Australia’s researchers are top of the world

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 their institution in each field. But League of Scholars’ two founders, Paul McCarthy and Rasika Amarasinghe, 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 find them. 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 electromyography 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.

“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.
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
Best of the best

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

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 at the 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 exceed 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.

TIM DODD, HIGHER EDUCATION EDITOR, THE AUSTRALIAN
dodd@theaustralian.com.au
PAUL MCCARTHY, CEO, LEAGUE OF SCHOLARS
paul@leagueofscholars.com

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.
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.
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.
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 Huttmacher  
**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.

Joas 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.