

Australia's researchers are top of the world

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EXCLUSIVE

TIM DODD
JILL ROWBOTHAM

Researchers in Australian universities are the best in the world in 14 fields of research, according to new data published on Wednesday in The Australian's 2019 Research magazine.

The globally leading researchers are in fields varying from traditional areas of expertise, such as Asian studies and history where the Australian National University's Edward Aspinall is top, to anaesthesiology (Monash University's Paul Myles) and computing systems (the University of Melbourne's Rajkumar Buyya).

Research magazine uses unique methodology to reveal the best research, drawing on public sources to find the researchers and the research institutions that lead on both volume and quality of their work.

The Australian's partner, research analytics firm League of Scholars, uses data from Google Scholar to examine papers published in the top 20 journals in more than 250 fields of research across the past five years and identifies the authors and institutions that have the most citations of their papers in these journals.

The result is a detailed list naming the top researcher and re-

FREE MAGAZINE



The 2019 Research magazine, free with The Australian, celebrates academic excellence and reveals Australia's top researchers and institutions in more than 250 fields of endeavour.

OUT TODAY

search institution in each field. But League of Scholars' two founders, Paul McCarthy and Rasika Amarasiri, also use their big data techniques to scan the world's research, which led to their finding that Australia-based researchers lead the globe in 14 fields.

Some world No 1 researchers are located in places where many would not expect to them to be.

Charles Sturt University's Sharynne McLeod is based in Bathurst, west of the Dividing

Range in NSW, where she is professor of speech and language acquisition. Her work, and academic leadership, is of such quality that not only does she personally top Australia, and the world, in audiology, speech and language pathology research, but her university is also the lead research institution in Australia in this field.

In her career in speech pathology, Professor McLeod has ranged across many areas, including using ultrasound and electropalatography to investigate where the tongue touches the palate to produce speech sounds, to teaching phonetics to university students for whom English was a second language.

In June this year she addressed the UN about the Convention on the Rights of Persons with Disabilities.

"There are three groups of people whose voices are not heard very often and they are really the feature of my work," Professor McLeod said.

"That's children, people with communication disabilities — particularly children — and people who speak a non-dominant language in their community."

All of these informed her 2009 Australian Research Council Future Fellowship, which she credits with laying the foundation for her emergence as global research leader.

TOP OF THE WORLD

Australian-based researchers who are first in their field in the world

Research field	Researcher	University
Asian Studies & History	Edward Aspinall	ANU
International Law	Anthea Roberts	ANU
Audiology, Speech & Language Pathology	Sharynne McLeod	CSU
Radar, Positioning & Navigation	Peter Teunissen	Curtin Uni
Anaesthesiology	Paul Myles	Monash Uni
Automation & Control Theory	Peng Shi	Uni of Adelaide
Computing Systems	Rajkumar Buyya	Uni of Melbourne
Health & Medical Sciences (general)	Alan Lopez	Uni of Melbourne
Ecology	Jane Elith	Uni of Melbourne
Pest Control & Pesticides	Bhagirath Singh Chauhan	Uni of Queensland
Plant Pathology	Bhagirath Singh Chauhan	Uni of Queensland
Botany	Sergey Shabala	Uni of Tasmania
Environmental Sciences	Huu Hao Ngo	UTS
Higher Education	David Boud	UTS

Source: The Australian 2019 Research magazine

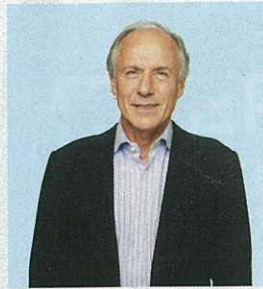
"I had a full-time teaching load at the time and the Future Fellowship gave me four years of focused research," Professor McLeod said.

"Part of the fellowship paid for me to travel across the world and set up the International Expert Panel on Multilingual Children's Speech and to collaborate with researchers in over 60 different languages. We developed resources in their languages, which benefits all the people who speak

these languages in Australia, as well. We've been able to distil what happens to children across the world as they learn to speak and what we should expect of children."

And as a professor of speech (who had a monolingual childhood) she has also gone a step further and learned a language herself. She has a certificate I in Wiradjuri, a local Aboriginal language of the area where she lives.

Foreword



As Australia's Chief Scientist I am privileged to chair the judging panel for the Prime Minister's Science Prize. Every year, we end up in the difficult position of having to pick the finalist from among several stunningly capable nominees. It's the kind of problem I love to have, and it reminds me every time what incredible talent lurks in Australia's research laboratories.

The challenge is to nurture the talent we have and to ensure the next generation of researchers is well educated and enters the workforce with high aspirations.

Aspirations soar when young people recognise that there are real-world problems waiting to be solved and that they can be part of the solution. They learn about these real-world problems from their parents and teachers, relatives, friends and stories. It is this last category in which this magazine makes an important contribution.

With their aspirations raised, young people have the confidence to try to solve real-world problems if they have a knowledge base on which to build. Hence my ongoing campaign to ensure that our young people are taught facilitating subjects at school and expected to do well. It is our duty to raise the bar of aspirations for young people, then coach them to leap over it.

Overall, we have been delivering. I am inspired, optimistic and honoured to witness the work produced by our researchers — whether it's the latest developments in space-based Earth observation technologies, improved cybersecurity algorithms or breakthroughs in my own field of neuroscience.

As a community we must set goals and be ambitious. The work currently underway on a national strategy for Australia to be a global leader in clean hydrogen production, export and use is an example of this approach. We are exploring options, researching capacity, understanding the parameters, defining what we do well, and mapping the best way to develop the sector.

The stories of the researchers featured in this magazine recognise the individual and combined achievements of our research sector, which in turn motivate others to strive for excellence, and show why our researchers are vital in supporting a strong economy, with benefits for all.

Dr Alan Finkel, AO
AUSTRALIA'S CHIEF SCIENTIST

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HOW WE DID IT

The methodology that has allowed us to identify Australia's research leaders across 258 discrete fields

Best of the best

Young achievers, lifetime achievers and world-beating achievers — we identify the nation's leading researchers across more than 250 fields



From left: Paul McCarthy and Rasika Amarasiri

Welcome to *The Australian's* 2019 *Research* magazine which, for the second year running, has dipped into the world of big data and drawn from it a unique and detailed picture of Australia's best research and the people who do it. We have taken advantage of the mass of information freely available online and, using the power of data analysis, have produced a list of our top researchers, and the top research institutions, in more than 250 fields of academic endeavour.

This is information you can't find anywhere else. And because it's a fine-grained view of research achievement, it allows excellence to be recognised which would otherwise not be noticed outside of a researcher's peer group.

It also identifies research excellence in places which are often overlooked. For example, Australia's top researcher in the field of audiology, speech and language pathology is Sharynne McLeod from Charles Sturt University. Of special note is that Professor McLeod, based in Bathurst in NSW, is not only at the top of her field in Australia, she's top of the world. In all, Australian-based researchers are first in the world in 14 fields of research.

We have also stepped back to look at the big picture, creating a leaderboard which honours 40 lifetime achievers in our universities and research institutions, and another leaderboard for the top 40 early career researchers, the ones who will lead the research achievements of the future.

All this is possible because of the work of pioneering research analytics firm League of Scholars, and its co-founders Paul McCarthy and Rasika Amarasiri, who have structured and filtered this information to bring it to life.

This year we have introduced something new, using the data to investigate not only which researchers are best in particular fields but who excels over many fields. The result is that we have named Australia's top interdisciplinary researcher on Page 40.

Our results are, of course, dependent on the data sources used (in our case Google Scholar) and the algorithms employed. We are very confident in them although we know improvements are possible. For example, people who have taken career breaks would find it harder to perform well on the measures we've used. We're looking at solutions for such issues.

But we also believe our approach has certain advantages over other approaches to measuring research impact. It is granular and able to identify performance in specialised fields. It gives more attention to humanities and social sciences than many other measures, and it's up to date. We hope it stimulates discussion and we welcome your feedback.

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How to read the tables

There are four main types of tables in this magazine, each presenting different information about Australia's top researchers across more than 250 different fields of scholarship. The fields are divided into eight broad discipline areas.

World's best (Page 9): This list shows the 14 fields in which Australian-based researchers are the best in the world.

Lifetime achievers (Page 10): This list shows 40 top achievers over their research careers thus far. It lists a top five (not in order of achievement) in each of eight discipline areas: business, economics and management; social sciences; engineering and computer science; physics and mathematics; health and medical sciences; humanities, arts and literature; life sciences; and chemical and material sciences.

Because the lifetime achievers list measures

their cumulative research effort, researchers on this list have reached mid-career or beyond.

Field leaders: These listings, spread through these pages with one list for each of the eight discipline areas, are the heart of this magazine. Each of the eight research discipline areas is divided into research fields, and for each field we name Australia's leading researcher and their main institutional affiliation. We also name the leading research institution for each of the fields.

Early achievers (Page 54): This list shows 40 top early-career researchers and, like the lifetime achievers list, it names five researchers in each of the eight discipline areas named above. All of them are less than 10 years into their research careers, based on the date of their first citation.

For full details on how each list is calculated, see "How we did it", Page 58

Top of the world

These Australian-based researchers are the best in the world in their field based on the quality, volume and impact of their work

Field Asian Studies & History

Field leader Edward Aspinall

Institution Australian National University

Field International Law

Field leader Anthea Roberts

Institution Australian National University

Field Audiology, Speech & Language Pathology

Field leader Sharynne McLeod

Institution Charles Stuart University

Field Radar, Positioning & Navigation

Field leader Peter Teunissen

Institution Curtin University

Field Anesthesiology

Field leader Paul Myles

Institution Monash University

Field Automation & Control Theory

Field leader Peng Shi

Institution University of Adelaide

Field Computing Systems

Field leader Rajkumar Buyya

Institution University of Melbourne

Field Health & Medical Sciences (general)

Field leader Alan Lopez

Institution University of Melbourne

Field Ecology

Field leader Jane Elith

Institution University of Melbourne

Field Pest Control & Pesticides

Field leader Bhagirath Chauhan

Institution University of Queensland

Field Plant Pathology

Field leader Bhagirath Chauhan

Institution University of Queensland

Field Botany

Field leader Sergey Shabala

Institution University of Tasmania

Field Environmental Sciences

Field leader Huu Hao Ngo

Leading institution University of Technology Sydney

Field Higher Education

Field leader David Boud

Leading institution University of Technology Sydney



Sergey Shabala

Plant physiologist, University of Tasmania Leading researcher in the world in the field of botany

Sergey Shabala pursues his pet topic with a relentless logic. Every minute, he says, three hectares of arable land are lost in Australia to the encroachment of salt. "I don't see honestly that it will be changed or reversed," he says. "So in 20 or 30 years from now agriculture will become saline agriculture."

So for Professor Shabala there is only one way to go — find a way to make the plants used in agriculture more salt-resistant.

Interestingly, crops such as wheat, barley and rice were once more tolerant of salt. But when new high-yield varieties were developed in the 1960s — which led what we call the agricultural revolution, allowing the world to feed a larger population — some of this capacity was lost.

But now with salinity increasing, the miracle crops of 50 years ago are no longer performing so well. "Plants don't respond as they are supposed to fertilisers any more because, under the stress conditions, their demands for nutrients and resources are different," Professor Shabala says.

His answer is to step up research into wild crops to try to identify what they had which makes them more salt-tolerant.

"What we found is that the critical mechanism responsible for salt tolerance is the ability to accumulate and secrete salt in specialised structures," he says. The structures are still present in modern varieties of wheat, barley and rice but they are no longer able to secrete the salt.

His solution is to look for wild genes which can be returned to modern crops to make them more efficient in acquiring nutrients under conditions of stress, whether that comes from salinity, too little water, too much water or the presence of pollutants such as heavy metals.

Professor Shabala doesn't expect his work to pay off overnight. He thinks that practical applications are 10-15 years away.

And then he knows there will be a debate as to whether the community will accept lost wild genes being reinserted into the genomes of agricultural crops using genetic engineering techniques. Or whether scientists will have to do it the slow way by finding the gene in the wild and breeding it back in.

But of one thing he's certain. "We need to make plants more robust in responding to stresses and extremes in climate," he says.

TIM DODD

Lifetime Achievers Leaderboard

Stars of research

These are Australia's top 40 researchers. The five best performers have been selected from each of the eight main disciplines

Colour legend

- Business, Economics & Management
- Chemical & Material Sciences
- Engineering & Computer Science
- Health & Medical Sciences
- Humanities, Arts & Literature
- Life Sciences
- Physics & Mathematics
- Social Sciences



Paresh Narayan
International Business
At Deakin University, his research interests are applied financial econometrics, energy economics and financial markets



Benno Torgler
Economics
At Queensland University of Technology, his research interests include behavioural, experimental and non-market economics



Sara Dolnicar
Tourism
At the University of Queensland, her research interests are market segmentation methodology and testing survey measures in social sciences



Neal Ashkanasy
Human Resources
At the University of Queensland, his research interests are leadership, organisational culture, ethics and emotions in organisations



Jordan Louviere
Marketing
At the University of South Australia, he is an expert in conjoint analysis and consumer choice modelling



Shi Zhang Qiao
Materials Engineering
At the University of Adelaide, his research interests are synthesis and characterisation of nanomaterials



Yoshio Bando
Materials Engineering
At the University of Wollongong's Australian Institute for Innovative Materials, a leader in nanomaterials and electron microscopy



Yusuke Yamauchi
Chemical and Materials Science
At the University of Queensland, he researches design of nanocrystals and nanoporous materials



Dmitri Golberg
Materials Engineering

At Queensland University of Technology, his research interests include the fabrication of prototype photodetectors



Wang Guoxiu
Electrochemistry

At the University of Technology, Sydney, he is expert in materials chemistry, electrochemistry, and energy storage and conversion



Peng Shi
Automation and Control Theory

At the University of Adelaide, his research interests are systems and control theory, and computational intelligence



Rajkumar Buyya
Computing Systems

At the University of Melbourne, his research interests include the future of computing and large-scale software engineering



Dietmar Hutmacher
Biomedical Technology

At the Queensland University of Technology, his research interests are biomaterials, biomechanics, medical devices and tissue engineering



Qing-Long Han
Automation and Control Theory

At Swinburne University, his research interests include power system stability and control and wireless communication



Peter Love
Civil Engineering

At Curtin University, he researches building construction management and project planning, computer vision and construction engineering



James Sallis
Public Health

At the Australian Catholic University, his research includes promoting physical activity, sedentary behaviour, nutrition and obesity



Richard Ryan
Social Psychology

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



Grant Montgomery
Genetics and Genomics

At the University of Queensland, his research interests include genomic mapping for risk of endometriosis and melanoma



Roy Baumeister
Social Psychology

At the University of Queensland, his research interests include willpower, self-control, self-esteem, human morality and success



Peter Visscher
Genetics and Genomics

At the University of Queensland, his research interests include understanding genes that underlie variation in risk to diseases



Axel Bruns
Communication

At the Queensland University of Technology, his research interests include social media, big data and online communities



Raewyn Connell
Gender Studies

At the University of Sydney, her research interests include social structures, inequalities and social justice



Jean Burgess
Communication

At the Queensland University of Technology, she researches social implications of digital media technologies, platforms and cultures



Alastair Pennycook
Foreign Language, Learning

At the University of Technology, Sydney, his research interests include implications of the global spread of English

Lifetime Achievers Leaderboard Stars of research



Adrian North
Music and Musicology

At Curtin University, his research interests include music and well-being in specific and general populations



Edward C Holmes
Virology

At the University of Sydney, his research interests include the emergence of novel viral infections



Ben Hayes
Animal Husbandry

At the University of Queensland, his research interests are genetic improvement of livestock, crop, pasture and aquaculture species



William Laurance
Biodiversity and Conservation Biology

At James Cook University, his research interests include impacts of intensive land-uses on tropical forests



Ove Hoegh-Guldberg
Marine Sciences and Fisheries

At the University of Queensland, his research interests include coral reefs, global warming and marine life



Joshua Cinner
Biodiversity and Conservation Biology

At James Cook University, his research interests include using social science to improve coral reef management



Ivo Labbé
Astronomy and Astrophysics

At Swinburne University, his research interests include the study of distant galaxies using big telescopes



Chunnong Zhao
High Energy and Nuclear Physics

At the University of Western Australia, his research interests are parametric instability and optomechanics



Christian Reichardt
Astronomy and Astrophysics

At the University of Melbourne, his research interests include cosmic microwave background and experimental astrophysics



Joss Bland-Hawthorn
Astronomy and Astrophysics

At the University of Sydney, his research interests include galactic archaeology and photonics



Dennis Stello
Astronomy and Astrophysics

At the University of NSW, his research interests include astroseismology, or analysing star quakes



Billie Giles-Corti
Public Health

At RMIT University, her research interests include the built environment's impact on health and wellbeing



Andrew Martin
Educational Psychology and Counselling

At the University of NSW, his research interests are educational motivation, engagement and achievement



Takemi Sugiyama
Public Health

At the Australian Catholic University, his research interests include the nexus between health and design



Rob Raven
Environmental Law and Policy

At Monash University, his research interests include the dynamics and governance of sustainability transitions and socio-technical innovation



David Treagust
Science and Engineering Education

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