s mission-directed research and development approach challenges researchers, government and organisational partners to “prepare for our nation’s unfolding needs” with eight core areas of research.

The Queensland government has similarly developed areas of traditional and emerging

strengths for the state, to join business leaders, research teams and investors to solve problems that affect people, the economy and the environment.

UQ has also embraced this approach with five research impact themes: building better bioeconomies; achieving resilient environments and livelihoods; designing technology for tomorrow; transforming societies; and leading healthy lives.

Through our Global Change Research Networks, we connect UQ experts with government, corporations and investors.

One such alliance is an industry-led agribusiness consortium based out of Toowoomba, Queensland. This emerging initiative is the result of collaborations between state government and UQ (the Queensland Alliance for Agriculture and Food Innovation), and its extension into an alliance incorporating large corporates and the vibrant start-up and local business community. It aims to address advanced primary production, advanced food and fibre manufacturing, agri-food sustainability and intelligent supply chains, and digitisation by attracting and contributing to the global AgriFood community.

Similarly, a collaboration between UQ’s Australian Institute for Bioengineering and Nanotechnology and the Dugalunji Aboriginal Corporation at Camooweal, supported by the Queensland government, has the potential to revolutionise the global sustainable materials industry, while creating jobs and boosting the regional economy, and producing outcomes that can be commercialised, manufactured and distributed at scale. Using nanofibres in native spinifex grass to make stronger and thinner latex, the project could have wide-reaching applications in industries such as health care, devices and contraceptives.

To facilitate alliances like these, this year has offered many lessons amid the disruption. Strong calls to action, clarity around priorities, and longer-term commitments to funding will allow researchers and organisations to better focus on what they do best — discovery, innovation, translation and rapid commercialisation, which will ultimately benefit all Australians as we focus on rebuilding our economy.

Visit: research.uq.edu.au.

Professor Bronwyn Harch

DEPUTY VICE-CHANCELLOR (RESEARCH),
VICE PRESIDENT (RESEARCH),
UNIVERSITY OF QUEENSLAND

Early Achievers Leaderboard

Rising stars

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

The Early Achievers Leaderboard lists the five top researchers from Australian universities and research institutions in each of the eight major discipline areas, who are less than 10 years into their career. To identify the five top researchers in each area we calculate an H-index for each of them and divide it by the length of their career in years (the number of years since their first citation). The H-index, named for physicist Jorge Hirsch who suggested it in 2005, is defined at the highest number H such that a given researcher has published H papers which have been cited H times. It measures both productivity and impact. For example, if a researcher has published 50 papers, each of which has at least 50 citations, but has not managed to go one better and publish 51 papers each with at least 51 citations, then their H-index is 50.

Business, Economics & Management



Nik Steffens
Human Resources and
Organisations

At the University of Queensland, he researches concepts of self and identity in organisations.



Jun Wen
Tourism and Hospitality

At Edith Cowan University, his research interests include the nexus between tourism in China, New Zealand and Australia.



Danni Zheng
Tourism and Hospitality

At the University of Queensland, her research includes the attitudes of residents at tourism destinations.



Dinh Phan
International Business

At La Trobe University, his research interests include asset pricing, forecasting and commodity markets.



Sara Quach
Marketing

At Griffith University, her research includes relationship marketing, consumer behaviour and retailing.

Chemical & Material Sciences



Xiaoguang Duan
Chemical Kinetics and
Catalysis

At the University of Adelaide, he researches environmental technology, green catalysis and nanomaterials.



Dongliang Chao
Materials Engineering

At the University of Adelaide, his research includes the design and synthesis of advanced materials.



Zengxia Pei
Materials Engineering

At the University of Sydney, he is developing high-performance electrically rechargeable zinc-air batteries.



Yijun Zhong
Materials Engineering

At Curtin University, he researches batteries, fuel cells and electrochemical catalysis.



Yu Zhang
Electrochemistry

At UNSW Sydney, her research interest includes black silicon solar cells.

Early Achievers Leaderboard **Rising stars**

Engineering & Computer Sciences



Liang Zheng
Computer Vision and
Pattern Recognition

At the Australian National University, his research includes personal re-identification and medical image understanding.



Tongliang Liu
Computer Vision and
Pattern Recognition

At the University of Sydney, his research includes designing algorithms to enable machine learning.



Yunchao Wei
Multimedia

At the University of Technology, Sydney, his research includes computer vision and machine learning.



Xin Xia
Software Systems

At Monash University, he researches data science for software engineering.



Srecko Joksimovic
Educational Technology

At the University of South Australia, he researches the symbiosis of human and artificial cognition.

Health & Medical Sciences



Felix Ogbo
Public Health

At Western Sydney University, he researches epidemiology, global health and maternal and child welfare.



Simon Rosenbaum
Psychiatry

At UNSW Sydney, as an exercise physiologist his research includes physical activity and mental illness.



Azmeraw Amare
Psychiatry

At the University of Adelaide, he researches precision medicine, pharmacogenomics and translational medicine.



Hojabr Kakavand
Oncology

At the University of Sydney, he researches gut and lung microbiome interaction with lung cancer development.



Kefyalew Alene
Communicable Diseases

At Curtin University, he researches spatial epidemiology of infectious diseases including tuberculosis.

Humanities, Arts & Literature



Miriam Forbes
Sex and Sexuality

At Macquarie University, her research includes improving understanding of the empirical structure of psychopathology.



Kelly-Ann Allen
Religion

At Monash University, her research includes connectedness and belonging at school.



John Mingoia
Communication

At the University of South Australia, his research includes the effect of media literacy on the desire for tanned skin.



Marcus Carter
Humanities, Literature and
Arts

At the University of Sydney, his research includes human-computer interaction and game studies.



Jasmine Fardouly
Communication

At Macquarie University, she researches social influences on young people's mental and physical health.

Life Sciences & Earth Sciences



Dane Vassiliadis
Life Sciences & Earth Sciences

At the Peter MacCallum Cancer Centre, he studies epigenetic modalities driving therapeutic resistance in cancer.



Mohammad Iranmanesh
Sustainable Development

At Edith Cowan University, he researches chain supply management, digital marketing and technology management.



Yang Wu
Life Sciences and Earth Sciences

At the University of Queensland, his research interests include statistical genetics.



Qinglin Chen
Environmental Sciences

At the University of Melbourne, her interests include soil ecology and microbiology, and antibiotic resistance.



Lachlan Howell
Biodiversity and Conservation Biology

At the University of Newcastle, his research interests include conservation public policy and biobanking.

Physics & Mathematics



Xingyuan Xu
Optics and Photonics

At Monash University, his research includes integrated neurotrophic optics, microcombs and microwave photonics.



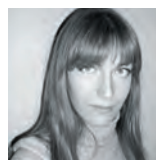
Gholamreza Kefayati
Thermal Sciences

At the University of Tasmania, his research interests include fluid mechanics and heat transfer.



Toan Dinh
Condensed Matter Physics and Semiconductors

At the University of Southern Queensland, his research includes micro/nano-electromechanical systems.



Daria Smirnova
Condensed Matter Physics and Semiconductors

At the Australian National University, her research interests include nonlinear optics and nanophotonics.



Tuan-Khoa Nguyen
Condensed Matter Physics and Semiconductors

At Griffith University, his research includes micro fabrication of MEMS sensors and devices.

Social Sciences



Blesson Varghese
Environmental and Occupational Medicine

At the University of Adelaide, his research interests include work-related injury epidemiology and prevention.



Sefa Churchill
Environmental Law and Policy

At RMIT University, his research includes development economics, macroeconomics and energy economics.



Theresa Dicke
Educational Psychology and Counselling

At the Australian Catholic University, she researches self-belief's role in stress development and health maintenance.



Rachel Kelly
Environmental Law and Policy

At the University of Tasmania, her research interests include social licence and marine conservation.



Duy Nong
Environmental Law and Policy

At CSIRO, his research interests include energy, environmental and agriculture economics.

Global research collaborations

Co-authorships with top universities

Australian universities and other research institutions work with the best universities in the world but, for historical reasons, lean more toward the UK than the US

Over the past four decades the University of Melbourne is the Australian institution whose researchers have collaborated most with the top 10 world research universities as listed by the Academic Ranking of World Universities this year.

Melbourne researchers undertook 679 collaborations with them from 1979 to 2019, as measured by the number of co-authored papers published jointly by their academics and world top 10 universities.

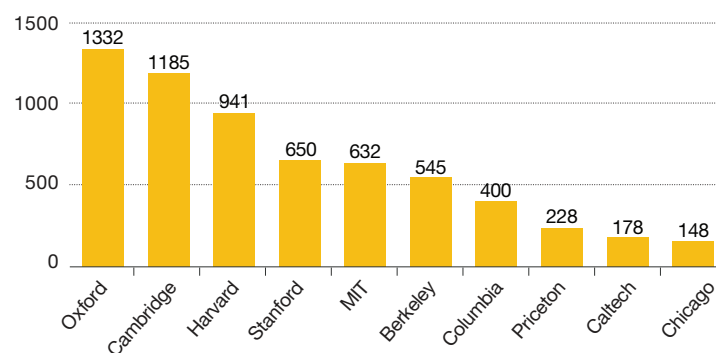
The ARWU top 10 are: Harvard, Stanford, Cambridge, MIT, Berkeley, Princeton, Columbia, Caltech, Oxford, and Chicago. US universities make up eight of the top ten but Australian academics favour Oxford and Cambridge particularly Melbourne, where nearly 40 per cent of its top 10 partnerships were with Oxbridge.

Oxford (with 1,332) had more Australian partnerships than any other top 10 university, Cambridge was next with 1,185.

Interestingly, the ARWU top 10 collaborations of Australia's big five medical research institutes – Baker, Garvan, Florey, Walter and Eliza Hall, and QIMR Berghofer – make up a higher proportion (4-12 per cent) of their total research collaborations than any university can show. The highest university is ANU at 3 per cent.

Global elite universities' collaboration with Australian researchers

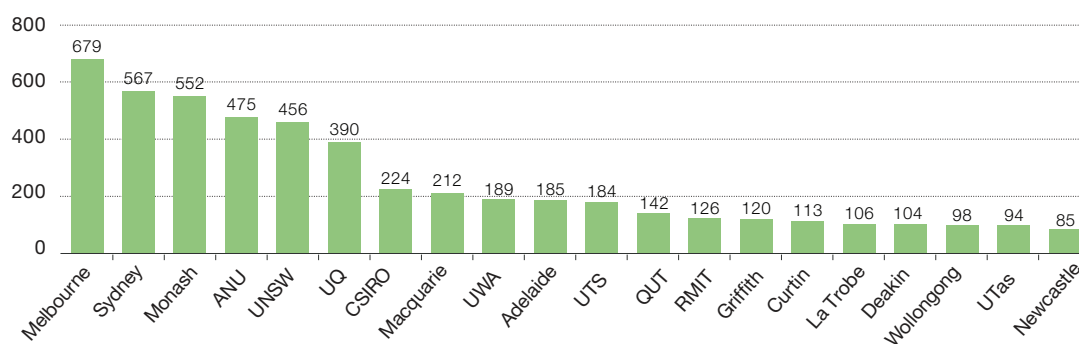
Co-authorships with Australian-based researchers



Source: League of Scholars

Australian university research collaboration with the global elite

Co-authorships with ARWU top 10 universities.



Source: League of Scholars

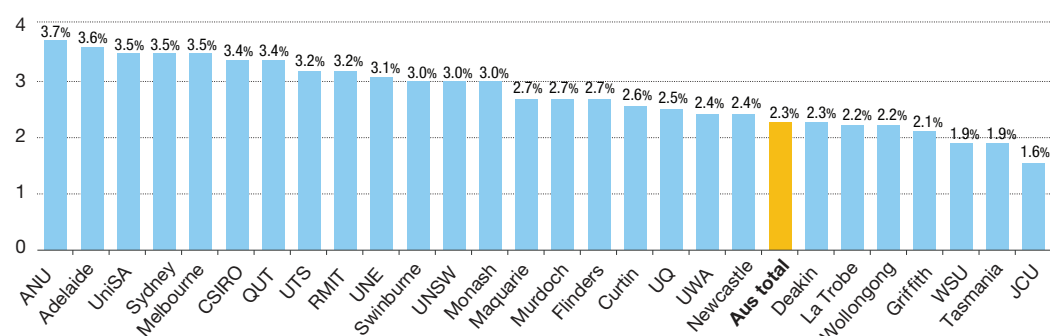
Business research collaborations

Co-authorships with industry

The ANU and the University of Adelaide work more with industry in their published research than any other universities. But Australia lags the world in university-industry collaboration

Australian university research collaborations with industry

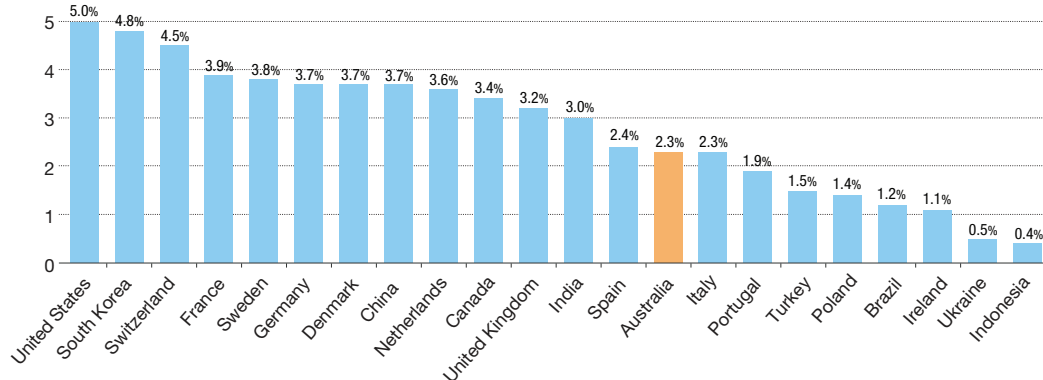
% of publications from 2017-20 with industry co-authors



Source: League of Scholars

Global research collaborations with industry

% of publications from 2017-20 with industry co-authors



Source: League of Scholars

The Australian National University and the University of Adelaide link more with industry in their research than any other universities in

Australia. In the past three years 3.7 per cent of research papers published by ANU academics had a co-author in industry, and the University of Adelaide scored nearly as high, at 3.6 per cent. As a state, South Australia rates highly in university-industry collaboration, with the University of SA scoring well at 3.5 per cent.

Not surprisingly, the CSIRO also scores relatively highly at 3.4 per cent. The rate for Australia as a whole is only 2.3 per cent, significantly lower than for other comparable developed nations.

The US, South Korea and Switzerland have the highest rate of university-industry collaboration at 5 per cent, 4.8 per cent and 4.5 per cent respectively. France, Sweden, Germany, Denmark, China, the Netherlands, Canada, the UK, India and Spain also score higher than Australia on this measure.

The big players in the digital economy are the major research collaborators. The top 10 which collaborate most with Australian researchers are, in order: Google, IBM, Microsoft, Amazon, Facebook, Intel, Huawei, General Electric, Oxbotica and Genentech.

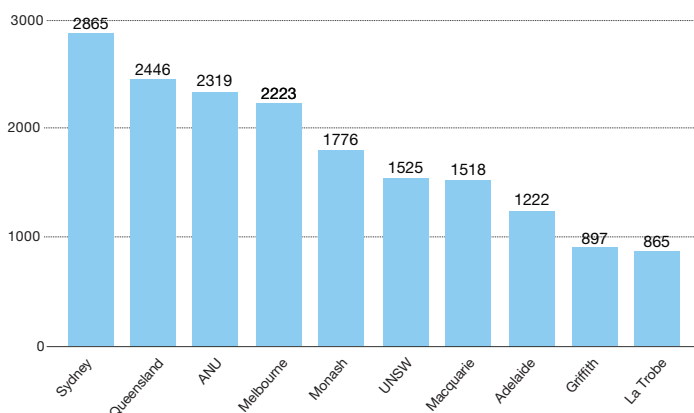
Top ten books

Australian scholarly books which made the most impact

Particularly in the humanities and social sciences, books are a significant avenue for researchers to record and disseminate their findings. Academics at Australian universities, other higher education institutions and research organisations have produced more than 13,600 scholarly books, written by more than 7200 different authors. Most of them would not be regarded by the public as best sellers. Yet the academic book published in the past 10 years with the highest impact – Business Research Methods by Emma Bell, Alan Bryman and the University of Melbourne’s Bill Harley – was cited more than 20,000 times by other researchers in all editions. Second was Mycorrhizal Symbiosis by Sally Smith, an eminent scientist at the University of Adelaide, with over 15,000 citations. Smith, who died last year, was a world authority on the topic, which describes the mutually beneficial connection between a plant’s roots and fungi in the soil – vital knowledge for agricultural production. Scholars affiliated with the University of Sydney have been the most prolific book authors, publishing 2865 books, compared to 2446 from the University of Queensland, 2319 from the Australian National University and 2223 at the University of Melbourne.

Books by researchers at universities

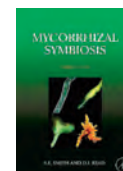
Peer reviewed books published by Australian academics by author affiliation 1979-2019



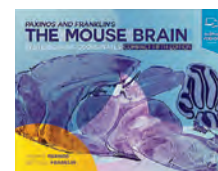
Source: League of Scholars



Business research methods
E. Bell, A. Bryman, B. Harley
Oxford University Press, 2018
20,364 citations



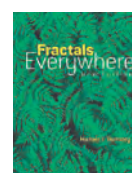
Mycorrhizal symbiosis
S.E. Smith, D.J. Read
Academic Press, 2010
15,668 citations



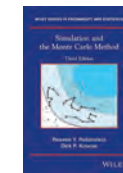
The mouse brain in stereotaxic coordinates
G. Paxinos, K.B.J. Franklin
Academic Press, 2019
15,384 citations



Gender and power: Society, the person and sexual politics
R.W. Connell
John Wiley & Sons, 2013
14,037 citations



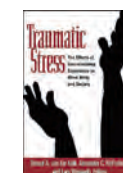
Fractals everywhere
M.F. Barnsley
Academic press, 2014
8,392 citations



Simulation and the Monte Carlo method
R.Y. Rubinstein, D.P. Kroese
John Wiley & Sons, 2017
7,512 citations



The politics of the earth: Environmental discourses
J.S. Dryzek
Oxford University Press, 2013
5,084 citations



Traumatic stress: The effects of overwhelming experience on mind, body, and society
B.A. Van der Kolk, A.C. McFarlane, L. Weisæth
Guilford Press, 2012
4,468 citations



Resilience thinking: sustaining ecosystems and people in a changing world
B. Walker, D. Salt
Island Press, 2012
3,766 citations



The myth of the powerless state
L. Weiss
Cornell University Press, 2018
3,179 citations



Research in Australia is a global collaboration sport

Australia is a global leader in research. This requires years of training, brilliant individual performances, teamwork and turning up to play every day. Most research matches are played in the open with no restrictions on crowds. However, it is also important to protect our national security by playing some of our games in front of home crowds only. Australian universities are working hard to be careful and adept players in the restricted version of the sport. It is a work in progress. For open research, I think it would be great to devote the middle pages of every newspaper to celebrate our research champions and their wins.

It is gratifying to see The Australian again undertaking an assessment of the strength of Australian research. It is wonderful to read accolades for great Australian researchers, early career and senior alike.

Research is an international endeavour. In the recent Academic Ranking of World Universities, only the US and Britain had more universities in the Global Top 100 — a remarkable achievement given Australia's population and investment in research.

For us to be this competitive requires

persistence. It is impossible to ace any ranking without long-term investment. One cannot rank highly in research by having a blinder on the day. Persistence, labour, institutional backing with government and community support are critical.

Communities support research because they can experience the benefits. Storytelling is needed so that things people would otherwise take for granted are known to originate from our research.

An international activity, research is distinguished from sport in a profound way. For decades our research institutions have been populated with talent from all corners of the planet. We attract the best of the best, and they willingly join our communities and contribute to our endeavours.

Researchers are the best because they compete and collaborate internationally; their excellence is measured in global terms. Just like the rest of Australian society, our research institutions combine the knowledge and proud, ever-revealing histories of First Nations Australians with that of other people born here, those who move here, and others who visit.

In these dynamic collaborations, we exchange methods, materials, data, culture and ideas, and all share the societal benefits.

Open knowledge and open scholarship are foundations of research, as are freedom of speech and the academic freedom of our researchers. Public funding for research via the Australian Research Council and the National Health and Medical Research Council mandates that Australians publish their work in open access literature — it must be freely available to everyone — by decree of our government.

Innovation is the implementation of ideas to create value. When research reflects demand, innovation is built into the game plan. This works to maximise the returns to the people of Australia. It also ensures Australia's contribution to solving global challenges occurs rapidly. Innovation planning helps us to choose what to protect and how to protect it for our sovereign strength.

Australia has carried out “secure” research for as long as we've undertaken “open” research. However, we have entered an era in which government and society are now asking that our intellectual endeavours are explicitly partitioned — not everything should remain open.

The university sector has participated fully with government in framing the Guidelines to Counter Foreign Interference in the Australian University Sector and we are moving forward apace with implementation. As we do this, it is critical that we remember what makes us one of the strongest research nations on earth: collaboration. We are a society open to the contributions of those from different cultures and life experiences. Being a world leader remains a sensible concept only when we mix it with the world's best.

The data are clear. Australia performs at least as well internationally in research as we do in sport. Wouldn't it be great to see the media have daily pages of research as they devote to sport? What if the middle pages of every newspaper were dedicated to research? What a strong, constructive and positive signal that would be to the community of Australia who avidly read the sport and news sections! Rather than just a once-a-year league table, we could highlight how their research successes are improving the lives of Australians every day.

Let's hope we can soon open the middle pages of The Australian daily and be enthralled in its celebration of our great researchers and their achievements.

Professor Chris Moran
DEPUTY VICE-CHANCELLOR (RESEARCH)
CURTIN UNIVERSITY