



THE UNIVERSITY
of ADELAIDE

Annual Report 2022

Waite Research Institute



**make
history.**





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WRI at a glance

The Waite Research Institute (WRI) supports research and innovation that builds capacity for Australia's agriculture, food and wine sectors.

The WRI's vision is to drive agricultural innovation to secure its sustainable future by pursuing the following five goals:

- research with impact in sustainable intensification of agriculture in a changing climate,
- building large-scale initiatives across disciplines,
- enhancing excellence through researcher development,
- connecting researchers with industry,
- actively supporting a culture of transparency, trust, fairness, equity, diversity and inclusion.

To achieve our vision, we invest in outstanding researchers and advanced facilities across multiple disciplines, to create new strategic initiatives of scale and focus within areas of established strength.

The WRI has taken a leading role in developing and championing the University's FAME Strategy in Agrifood and Wine and its four themes:

- Dryland Agriculture
- Value-Added Agrifood
- Supporting the Agrifood and Wine Value Chain
- Biosecurity and Livestock Wellbeing

Our commitment to equity, diversity and inclusion is central to creating a culture of trust, enjoyment, excellence, and innovation. We have been central to attracting new staff from diverse backgrounds and actively support flexible work arrangements and care provision.

WRI Staff



Professor Matthew Gilliham
Director



A/Professor Matthew Tucker
Deputy Director



Dr Rebecca Vandeleur
Operations and Research
Manager (0.8 fte)



Dr Lieke van der Hulst
Executive Officer (0.7 fte)



Ms Ishka Bless
Executive Officer (0.2 fte)

DVCR and PVCR(RE) Introduction

The University of Adelaide has a strong commitment to research excellence that is distinguished by its international standing, dedication to innovation and excellence in research and teaching.



Professor Anton Middelberg

More than 4000 research staff and students are working together, supported by modern infrastructure and an innovative culture, to tackle research challenges and deliver positive impacts both locally and globally.

As a University we have a long history of 'collaborative innovation' that benefits our partners, our state, our nation and the global community. It is a principle that we hold dearly and one that is central to our goal of making history.

The Research Institutes are a fundamental element of our approach to collaboration both within the University and externally with our many partners. The Institutes provide critical opportunities for our staff and students to take a multidisciplinary approach to responding to sector and community challenges.

The Waite Research Institute is an exemplar of the University's approach to collaboration and has exceptional linkages not only within the University but also with South Australia's primary industries. We are particularly proud of the strategic partnership with the Australian Wine Research Institute and look forward to progressing research and development activities in winemaking, viticulture and the wider wine community. An emerging focus of the alliance will be on no and low alcohol wine production (NOLO) – a developing market both domestically and internationally.



Professor Laura Parry

The visionary ARC Centre of Excellence in Plants for Space (P4S), another example of bringing together multidisciplinary partners from across Australia and the globe, will develop the knowledge and understanding of the technologies required to support deep space exploration. Led by Professor Matthew Gilliam, the current Director, Waite Research Institute, the P4S program will bring together 37 partners including universities, space agencies and controlled environment agriculture companies.

The WRI is dedicated to supporting the capabilities of its members and we commend their work addressing the challenges and opportunities of a sector that is critical to South Australia.

Professor Anton Middelberg

Deputy Vice-Chancellor and Vice-President (Research)

Professor Laura Parry

Pro Vice-Chancellor (Research Excellence)

Summary of the year

2022 was a year of opening up, keeping the benefits of meetings online and more flexible work arrangements, combined with opportunities to travel and reconnect with the world in person.



Professor Matthew Gilliam

For many WRI researchers this has provided a renewed energy and focus for our work in the field, greenhouse and on the lab bench.

At the start of the year, we were delighted to welcome to WRI two new Future Making Fellows, Drs Tatiana Soares da Costa and Stephanie Watts-Fawkes and their teams. Both are high-achieving Early Career Researchers having previously been awarded ARC Discovery Early Career Researcher Awards and bring a wealth of expertise in their respective fields. You will find features on their research in the following pages.

WRI engagement and support this year was instrumental in helping our phenomenal researchers win bids for numerous grants and awards, especially through our grant writing support, mentoring programs and strategic leverage, to continue the track record of research excellence in Agriculture, Food and Wine at the University of Adelaide.

Successes this year included continued partnership with the GRDC for a total of almost \$11M, with \$1.6M of new investments starting in 2022, including a University-led project in increasing cereal yield and fighting grain loss due to gastropods. Our researchers had multiple successes with the ARC too including: a LIEF grant led by A/Prof. Stuart Roy for a new GM field testing facility, a DECRA grant for Dr Amanda Choo, and successful ARC Discovery and Linkage applications for Professor Dabing Zhang, A/Prof Matthew Tucker and Dr Fiona Whelan. In addition, there have been a host of industry linked grants successes, and some cracking discovery and applied research outputs which we have the pleasure to report upon.

Halfway through 2022, the WRI team found a great part-time replacement in Ishka Bless as Lieke van der Hulst took a leave of absence. Ishka has added tremendous value to the team with her



knowledge and great communication skills and we are lucky to have her stay on for some time to continue the shared role of Executive Officer into the next year.

A personal highlight was the successful culmination of the previous three years of planning by the WRI in the award of a new \$90M Australian Research Council Centre of Excellence in Plants for Space (P4S). Bringing together University of Adelaide researchers from a wide range of disciplines, P4S connects us with a network of 37 partners including other Australian universities, international space agencies, controlled environment agriculture companies and government and technology partners. The launch of P4S will be late 2023 and I will take up the Directorship, meaning I will step away from leadership of WRI, while still being an active member of the institute in my new role.

Therefore, I would like to thank our members for their support and hard work over the last 5 years during my leadership roles at WRI. The multitude of grants, accolades, and prizes that our members achieve shows the depth of excellence, our collaborative and supportive culture, and the hard work and dedication that is put in by our researchers. It has been an honour representing this institute whose heritage is in its 100th year, I have enjoyed the role and look forward to its continued growth and success.

Professor Matthew Gilliam
Director, WRI

“The multitude of grants, accolades, and prizes that our members achieve shows the depth of excellence, our collaborative and supportive culture, and the hard work and dedication that is put in by our researchers.”



WRI Fellows

The University of Adelaide's Division of Research and Innovation funded ten Future Making Fellowships, to attract and support early-career and mid-career researchers of outstanding research calibre and potential. WRI attracted two Future Making Fellows in 2022, Dr Tatiana Soares da Costa and Dr Stephanie Watts-Fawkes.



Dr Tatiana Soares da Costa

Future Making Fellow: Tatiana Soares da Costa

The overall focus of Dr Soares da Costa's research work is to define the structure, function and regulation of essential proteins in bacteria and plants to guide the development of new classes of antibiotics and herbicides. Specifically, Dr Soares da Costa's research group aims to target multiple proteins simultaneously in essential biosynthetic pathways.

Dr Soares da Costa has expertise in a number of techniques in the fields of biochemistry, biophysics, chemistry, microbiology and plant biology, allowing her to better understand how proteins and small molecule inhibitors interact, thus providing insights into the rational design of new inhibitors for pharmaceutical and agrochemical purposes.

Aside from being a WRI Future Making Fellow, Dr Soares da Costa is also the Head of the Herbicide and Antibiotic Innovation Lab at the University of Adelaide's Waite campus, 2022 SA Young Tall Poppy Scientist of the Year and one of the Superstars of STEM for the 2023-'24 program. Dr Soares da Costa currently supervises six full time HDR students as a principal supervisor in the following research topics:

- Unlocking the value of Lysine for sustainable agriculture
- Towards the development of novel herbicide modes of action

- Identifying novel therapeutics to tackle antibiotic resistance
- Developing novel strategies to monitor and combat herbicide resistance
- Validating novel antibiotic and herbicide targets to circumvent resistance
- A novel repurposing approach for herbicide discovery to combat resistant weeds.

Dr Tatiana Soares da Costa top publication 2022

A dual-target herbicidal inhibitor of lysine biosynthesis - Emily RR Mackie, Andrew S Barrow, Rebecca M Christoff, Belinda M Abbott, Anthony R Gendall, Tatiana P Soares da Costa (*eLife*, Jun 2022)



Dr Stephanie Watts-Fawkes

Future Making Fellow: Stephanie Watts-Fawkes

Dr Stephanie Watts-Fawkes conducts research on the plant-fungal symbiosis known as arbuscular mycorrhizas. The specific focus in her work is on the investigation of how arbuscular mycorrhizas can improve plant zinc and phosphorus nutrition on nutrient-depleted soils. Dr Watts-Fawkes' work emphasizes the potential agricultural applications of arbuscular mycorrhizas, and uses important crops as model species to encourage links between research and industry. Dr Watts-Fawkes has expertise in the fields of molecular biology, plant biology, agricultural science and biochemistry. Aside from being a WRI Future Making Fellow, Dr Watts-Fawkes is also a current ARC DECRA which expands on her mycorrhizal work and how arbuscular fungi that colonise rice and wheat plants affect the production of the 'anti-nutrient' phytate in grains.

Dr Watts-Fawkes currently supervises one full time HDR student as principal supervisor, and one full time HDR student as co-supervisor on the following research topics:

- 'Mycrobes' in Lunar and Martian regolith simulants: how to make soil on moons and other planets
- Exploring the impact of arbuscular mycorrhizal fungi on cereal grain nutrition.

Furthermore, Dr Watts-Fawkes is the external co-supervisor for two full time HDR students in the topics of:

- Manipulation of plant-derived phytonutrients and antinutrients in bread to improve iron bioavailability
- The potential benefits of dual placement phosphorus fertiliser application to south-eastern Australian crop species.

Dr Stephanie Watts-Fawkes top publications 2022

Spatiotemporal dynamics of soil health in urban agriculture. - Salomon, M. J., Watts-Williams, S. J., McLaughlin, M. J., & Cavagnaro, T. R. (*Science of the Total Environment*, Jan 2022)

Development of an organomineral fertiliser formulation that improves tomato growth and sustains arbuscular mycorrhizal colonisation. - Ngo, H. T. T., Watts-Williams, S. J., Panagaris, A., Baird, R., McLaughlin, M. J., & Cavagnaro, T. R. (*Science of the Total Environment*, Apr 2022)

Arbuscular mycorrhizas increased tomato biomass and nutrition but did not affect local soil P availability or 16S bacterial community in the field. - Tran, C. T. K., Watts-Williams, S. J., Smernik, R. J., & Cavagnaro, T. R. (*Science of the Total Environment*, May 2022)

Mortlock Trust

The Mortlock Trust is administered by the University of Adelaide to support agricultural research in areas associated with the Waite Research Institute. In 2022, two Mortlock Fellows were appointed and will take up positions in the School of Agriculture, Food and Wine in 2023.



Dr Ehsan Tavvakoli

Mortlock Fellow: Ehsan Tavvakoli

Dr. Ehsan Tavakkoli's research investigates soil-plant interactions and environmental biogeochemistry, producing knowledge and resources that significantly advance agricultural productivity and sustainability. He combines multiple disciplines, including crop physiology, soil biochemistry, and nanogeochemistry, to pioneer insights in engineering the ideal rhizosphere for optimal soil carbon storage and crop productivity. His research program is at the forefront of applying advanced stable isotope probing and spectroscopic techniques, particularly synchrotron-based methods, to interrogate soil environmental processes at the molecular level.

In 2023, Dr. Tavakkoli will begin his Senior Mortlock Fellow appointment. He is currently co-supervising six PhD students, including two at the University of Adelaide School of Agriculture, Food and Wine, on the following topics:

- Chemical Factors Controlling the Effectiveness of Deep-Placed Phosphorus Fertilizer
- Astroagronomy: Growth of the 'Three Sisters' in Lunar and Martian Regolith Simulants.

Dr Ehsan Tavakkoli top publication 2022

Microspectroscopic visualization of how biochar lifts the soil organic carbon ceiling. Zhe Weng, Lukas Van Zwieten, Ehsan Tavakkoli, Michael T Rose, Bhupinder Pal Singh, Stephen Joseph, Lynne M Macdonald, Stephen Kimber, Stephen Morris, Terry J Rose, Brulio S Archanjo, Caixian Tang, Ashley E Franks, Hui Diao, Steffen Schweizer, Mark J Tobin, Annalise R Klein, Jitraporn Vongsivut, Shery LY Chang, Peter M Kopittke, Annette Cowie (*Nature Communications*, Sep 2022)

Disentangling carbon stabilization in a Calcisol subsoil amended with iron oxyhydroxides: A dual-¹³C isotope approach. Yuning Fang, Ehsan Tavakkoli, Zhe Weng, Damian Collins, Deirdre Harvey, Niloofar Karimian, Yu Luo, Promil Mehra, Michael T Rose, Nigel Wilhelm, Lukas Van Zwieten (*Soil Biology and Biochemistry*, Jul 2022)



Dr Shervin Kabiri

Mortlock Fellow: Shervin Kabiri

Dr Shervin Kabiri conducts research on understanding the fate, transport and emergence of soil contaminants such as per- and polyfluoroalkyl substances (PFAS). Dr Kabiri focuses on the effects of PFAS on agriculture, and their impact on the environment and human health. Several aspects of her work are: Understanding the fundamental processes controlling PFAS release from contaminated soils, investigating long-term retention of PFAS in soil, PFAS immobilisation and phytoremediation, development of a new technology for removal of PFAS from multiple substrates and PFAS uptake by plants.

Dr Kabiri will start her research as a Mortlock fellow in 2023, with a three-year timeline for her fellowship.

Currently, Dr Kabiri is co-supervisor to two PhD students on the topics of:

- Desorption of per- and polyfluoroalkyl substances from solid matrices
- Development and optimisation of materials for the remediation of PFAS.

Dr Shervin Kabiri top publication 2022

Assessment of Mobilization Potential of Per- and Polyfluoroalkyl Substances for Soil Remediation - Thi Minh Hong Nguyen, Jennifer Bräunig, Rai S Kookana, Sarit L Kaserzon, Emma R Knight, Hoang Nhat Phong Vo, Shervin Kabiri, Divina A Navarro, Charles Grimison, Nicole Riddell, Christopher P Higgins, Michael J McLaughlin, Jochen F Mueller (*Environmental science and technology*, Jul 2022)

Grants, accolades and recognition

Researchers and WRI members working across agriculture, food and wine were awarded a range of grants and accolades in 2022.

Discovery projects

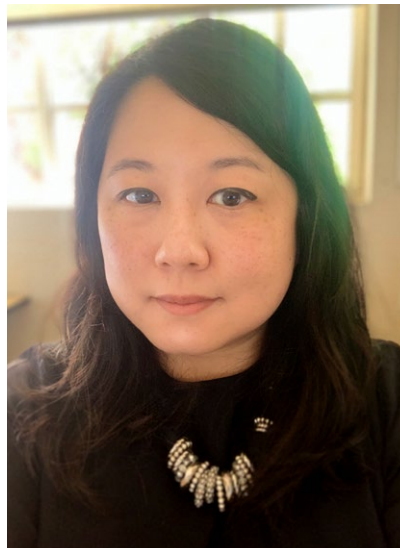
Professor Dabing Zhang’s team will aim to investigate new temperature-responsive factors that regulate cereal grain development to protect grain production under heat stress, \$748,474 awarded.

Dr Fiona Whelan’s team aims to address the need for new small molecule biosensing capability in diverse fields including food and wine production, environmental monitoring, biocatalysis, and diagnostics using a synthetic biology approach, \$522,724 awarded.

LIEF grant

The WRI supported an ARC LIEF infrastructure grant application for new facilities at the University of Adelaide’s biotechnology field site at Rosedale, South Australia, and the University of Melbourne’s biotechnology field site at Dookie, Victoria. The project is a collaboration between the University of Adelaide, The University of Melbourne, The Australian National University and the Australian Plant Phenomics Facility.

The WRI supported the project by providing access to grant editing prior to its submission. The ARC LIEF project will fund the building of infrastructure at the Adelaide field site to assist with the cleaning and storage of field equipment, as well as infrastructure which will allow environmental manipulation (heat chambers and rain shelters). It will also allow the purchase of innovative imaging technologies for phenotyping crop development and for assisting with monitoring biosecurity compliance. Finally, the grant will allow the setup of a grain quality centre for biotechnology plants at the University of Melbourne.



Dr Amanda Choo

DECRA

Dr Amanda Choo was awarded a Discovery Early Career Researcher Award (DECRA) in 2022. Dr Choo’s project aims to address the need for a Queensland fruit fly male-only sterile release strain for the national Sterile Insect Technique program to control this devastating Australian horticulture pest. Expected outcomes include significant reduction in production costs and increased efficiency of the national sterile release program, facilitating control of this damaging pest to protect Australia’s billion-dollar horticultural industry.

A peer mentoring for grant and fellowship success program has been supported by WRI for many years, and Dr Amanda Choo took part in the workshop in 2021. She has mentioned WRI support to have been instrumental for her success in obtaining the DECRA in 2022.

GRDC Investments

GRDC is responsible for planning, investing and overseeing research, development and extension for a wide range of grain crops. GRDC funded WRI researchers work closely with growers to ensure outcomes are supporting enduring profitability for Australian grain growers. Several projects received GRDC funding in 2022, including: breeding investments for faba bean (2016-2023) and vetch (2021-2023), a data partnership initiative (2022-2023) and agronomy strategies for frost management in pulses (2022-2025). A total of \$1,674,435 was received in 2022 by WRI members.

WRI researcher Dr Scott Boden was one of the recipients of GRDC investment, with funding for a project running over five years. The title of the funded project is “Increasing cereal yield potential through reduced floret abortion” and aims to identify and generate variation for several genes that influence floret abortion in wheat and investigate its potential to improve fertility in Australian-adapted cultivars. Dr Boden’s connections to industry drive the project, as discovered gene-specific marker information, germplasm, and phenotypic data will be delivered to breeders to facilitate allele selection and their adoption in breeding programs.





WRI members have also found great success in a variety of personal accolades in 2022, including:

- SA Tall Poppy of the Year, Dr Tatiana Soares da Costa
- Finalist in the SA Woman of the Year Awards, Dr Tatiana Soares da Costa
- Award for Teaching Excellence at the Australian Awards for university teaching (AAUT) 2022, awarded to Associate Professor Beth Loveys, and Dr Karina Riggs, for supporting the transition of second year students through to completion in the School of Agriculture, Food and Wine. They have led fit-for-purpose initiatives to enhance learning and engagement through thoughtfully and intentionally addressing the needs of their students.
- Harold Woolhouse Prize, awarded to Dr Ruchira Ranaweera for her work on the investigation of a rapid method for authentication of Australian red wines using fluorescence spectroscopy and machine learning classification.
- Premier's Climate Change Council 2022 SA Climate Leaders Award, awarded to PhD candidate Bobbie Lewis Baida for doing critical research into the effects of climate change on sheep production.
- Fellow of the Australian Academy of Science, Emeritus Professor Peter Langridge, in recognition of his pioneering work in the field of plant genomics, and his contribution to strengthening agricultural production in Australia and internationally.
- Playford Trust Scholarships, to honour students Nicole Crawhurst and Joshua Grist and PhD candidate Jack Kelly with projects on the drought response of superfood plant *Salvia verbenaca*, or Chia, genetic mechanisms controlling the timing of crucial phases in the growth and development of barley crops, and the physiological potential of our staple crop varieties.
- Clarivate annual global list of Highly Cited Researchers, Professors Matthew Gilliham and Dabing Zhang acknowledged for world-class research in Plant Sciences.

ARC Centre of Excellence in Plants for Space

WRI has supported research into space horticulture, controlled environment agricultural systems, sustainable food production and on demand bioresource production over the years, and in 2022 efforts culminated in the successful bid for the Australian Research Council Centre of Excellence in Plants for Space (P4S).



Plants for Space SMG, Prof Melissa de Zwart, Prof Matthew Gilliham, Prof Sally Gras

Western Australia, and Victoria), 5 Space agencies and enablers, 5 Controlled Environment Agriculture companies, 6 education providers, and 7 government and technology partners that collectively harness a global fit-for-purpose critical mass not found elsewhere. This multi-nodal international endeavour features transdisciplinary skillsets from 38 partners organised into 4 workstreams to deliver 4 missions: P4S will be working closely with Flinders University, La Trobe University, The University of Melbourne, and the University of Western Australia. The Senior Management Group for P4S is made up of P4S Director Professor Matthew Gilliham (UoA), P4S Deputy Director Professor Melissa de Zwart (Flinders) and Deputy Director Professor Sally Gras (UoM).

P4S is an Australian contribution to NASA's Artemis missions underpinned by accords signed by 21 countries which aims to deliver humans back to the moon and on to mars over the coming decades. P4S represents a strategic opportunity to expand the global biomanufacturing sector, working with government, industry, defence, and academia to develop a vibrant and successful Space sector that leverages world-class R&D capacity, connects the global Space economy, and attract 'spin-in' from the food and beverage sector. P4S is funded until 2031 through contributions by the Australian Federal and State Governments, industry partners and universities currently totalling \$90 million in cash and in-kind support.

The ARC Centre of Excellence in P4S is a virtual centre, led by current WRI director Matthew Gilliham and the University of Adelaide. P4S's vision is to develop the life science technologies that are needed to enable human deep Space exploration and improve on-Earth sustainability through plant & food redesign.

P4S is a major global collaborative venture that at inception will partner 15 academic institutions (5 from South and

Skillsets

- Food scientists
- Plant scientists
- Process engineers
- Systems engineers
- Psychologists
- Nutritionists
- Educators
- Lawyers

Workstreams

Plants

Products

Processes

People

Missions



Zero waste plants optimised for controlled environments



Complete nutrition plant-based foods



On demand bioresource production



Future-ready workforce and society

P4S skillsets, workstreams and missions

Key publications

WRI Key publications were identified on the basis of the potential impact in their specific field, as based on altmetric score overall, altmetric score on scientific reads and impact factor of the publishing journal.

MicroRNA-resistant alleles of *HOMEODOMAIN-2* modify inflorescence branching and increase grain protein content of wheat. Laura E Dixon, Marianna Pasquariello, Roshani Badgami, Kara A Levin, Gernot Poschet, Pei Qin Ng, Simon Orford, Noam Chayut, Nikolai M Adamski, Jemima Brinton, James Simmonds, Burkhard Steuernagel, Iain R Searle, Cristobal Uauy, **Scott A Boden** (*Science Advances*, May 2022). Altmetric score 669, impact factor 14.136

Root angle is controlled by EGT1 in cereal crops employing an antigravitropic mechanism. Riccardo Fusi, Serena Rosignoli, **Haoyu Lou**, Giuseppe Sangiorgi, Riccardo Bovina, Jacob K. Patterm, Aditi N. Borkar, Marco Lombardi, Cristian Forestan, Sara G. Milner, Jayne L. Davis, Aneesh Lale, Gwendolyn K. Kirschner, Ranjan Swarup, Alberto Tassinari, Bipin K. Pandey, Larry M. York, Brian S. Atkinson, Craig J. Sturrock, Sacha J. Mooney, Frank Hochholdinger, **Matthew R. Tucker**, Axel Himmelbach, Nils Stein, Martin Mascher, Kerstin A. Nagel, Laura De Gara, James Simmonds, Cristobal Uauy, Roberto Tuberosa, Jonathan P. Lynch, Gleb E. Yakubov, Malcolm J. Bennett (*Proceedings of the National Academy of Sciences*, July 2022). Altmetric score 158, impact factor 12.779

Global evaluation of commercial arbuscular mycorrhizal inoculants under greenhouse and field conditions. **M.J. Salomon**, R. Demarmels, **S.J. Watts-Williams**, **Mike John McLaughlin**, Arjun Kaffle, C. Ketelsen, A. Soupir, Heike Bücking, **T.R. Cavagnaro**, Marcel G.A. Van der Heijden (*Applied Soil Ecology*, Jan 2022). Altmetric score 59, impact factor 5.509

The evolutionary advantage of an aromatic clamp in plant family 3 glycoside exo-hydrolases. Sukanya Luang, Xavier Fernández-Luengo, Alba Nin-Hill, Victor A Streltsov, **Julian G Schwerdt**, Santiago Alonso-Gil, James R Ketudat Cairns, Stéphanie Pradeau, Sébastien Fort, Jean-Didier Maréchal, Laura Masgrau, Carme Rovira, **Maria Hrmova** (*Nature Communications*, Sep 2022). Altmetric score 36, impact factor 17.69

A dual-target herbicidal inhibitor of lysine biosynthesis. **Emily RR Mackie**, Andrew S Barrow, Rebecca M Christoff, Belinda M Abbott, Anthony R Gendall, **Tatiana P Soares da Costa** (*eLife*, Jun 20, 2022). Altmetric score 34, impact factor 8.713

HaploMaker: An improved algorithm for rapid haplotype assembly of genomic sequences. **Mario Fruzangohar**, **William A Timmins**, **Olena Kravchuk**, **Julian Taylor** (*GigaScience*, May 2022). Altmetric score 22, impact factor 7.658

Orchestration of ethylene and gibberellin signals determines primary root elongation in rice. Hua Qin, Bipin K Pandey, Yuxiang Li, **Guoqiang Huang**, Juan Wang, Ruidang Quan, Jiahao Zhou, Yun Zhou, Yuchen Miao, **Dabing Zhang**, Malcolm J Bennett, Rongfeng Huang (*The Plant Cell*, Jan 2022). Altmetric score 20, impact factor 12.085

Plant Trans-Golgi Network/Early Endosome pH regulation requires Cation Chloride Cotransporter (CCC1). **Daniel W McKay**, Heather E McFarlane, **Yue Qu**, **Apriadi Situmorang**, **Matthew Gilliam**, **Stefanie Wege** (*eLife*, Jan 2022). Altmetric score 20, impact factor 8.713

Increasing ionic strength and valency of cations enhance sorption through hydrophobic interactions of PFAS with soil surfaces. Wenwen Cai, **Divina A. Navarro**, Jun Du, Guangguo Ying, Bin Yang, **Mike J. McLaughlin**, **Rai S. Kookana** (*Science of the Total Environment*, Apr 2022). Altmetric score 7, impact factor 10.754

Fluorescent cytoskeletal markers reveal associations between the actin and microtubule cytoskeleton in rice cells. Zengyu Liu, Isabella Østerlund, Felix Ruhnnow, Yiran Cao, **Guoqiang Huang**, Wenguo Cai, Jiao Zhang, Wanqi Liang, Zoran Nikoloski, Staffan Persson, **Dabing Zhang** (*Development*, Jun 2022). Altmetric score 4, impact factor 6.862



Impact and engagement

External engagement

The WRI has supported and co-invested in a range of centres, groups and strategic initiatives over the years. Important collaborations with external stakeholders in 2022 included:

- **a strategic partnership between the University of Adelaide and the Australian Wine Research Institute** with support from Wine Australia. The partnership will establish a joint research program funded by Wine Australia over four years, currently comprising 13 projects focused on research and development activities in winemaking, viticulture and the wider wine community, and facilitating the dissemination, adoption and commercialisation of the results. The projects are aligned with priorities identified in Wine Australia's Strategic Plan 2020–25; and will increasingly focus on NOLO (no and low alcohol wine production), ESG (sustainability) as well as wine production and quality.
- **a national research project led by the University of Adelaide in collaboration with SARDI.** The four-year project has investment from the Grains Research and Development Corporation (GRDC), while University of South Australia, CSIRO, the Western Australian Department of Primary Industries and Regional Development (DPIRD) and other research partners are also involved. The project is set to provide Australian grain growers with new tools and management techniques to combat snails, aiming to minimise losses and improve market opportunities for affected crops.
- **the Adelaide-Nottingham Alliance** between the University of Adelaide and the University of Nottingham. The alliance seeks to develop broader and deeper collaboration in strategic areas of focus and capability at both institutions in global food systems, intelligent health and a sustainable future. The two partners have collaborated on multiple funding awards including a £2.8m BBSRC Responsive Mode Link grant led by the University

of Nottingham and the recently announced AU\$90 million University of Adelaide-led Centre for Excellence in Plants for Space in which Nottingham researchers will play a key role.

- **the project “Past, present and future drivers of soil change”,** led by University of Adelaide Professor Timothy Cavagnaro and Dr Rhiannon Schilling from SARDI. The project aims to analyse soil biology composition and how it has changed since the early 2000s, across a time period where crop yields have almost doubled. The project has secured more than \$3 million in funding from the Federal Government's Soil Science Challenge program, run by the Department of Agriculture, Water and the Environment.

WRI has also invested in ongoing support for projects over the years with great outcomes in 2022 including:

- **the continuous development of the VitiCanopy app.** In 2022 the VitiCanopy app has been upgraded to include the ability to analyse multiple images at once, GPS capability to create maps of the spatial variability of canopy size, and Cloud storage. VitiCanopy has been funded by Wine Australia and the University of Adelaide, and provides users with a quick and simple way to measure grapevine canopy from images uploaded to the app for analysis.
- **additional Innovations Connections funded contract research project for Professor Kerry Wilkinson** (on wine vinegar) with industry partner Cassegrain Wines. The WRI supported the ongoing Cooperative Research Centre Project (CRC-P) on smoke taint in 2020, which helped to attract a PhD student and contribute to a successful CRC-P bid. Outcomes from





Experimental set up in the vineyard for smoke taint research (Photo: Isaac Freeman)

the research will provide economic and social benefits to the wine industry, and are part of a broader \$2,387,017 million project. The industry-research project is developing new methodologies and strategies for the Australian wine industry to manage taint from grapes exposed to bushfire smoke. The project is showing promising results in evaluating novel adsorbents and membrane filtration as methods to ameliorate smoke taint. In 2022 researchers Kerry Wilkinson and Alex Cassegrain also came together to produce a two-part podcast on smoke taint, in a collaboration between the WRI and the Australian Society for Viticulture and Oenology. This will be released mid-2023. Furthermore, the ongoing support for Professor Wilkinson's smoke taint research has [found a promising new technology for overcoming smoke taint in grapes](#) in the use of activated carbon fabric in the vineyard. In 2022 this study was published in the [Australian Journal of Grape and Wine Research](#).

WRI member support

Enhancing excellence through researcher development is a priority for the Institute, and in 2022 the following initiatives were successful contributions to researcher profiles.

WRI provided funding to five EMCRs to attract honours students, by providing direct financial support for student scholarships and operating funds. Highlights of the supported researchers and students include:

- Dr James Cowley – Jared Vandesluys, “Investigating the medicinal crop potential of Australian native Plantago”. Data collected in this honours study has been critical for ongoing grant applications to develop native Plantago as new crops.
- Dr Beth Loveys – Nicole Crawhurst, “Characterisation of *Salvia verbenaca* growth and seed mucilage under water deficit”. Nicole received a Playford Scholarship for her studies
- Dr Xiujuan Yang – Ling Xu, “Investigation of the B-sister MADS-box protein interactome in barley (*Hordeum vulgare L.*)”, and Dominic Lyford, “Conservation of MADS box gene function from barley to Arabidopsis”.
- Ling received first class honours and has continued research within the WRI as a PhD candidate, on a project called “Dissecting the MADS-box interactome during barley ovule and seed development”. Dominic Lyford also continued as a PhD student working a similar project, “MADS-box gene function and conservation in barley and Arabidopsis”.
- Dr Thomas Lines – Jonathon Ward, “Under-vine ground cover does not significantly affect canopy arthropod diversity in small field trial”.
- Dr Tatiana Soares da Costa – Mirrin McKay, “Unlocking the Value of Lysine for Sustainable Agriculture”. Mirrin has continued her research after her successful honours and has co-authored a review paper on the topic during her studies.

Furthermore, she was awarded the Charles John Everard scholarship for her work and now has an ongoing collaboration with the Australian synchrotron to continue her PhD.

WRI supports publications in high impact journals through the Top Paper Initiative, and by coordinating an accompanying media release or research impact story. The publication costs were covered for the following successful papers in 2022:

- Plant Trans-Golgi Network/Early Endosome pH regulation requires Cation Chloride Cotransporter (CCC1). **Daniel W McKay**, Heather E McFarlane, **Yue Qu**, **Apriadi Situmorang**, **Matthew Gilliam**, **Stefanie Wege** (*eLife*, Jan 2022)
- HaploMaker: An improved algorithm for rapid haplotype assembly of genomic sequences. **Mario Fruzangohar**, **William A Timmins**, **Olena Kravchuk**, **Julian Taylor** (*GigaScience*, May 2022)
- The evolutionary advantage of an aromatic clamp in plant family 3 glycoside exo-hydrolases. Sukanya Luang, Xavier Fernández-Luengo, Alba Nin-Hill, Victor A Streltsov, **Julian G Schwerdt**, Santiago Alonso-Gil, James R Ketudat Cairns, Stéphanie Pradeau, Sébastien Fort, Jean-Didier Maréchal, Laura Masgrau, Carme Rovira, **Maria Hrmova** (*Nature Communications*, Sep 2022).





A peer mentoring for grant and fellowship success program has been supported by WRI for many years. The purpose of the program is to provide a facilitated, structured program for EMCRs to observe the process to craft a grant, fellowship or other written application. During the program participants will also have the opportunity to work on publication metrics, peer mentoring and networking.

Throughout 2022 31 participants joined in the WRI EMCR Grant/Fellowship writing program. The WRI extended the invitation to University of Adelaide researchers, as well as WRI partners resulting in participation from the School of Agriculture, Food and Wine; School of Economics & Public Policy; School of Animal and Veterinary Sciences; School of Public Health and SARDI. During the 2022 program the participants worked on DECRA applications (outcomes to be released in September 2023), as well as the following successful applications:

- ARC Mid-Career Industry Fellowship: Dr Ryan Whitford, \$1.3 million to support project cost and salary contributions for up to 4 years. Dr Whitford's project includes collaboration with industry partner BASF SE and aims to reduce costs by improving wheat's female receptivity to airborne pollen, a major bottleneck to commercial realization of hybrids globally.

- Science and Innovation Award for Young People in Agriculture, Fisheries and Forestry, Biosecurity Digital Innovation section: Dr Caitlin Evans, \$22,000 to contribute to project costs for a 12-month project.
- South Australian Grain Industry Trust grant: PhD candidate Simon Michelmore, \$126,166 for a joint project between the University of Adelaide and SARDI to exploit natural genetic variation in herbicide metabolism ability to reduce the market access risks associated with chemical residues in herbicide tolerant pulse grain
- Dust Diseases Board iCARE Fellowship: Dr Chandnee Ramkissoon won this competitive 3-year Fellowship (\$240,000) program, which offers 1-2 successful applicants (nationally) per year support for building research capacity in dust diseases research. Dr Ramkissoon is the first University of Adelaide recipient of this Fellowship, which will aim at strengthening industry-linked research program focused on the prevention of occupational lung disease.
- DVCR small equipment funding grant: Dr Jenna Malone, valued at \$15,000

Feedback from participants indicated that they often would not have applied without support of the program.

WRI also provided grant editing support for twelve researchers in 2022. Outcomes of most of these grant proposals will be announced later in 2023. Already announced as successful was a LIEF grant for a new GM facility at Rosedale farm.

In November 2022 a group of 15 participants joined the Science in Public Media and Communication Training workshop. Waite Research Institute provided funding for the full day workshop and attracted researchers from the Waite Research Institute as well as the School of Agriculture, Food and Wine; School of Biological Sciences; School of Animal and Veterinary Sciences; Institute for Photonics and Advanced Sensing; and the School of Mechanical Engineering.

Furthermore, a number of participants from the University of Adelaide Media Team and the Australian Institute for Machine Learning communications officer joined the workshop in order to be informed on the training received on the day. The workshop was a great success, leaving the attendees with a better understanding on how to manage media releases for future work.



Rosedale Farm

WRI general public impact and engagement

WRI researchers are consistently writing up high-impact publications for the scientific community, as well as introducing their work to a broader audience of the general public. This can be observed by the large number of press releases and University of Adelaide's news items on a wide range of topics.

- **Higher wheat yields and protein content on the horizon**, on the identification of a genetic driver that improves yield traits in wheat, which can also lead to increasing protein content by up to 25 per cent
 - o MicroRNA-resistant alleles of HOMEBOX DOMAIN-2 modify inflorescence branching and increase grain protein content of wheat (*Science Advances*, May 2022)
- **Delaying grapes from ripening results in more flavoursome wine**, a data-driven approach on understanding the best methods to delay on-vine grape ripening to achieve better quality wine
 - o A systematic review and meta-analysis of vineyard techniques used to delay ripening (*Horticulture Research*, May 2022)
- **New herbicidal compounds may provide major boost for Aussie farmers**, on the identification of herbicidal compounds that block the production of the amino acid lysine, essential for weed growth
 - o A dual-target herbicidal inhibitor of lysine biosynthesis (*eLife*, June 2022)
- **Straightening out kinky roots captures carbon and avoids drought stress**, the discovery of a new gene in barley and

wheat that controls the angle of root growth in soil and how this can aid in finding new cereal varieties that are less susceptible to drought

- o Root angle is controlled by EGT1 in cereal crops employing an antigravitropic mechanism (*Proceedings of the National Academy of Sciences*, July 2022)
- **Soil carbon increases under cover crops**, how planting cover crops directly underneath grapevines can help mitigate the effects of climate change and improve land sustainability
 - o Cover crops and carbon stocks: How under-vine management influences SOC inputs and turnover in two vineyards (*Science of the total environment*, July 2022)
- **Health leader honoured by bacteria naming**, on the discovery of a new type of lactic acid bacteria and naming it after South Australia's Chief Public Health Officer Professor Nicola Spurrier
 - o *Apilactobacillus apisilvae* sp. nov., *Nicolia spurrieriana* gen. nov. sp. nov., *Bombilactobacillus folatiphilus* sp. nov. and *Bombilactobacillus thymidiniphilus* sp. nov., four new lactic acid bacterial isolates from stingless bees *Tetragonula carbonaria* and *Austroplebeia australis* (*International journal of systematic and evolutionary microbiology*, September 2022)
- **Harnessing rainwater for self-sufficient veggie gardens**, on how rainwater harvesting can meet irrigation needs for household vegetable production. Researchers Isobel Violet Hume, Dr Matthias Salomon and Professor Timothy Cavagnaro also published **an article in *The Conversation*** on this work.

o Lawn with a side salad: Rainwater harvesting for self-sufficiency through urban agriculture (*sustainable cities and society*, December 2022)

Engagement with a broader audience is also supported by the coverage of ongoing research in more informal settings such as Research Tuesdays and the involvement of the public with research trials. Professor Rachel Burton, Professor Kerry Wilkinson and Professor Matthew Gilliham together with Associate Professor Jenny Mortimer spoke at the University's Research Tuesdays on, respectively, the future of sustainability and plant protein, as well as space agriculture and Plants for Space.

PhD candidate Ishka Bless recruited consumers for an in-depth study on the acceptance of entomophagy, which is an ongoing project on edible insects and how we could incorporate them into more sustainable diets.

WRI researchers are also regularly involved in public forum and conversation. For example, Dr Katja Hogendoorn presented 'Bug life: how insects rule our world' at the 2022 WOMADelaide Planet Talks, and numerous researchers contributed to local outreach events during Science Week, as well as Soapbox Science and Science in the Pub.

The WRI is still growing its following on multiple social media platforms as well, and regularly promotes research work, member profiles and student opportunities through Twitter, Instagram and Facebook as well as the Waite Campus focused website thewaite.org and weekly newsletter.

Further enquiries

Waite Research Institute
Level 1, Plant Research Centre
Hartley Grove, Waite Campus
Urrbrae SA 5064

email wri@adelaide.edu.au

phone +61 8 8313 6650

web adelaide.edu.au/wri

facebook facebook.com/waitereseearch

twitter twitter.com/waitereseearch

instagram instagram.com/waitereseearch

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Kaurna acknowledgement

We acknowledge and pay our respects to the Kaurna people, the original custodians of the Adelaide Plains and the land on which the University of Adelaide's campuses at North Terrace, Waite, and Roseworthy are built. We acknowledge the deep feelings of attachment and relationship of the Kaurna people to country and we respect and value their past, present and ongoing connection to the land and cultural beliefs. The University continues to develop respectful and reciprocal relationships with all Indigenous peoples in Australia, and with other Indigenous peoples throughout the world.