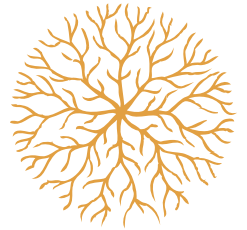




THE UNIVERSITY
of ADELAIDE



Annual Report 2019

WAITE RESEARCH INSTITUTE

adelaide.edu.au/wri

The Peter Waite Legacy and Vision

Peter Waite was a visionary. The son of a Scottish farmer, he immigrated to Australia in 1859 and prospered in the fledging colony of South Australia. Throughout his journey from the pastoral lands of the mid-north of South Australia to the boardroom of the “General and Commission Agent Company”, later to become Elders Smith & Co Ltd, Peter Waite embraced and developed innovative and contemporary farming practices.

Peter Waite gifted his homestead, Urrbrae House, and the surrounding property of 299 acres (121 ha) to The University of Adelaide in 1923 for education and research purposes. The Waite Agricultural Research Institute commenced operations on the site in 1924.



In explaining his gift, Peter Waite wrote:

“I have been much influenced by the wonderful work our agriculturalists and pastoralists have accomplished hitherto in the face of the very great odds they have had to meet. With comparatively little scientific training they have placed our wheat, wool and fruit in the highest estimation of the world: our sheep have been bought to such perfection that they

are sought after not only by all our sister states, but South Africa. Our agriculture machinery has been found good enough even for Americans to copy; and our farming methods have been accepted by other states as the most up-to date and practical for Australian conditions. We have now reached a point when it behoves us to call science to our aid to a greater extent than hitherto has been done, otherwise we cannot hope to keep in the forefront.”





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BIOFLO[®] 110 Jacket Water

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WARNING Surface may be hot before removing the vessel.

CAUTION! La surface de...

Deputy Vice-Chancellor (Research): Introduction

The University of Adelaide's seven research institutes are its flagship research and innovation powerhouses, each one strategically aligned with an area of strength and depth of expertise. The Waite Research Institute (WRI) builds on the Waite's impressive legacy and history of delivering world-leading science and solutions in agriculture.

The WRI brings together researchers from across the agriculture, food and wine spectrum, and thereby covers all three campuses and multiple Faculties and Schools. Working in areas as diverse as ag-tech, agri-economics and trade, consumer and sensory studies, plant breeding, soil ecology, wine and viticulture, agronomy, pests and diseases and animal wellbeing, WRI members are by the very nature of their disciplines engaged in addressing real-world challenges such as sustainable agriculture, the impacts of climate change on plants and food security.

With an exciting new era ahead under the leadership of Professor Matthew Gilliam, I look forward to seeing the WRI's pursuit of multidisciplinary, large-scale research and innovation outcomes in the coming years.

This report provides an overview of a diverse range of high-quality activities undertaken throughout 2019. It illustrates how our world-class fundamental research is driving impact and improving outcomes for the vital agricultural sector.

***Professor Anton Middelberg
Deputy Vice-Chancellor and Vice-
President (Research)***



The Waite at a glance

The Waite is Australia's most recognised and respected agricultural research and teaching brand

The Waite Campus is the largest concentration of agricultural research and teaching in the Southern Hemisphere. Located 7km from the CBD in the south-eastern suburbs of Adelaide, South Australia, the precinct hosts:

- > The University of Adelaide's School of Agriculture, Food and Wine (AFW)
- > CSIRO (Agriculture & Food, Land & Water)
- > South Australian Research and Development Institute (SARDI)
- > Australian Wine Research Institute (AWRI)
- > Australian Genome Research Facility (AGRF)
- > Arris Pty Ltd
- > Fight Food Waste Cooperative Research Centre
- > Food SA
- > Plant & Food Research (Australia)
- > Potatoes SA
- > Urrbrae House Historic Precinct, including the Waite Arboretum

In addition, the Waite hosts the following specialist research centres and breeding programs of national significance:

- > Australian Plant Phenomics Facility (The Plant Accelerator)
- > ARC Centre of Excellence in Plant Energy Biology (node)
- > ARC Industrial Transformation Training Centre for Innovative Wine Production
- > ARC Industrial Transformation Research Hub for Wheat in a Hot, Dry Climate
- > Wine Innovation Cluster (WIC)
- > The University of Adelaide/Shanghai Jiao Tong University Joint Lab for Plant Science and Breeding
- > The Fertiliser Technology Research Centre
- > National breeding programs for almonds, oats, durum wheat, and faba beans.



Over the last 90+ years, the Waite Campus has developed through the pursuit of excellence in agricultural science and collaboration between the co-located organisations to become:

- > Australia's most recognised and respected agricultural research and teaching brand
- > A global leader in agriculture, food, wine and natural resources science, exploring and informing critical national and global issues and challenges such as Australian agriculture industry competitiveness; food security; sustainable intensification of agricultural production; food, nutrition and health; advanced agricultural systems; and adaptation to climate variability and change
- > An international model of research, development, industry application and teaching through the co-location of institutional partners, with capability in whole of value chain approaches from gene discovery to consumer needs
- > Renowned for high-quality education and training in agriculture, food and wine through undergraduate and postgraduate coursework and research degree programs
- > A leading centre of research capability for grains, plant breeding, soil and wine science and natural resource management within Australia.

15 world-class research organisations and centres

1500 research and technical staff

450+ undergraduate students

180+ postgraduate students

\$120+ million research income/ expenditure per year

\$270 million research and teaching infrastructure

400+ research publications per year

Internationally recognised for delivering transformational and high impact agricultural technologies and systems



The Waite Research Institute

The Waite Research Institute (WRI) was established to deliver on the vision and legacy of Peter Waite by supporting The University of Adelaide's commitment to agricultural research, development and education. The Waite brand carries an iconic status worldwide, synonymous with research of the highest quality, focused on innovation in the Agricultural sector. It is one of seven University institutes that focus on areas of strength and excellence.

The WRI supports our members who are drawn primarily from the University's agriculturally focused campuses at Waite and Roseworthy, but also researchers from all other Faculties of the University including Health, Engineering, Professions and Arts.

A great strength of agricultural research on the university campuses is the co-location of leading independent research organisations including CSIRO, the Australian Wine Research Institute (AWRI), the South Australian Research

and Development Institute (SARDI) and companies including AGRF and Plant & Food Research at the Waite; and Australian Grain Technologies (AGT) and the Australian Pig Research Institute (APRIL) at Roseworthy. There are strong collaborative links between these organisations and much of the Campus infrastructure results from co-investment by these partners.

The WRI supports the University in developing and funding strategically important initiatives and by building research capacity and performance through investment in people and infrastructure. The WRI has resourced and coordinated support for new research initiatives, and targeted support of existing areas of strength. The intention is to drive research activity in new and exciting areas that have national and international appeal.

In pursuing these aims, the WRI has invested in research leadership and ECR professional

development, equipment purchases, small and large projects of strategic value, salary support for key research staff at various stages, large grant and Centre of Excellence bids and grant-writing support.

The WRI also supports agricultural research by the University and its partners by providing a 'front of house' service and coordination point for communications. The WRI also resources a range of initiatives that include shared events, a precinct website, and facilitation of workshops, symposia and meetings that enhance multidisciplinary collaboration.

Steady increases in the Waite's competitive research grant funding and industry collaborations, publications and HDR completions have all occurred on the WRI's watch, and the Excellence in Research Australia (ERA) rankings for all agricultural science disciplines remain above or well above world-class.

- > The **Waite Research Institute** is the modern successor to the original Waite Agricultural Research Institute, and is an entity of The University of Adelaide.
- > The **Waite Campus** is the site, owned by the University, and is referred to in relation to all university-only activity, including research and education.
- > The **Waite Precinct** is the collective name for the co-located organisations, agencies and entities on the site, all of which engage in complementary R&D and industry-aligned support for SA's vibrant agriculture, food and wine sectors.



The 2019 year in review

Awards and Grants

WRI members won more than \$32.4m in external grant funding and produced 488 peer-reviewed publications in 2019. This income included royalties from plant breeders rights and significant industry contract research as well as the big Category 1 grants from government and RDC sources.

The WRI was also recognised in a 2019 benchmarking exercise based on 2017-18 research income attributed (by members) to Institute activity, investment and support with the highest leveraged income of all University Institutes at 16:1, testament to the excellent work being done by WRI members, and the continued strength of the agricultural sciences in generating research income for the University.

The WRI's new Director, Professor Matthew Gilliham, won the Faculty of Sciences Research Leadership Award for 2019. Other award winners throughout the year included:

- > Dr Rhiannon Schilling won both the Vice-Chancellor's Award for Excellence in Research (ECR) and the Edith Dornwell Medal for Early Career Research Excellence
- > Professor Mike McLaughlin was invited to join the International Fertilizer Association's scientific panel on responsible plant nutrition
- > Kenton Porker won the GRDC Southern Region Emerging Leader Award
- > Dr Josh Philp was awarded the Daniel Walker Order of Merit for ECR Excellence

Announced in early July, an ARC Linkage Grant was awarded to Professor Rachel Burton's *Plantago ovata* breeding project (\$486K). Further Rural R&D for Profit funding (\$616K of a multi-partner \$4.7m total) was awarded for research on optimising pollination in protected cropping environments by Dr Katja Hogendoorn.

These wins followed Dr Rhiannon Schilling's involvement in a successful GRDC tender bid (led by PIRSA-SARDI) on acid soils management (~\$2.25m in total). Rhiannon went on to lead a successful joint AFW/ECMS

Machine Learning tender bid through the GRDC.

ERA Results

Announced in late March 2019, the 2018 Excellence in Research Australia benchmarking assessment of research quality and impact across universities were outstanding for the scientists at Waite and Roseworthy. For ERA purposes, agricultural and veterinary sciences are grouped together, and achieved the maximum ranking of 5 (well above world standard).

The sub-disciplines of Plant Biology, Crop and Pasture Science, Horticultural Production and Animal & Veterinary Science also achieved the maximum 5 ranking. Soil Science was ranked 4 (above world standard).

Outputs such as the new cereal crop and almond varieties developed at Waite were featured in the new Engagement & Impact part of the assessment, which gave Animal & Veterinary Sciences the highest rank possible.

Waite Tours and Visits

The WRI coordinated, hosted and supported Waite campus tours and meetings for more than 200 visitors in 2019, including farmer groups, diplomats and ambassadors, high school students, private companies, government ministers, university managers and international research and business delegations.

Communications and Engagement

The Waite precinct website (thewaite.org), managed and resourced by the WRI, is a valuable portal that is enhancing interaction and communication across the Waite and with external stakeholders. Averaging 4,000 visitor sessions and listing 20 events/seminars from across the precinct each month, the site has 700+ subscribers to the weekly update service and features high-quality agriculture, food and

wine content that is regularly drawn on by UA communications and external media outlets. Other WRI communications and engagement highlights in 2019 included:

- > A National Science Week grant was won to support a *Food and Wine in a Changing Climate* panel event, held on 20 August. This event achieved excellent engagement with a public audience of 110 and elicited very positive feedback.
- > Two segments filmed at Waite were featured on Gardening Australia, and Prof Andy Lowe was interviewed for stories on native foods by 60 Minutes and Catalyst.

Strategic and Business Development Activities

The WRI continued to resource the University's AgriFood & Wine Industry Engagement Priority throughout 2019, providing in-kind support for IEP activities and initiatives. Many of these are geared towards connecting and enabling internal resources to better match external sector needs; the IEP's communication and engagement network, a research leaders working group, a business development group and executive steering committee are all supported through the WRI.

Working together with colleagues in the Faculties and relevant central divisions, the WRI provided important contextual knowledge to the Director, Professor Andrew Lowe, and facilitated key conversations and mechanisms for better coordination of UA activity across this diverse space.

During 2019, the WRI continued its ongoing support of the Waite precinct partnerships, strategic investments in key projects and individuals, professional development and mentoring for early and mid-career researchers, and engaged in business development activities with several external partners, including the Australian Genome Research Facility, SARDI, Agrinos, and the Adelaide Convention Bureau.

ERA 5 well above world standard



Plant biology



Crop & pasture science



Horticultural production



Animal & veterinary science

ERA
above world standard

4



Soil science

Highly Cited Researchers

One third (4 of 12) of The University of Adelaide's researchers appearing on the global Highly Cited Researchers list for 2019 were again WRI members. Professors Matthew Gilliham and Dabing Zhang, and Emeritus Professors Sally Smith and Andrew Smith were identified as researchers whose work has been most influential and most extensively cited by others over the past decade.

Sadly, September 2019 also saw the sudden passing of Emeritus Prof Sally Smith. Her indomitable spirit and enormous contribution to the University were recognised at a Waite event attended by a who's-who of agricultural, plant and soil research, and university management, with the tributes led by Vice-Chancellor & President, Professor Peter Rathjen.



Emeritus Professor Sally Smith



WRI vision, goals and governance

In mid-2019, the WRI's vision, remit and aims were refreshed to coincide with the appointment of Professor Matthew Gilliam as Director. With an expansion of activity (and membership) to include animal sciences at Roseworthy, more interaction and collaboration with ECMS in the fast-growing ag-tech area and building on existing links with the Centre for Global Food & Resources and researchers in the social sciences, the WRI is the University's flagship for innovation in agriculture, food and wine.

Vision

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

The WRI's broad vision is to drive the innovation to secure a sustainable future for agriculture—by creating high-quality, nutritious and climate-resilient products. We do this not in isolation, but in close partnership with the agriculture, food and wine sectors.

To achieve this vision, we will invest in outstanding researchers and advanced facilities across multiple scientific disciplines, in both new strategic initiatives and areas of established strength.

Goals

1. Research with impact in sustainable intensification of agriculture in a changing climate
2. Building large-scale initiatives across disciplines
3. Enhancing excellence through researcher development
4. Connecting researchers with industry

Governance

The WRI is one of the University's seven Research Institutes, which focus on areas of strength and excellence. Institutes are entities funded and line managed through the Office of the Deputy Vice Chancellor (Research) (DVCR).

Operations

The WRI continues to assess opportunities and review applications, making investment decisions based on the minimum 7:1 leverage requirements now established for all University Institutes.

The WRI continues to seek, assess and support opportunities:

- > for building research excellence and capacity in areas that align with existing and emerging strengths in agriculture, food and wine;
- > that have strategic value for agricultural research and the University;
- > that can demonstrate breadth of impact;
- > that offer value for money through leveraging co-investment;
- > that deliver tangible returns; and
- > that foster multi-disciplinary efforts to address important problems.

Late in 2019, an additional \$250K funding was made available through the Office of the DVCR for seeding of new initiatives. Activities and projects were allocated based on merit-based assessment of applications by a panel of senior academics from a range of disciplines. Of the 52 applications received from across the University, a total of 14 projects were funded. See page 13 for more detail on these projects.

Major research themes

- > AgTech
- > Animal science
- > Crop science
- > Food technology
- > Sustainable agriculture
- > Wine and viticulture



WRI Staff

The WRI was supported by a small, multi-skilled team of two staff (1.9 FTE) in 2019. A change of leadership effective 1 July saw Professor Matthew Gilliham appointed the new Director and A/Professor Matthew Tucker replaced Professor Andrew Lowe as Deputy Director.



Prof Matthew Gilliham
Director (from 1 July)



A/Prof Matthew Tucker
Deputy Director (from 1 July)



Ms Carolyn Mitchell
Executive Officer (1.0 FTE)



A/Prof Chris Ford
Interim Director (to 30 June)



Prof Andy Lowe
Deputy Director (to 30 June)



Mrs Keryn Lapidge
Communications Officer (0.9 FTE)

Director's overview

It is an honour to be taking on the leadership of the Waite Research Institute. I thank Chris Ford for his strong leadership over the past 18 months. The WRI has long been considered the University's flagship for agricultural research. However, the WRI has previously focused all of its activities on the Waite campus. We have now broadened our remit to encompass all areas of agricultural research conducted by the University and its partners on all three of its campuses. This will ensure our members are able to take advantage of the latest technological advances and instigate large multidisciplinary projects.

This new expansive and inclusive approach was on display at the WRI Research Showcase, held in early November 2019, with nearly 300 researchers, HDR students and invited industry guests from across the University and beyond gathering to interact and hear about the latest research progress in a diverse and exciting program.

Investment in research that future-proofs and ensures profitable and productive agriculture in the face of limited natural resources, increased costs of energy and inputs,

urbanisation and environmental degradation is critical for the planet and our growing population. The agriculture, food and wine sector must meet these challenges against a background of serious climate change impacts such as seasonal instability, severe heat and storm events, warmer regions becoming marginal for some enterprises, and the need to reduce carbon emissions. These complex and inter-dependent issues need the kinds of high quality, integrated and interdisciplinary research that members of the WRI can provide.

The WRI continues to perform a key enabling role, supporting investment in unique research infrastructure and services that attract leading researchers and enable research excellence. For example, the WRI has co-funded research infrastructure and support costs such as staffing the Waite node of Adelaide Microscopy, the purchase of new equipment for shared use by several research groups and Centres, and contributed towards the cost of the University's High Performance Computing capability. The latter was an essential capacity/speed upgrade to reduce

bottlenecks in data processing and storage – a service that supports 700+ researchers with links to 31 University research groups, including several at Waite.

The WRI also plays a key role in boosting research excellence by developing people, investing in professional development, such as coaching and mentoring programs for promising early to mid-career scientists.

Strategic support for individuals, partnerships and Centres in key strength areas to maximise the opportunities for innovative and significant research is also very much part of our investment strategy. Our recent co-investment in the successful bid for \$5m further funding to the University's Fertiliser Technology Research Centre by The Mosaic Company is an example.

The WRI looks forward to greater engagement with colleagues in other parts of the University as we move forward with a renewed and expanded focus on achieving excellent outcomes for the vital agricultural sector in Australia.

Professor Matthew Gilliham

A selection of AFW projects funded in 2019

^ Applications that received WRI input/support/investment in development

* Graduates of the WRI's Research Leadership Development Program



Reflecting the breadth and diversity of the University's agriculture, food and wine research and funding sources, the following list is a representative cross-section of the projects/Centres/programs that won external funding in 2019.

AgriFutures Australia - Rural R&D for Profit program

Project title: Optimising pollination in protected cropping environments[^]

Primary Investigator: Dr Katja Hogendoorn

Funding amount: \$616,000

Project summary: The Rural Industries for Profit project 'Novel technologies and practises for the optimisation of pollination within protected cropping environments' aims to increase productivity and profitability of pollination—dependent crops grown under protected cropping systems.

The research will assess the effect of different types of netting on hive health and apple pollination, how pollen is moved through an orchard by bees, and what the optimal pollinisers are for a range of apple cultivars. In addition, the team are investigating how different management strategies of the orchard floor enhance conditions for native bees and influence hive health.

Together, the outcomes will help to develop strategies and advice for growers and netting companies to make pollination under net more efficient.

Grains Research & Development Corporation

Project title: Machine Learning to Extract Maximum Value from Soil and Crop Variability[^]

Primary Investigator: Dr Rhiannon Schilling*

Funding amount: \$1,274,489

Project summary: The yields of major crops in Australia are often below their water-limited potential. A reason for this is the complexity of GxExM, which results in crop growth with high variability.

This project will combine multi-layer paddock and field trial datasets with machine learning (ML) analytics enhanced with simulated cropping scenarios generated in Agricultural Production Systems sIMulator (APSIM).

Advanced ML that automatically fuses historical datasets from multiple sources will be used to extract maximum value from paddock and field trial map layers. This project will discover underlying relationships between climate, crop and soil variables that affect crop growth.

Australian Research Council

ARC Linkage Project grant

Project title: *Plantago ovata* breeding program[^]

Primary Investigator: Professor Rachel Burton^{*}

Funding amount: \$486,000

Project summary: This project will establish a breeding program for *Plantago ovata* in Australia to provide a reliable supply of high quality, superior psyllium – which is used as a dietary fibre supplement and is a key ingredient in the gluten-free food industry.

The project aims to attain better harvests, lower seed shattering and identify types of psyllium with new properties that may be superior for bread and other baked gluten-free products. With increasing numbers of people avoiding gluten, this project will benefit industry and growers in Australia as well as consumers.

The fundamental knowledge gained from the genetic and biochemical analyses of these lines will also broadly benefit seed biology research.



Barley heads

SA Grains Industry Trust

Project title: A collaborative plan to reduce head-loss in barley involving UA and SARDI researchers

Primary Investigator: A/Professor Matt Tucker^{*}

Funding amount: \$133,270

Project summary: Barley is Australia's second largest crop and is proportionally more significant in SA than in any other state. Around the time of harvest, many cultivars will drop heads, depending on environmental conditions. Bad years can see yield losses of 20 - 50%, due to this little understood problem.

This research project has brought together a multidisciplinary team from UA (AFW/ECMS) and SARDI, combining specialist agronomic, physiological and mechanical expertise to find the location of the "failure points" and "biochemical markers" that cause head-loss in barley.

If the biochemical basis for head-loss in barley can be determined and combined with a screening method to confirm tolerance, it would be possible to select for head retention in breeding programs and fine-tune the effectiveness of plant growth regulators as a management strategy for growers. This would improve yield and provide cost savings for cereal farmers.

Wine Australia

Project title: VitiVisor: an information, prediction and advisory platform for viticulture[^]

Primary Investigator: Professor Seth Westra

Funding amount: \$1,868,137

Project summary: A digital platform collects information direct from the vineyard via cameras and sensors and analyses it to assess vineyard performance, and offers coordinated advice on management practices such as irrigation, pruning, fertiliser, fungicide and pesticide applications.

VitiVisor brings together researchers in viticulture, engineering, remote sensing, farm economics, water accounting, artificial intelligence, machine learning and robotics, with grapegrowers possessing deep knowledge of vineyard production and processes from the Riverland wine region.

This project will develop an open-source information, prediction and advisory platform to support on-farm decision making, increase information transferability and access, and in so doing improve farm outcomes (i.e. gross margins/profitability and sustainability measures).

The platform is founded on the digitisation, organisation and visualisation of an unprecedented range of data related to all aspects of vineyard function, but the program will have a key focus around water usability and efficiency issues.



Vineyard sensors

A photograph of a wheat field inside a greenhouse. The wheat is golden-brown and appears to be ready for harvest. The greenhouse structure is visible in the background, with a curved metal frame and a translucent covering. A dark red rectangular box is overlaid on the left side of the image, containing white text.

WRI activities and outcomes in 2019

1 Sustainable intensification of agriculture in a changing climate

South Australia's primary industries are vital to the state's economy. Agricultural land in South Australia occupies 522,300 km², or about 53% of the state. In 2017–18, the gross value of agricultural production in South Australia was \$6.6 billion. Despite a challenging season, South Australia's 2019-20 grain harvest was an estimated 6.5 million tonnes, comprising roughly 25% of the state's agricultural and primary industries revenue. In wine, South Australia continues to lead the nation's grape crush in terms of both volume (~50% of the total) and quality (~80% of the premium market). The total value of Australia's wine sector is around \$5 billion per annum.

In this economic context, and against a backdrop of increasing drought, climate variability, degraded soils, pollution, urbanisation and population growth, The University of Adelaide's agrifood and wine research is critical to sustainably increasing agricultural productivity. The WRI demonstrates real-world impact through its members' work in:

- > Breeding more resilient varieties of crops such as durum wheat, almonds, oats and faba beans to better suit Australian conditions, maximise water use efficiency and tolerate heat, frost and salinity.
- > Developing markers and germplasm for desirable traits to go into commercial breeding trials and programs in barley, grapevines and bread wheat.
- > Research in sensory and social sciences to better understand consumer tastes, attitudes and preferences in a wide range of food and wine products.
- > Research to safeguard pollination and ecosystem services that support agricultural productivity.
- > Keeping abreast of the pests, diseases and weeds that can destroy or reduce the value of various crops to help growers manage and control them most effectively and sustainably.
- > Employing cutting-edge infrastructure, knowledge and technology to enable better agricultural outputs and products, decreased environmental impact and more efficient and cost-effective production systems.
- > Research in agronomic and farming systems management strategies to enhance plant, livestock and soil health, reduce inputs and increase productivity.

1.1 Stimulating new areas of research activity

Late in 2019, to coincide with the relaunch of the expanded WRI, the University allocated funding to stimulate new research in the agrifood & wine area. The WRI sought applications for seed funding of new, multidisciplinary projects in an open call, and received 50 proposals from across several business units, many of which involved collaboration. Of these, 14 were funded, for a total of \$213,000, as follows:

Project Title	Chief Investigator	Business units	\$ Funded
Frost screening in wheat using terahertz imaging: A preliminary study	Able, Jason	AFW, ECMS	\$10,000
Development of a deep learning model for genomic prediction	Baumann, Ute	AFW, ECMS	\$22,000
Beyond Biofuels - Innovative conversion of industrial hemp and sorghum residues into value-added products	Burton, Rachel	AFW, ECMS	\$6,000
3D printed renewable and biodegradable nanocellulose materials	Coad, Bryan	AFW	\$20,000
Detection of anti-nutritional compounds in plant-based feed	Falconer, Robert	AFW, ECMS, CSIRO	\$14,000
Development of a soil nitrogen probe packaging	Kostecki, Roman	AFW, PhysSci, Fac. Science	\$7,000
Bio-fertilisers and biologically produced methane from anaerobic digesters	Medwell, Paul	AFW, ECMS	\$20,000
Food Irradiation Testing (FIT): concept demonstrator towards establishment of national capability	Saarela, Maria	AFW, IPAS	\$20,000
Smart colorimetric labels for in-field risk mitigation and monitoring of pesticides use	Santos, Abel	AFW, ECMS	\$21,000
<i>Marchantia polymorpha</i> : A simple model to investigate complex salinity tolerance mechanisms	Wege, Stefanie	AFW, UoM	\$5,000
Edible insects: Realising the potential of an emerging agricultural industry	Wilkinson, Kerry	AFW, SARDI, CSIRO	\$18,000
ARC Industrial Transformation Research hub (ITRH) for Sustainable Barley Quality	Tucker, Matthew	AFW, ECMS	\$14,950
Building space horticulture for SA	Westra, Seth Hessel, Volker	AFW, ECMS	\$25,000
Research project development between The University of Adelaide and Morocco	Env Institute WRI	Env Inst, WRI, Biol Sciences	\$10,000
TOTAL			\$213,000

In a reflection of the growing importance of ag-tech to the sector and the emergence of this capability at The University of Adelaide, more than half of the successful applications involved an engineering or machine learning component.

This funding round was designed to enable pilot/proof-of-concept work that is likely to deliver return-on-investment and/or aligns with the strategic goals of the University in the agrifood and wine space. Projects are ongoing, with outcomes to be reported in the 2020 Annual Report.

2 Building large scale initiatives across disciplines

A key aim of all the University's Research Institutes is to leverage resources and invest in initiatives that bring in significant funding support from external agencies and industry partners, giving all stakeholders the best chance of shared success. The expanding of the WRI's membership to include livestock/ animal science, social scientists, engineers and so on, will enable stronger multi-disciplinary teams to be formed in pursuit of these opportunities.

2.1 Collaborative and Strategic Partnerships

The WRI has supported and co-invested in a range of centres, groups and strategic initiatives over the last several years as external funding has ebbed and flowed. Key past centres to benefit from WRI co-investment and/or in-kind support include the ARC Centre for Plant Cell Walls, ACPFG and FOODplus.

In 2019, the WRI was a partner in the following:

ARC Industrial Transformation Research Hub for Wheat in a Hot, Dry Climate

Wheat is a major food for many regions around the world. It is the second most produced crop in the world, providing approximately 20% of the daily calories and protein for 4.5 billion people.

The Wheat Hub brings together university-based wheat researchers and Australia's three major wheat breeding companies to exploit global diversity for wheat and advanced genomic technologies for faster development of heat and drought tolerant varieties which make better use of nitrogen fertiliser. Through the Wheat Hub, leading breeders gain access to the latest resources in genomics which are difficult to access, constituting a major step in enabling breeding programs to exploit genomics.

During 2019, the Wheat Hub has:

- > updated its wheat genomic interface, DAWN, to include more genetic information



Photo: ARC CoE Plant Energy Biology

for a range of wheat cultivars, and created versions of DAWN which are more Australian centric, with the reference genome being elite Australian wheat cultivars, rather than the standard Chinese Spring sequence.

- > held multi-location field trials of wheat germplasm with novel alleles for drought and/or heat tolerance with breeding partners in sites across Australia. The Nested Association Mapping (NAM) population has been grown to identify wheat accessions, loci and genes that can be used to enhance wheat yield in a hot and dry climate. These lines have now been supplied to other research groups around the world.
- > developed novel Unmanned Aerial Vehicle (UAV) data collection platforms, including an integrated multi-sensor array with thermal, multispectral and RGB sensors. A server-based data processing pipeline is being developed for use by partner organisations to analyse their own UAV data from future field trials.
- > developed its own gene editing system for wheat, which has been shown to have good editing efficiency in transient systems. The development of stable transformants is currently underway.

UA-SJTU Joint Lab in Plant Science and Breeding

Professor Dabing Zhang established the UA-Shanghai Jiao Tong University Joint Laboratory in Plant Science & Breeding at the Waite in January 2015 and continued to be co-supported by the WRI in 2019. A delegation from The University of Adelaide including Prof Mike Brooks, Prof Andrew Lowe and Prof Keith Jones visited SJTU in 2019.

Professor Zhang was a co-author of 10 high-impact publications during 2019, including papers in *Plant Physiology* and *Trends In Plant Science*. He also had three PhD students under his supervision and submitted two new fellowship and project applications. The 2019 year also saw Professor Zhang make the list of Highly Cited Researchers from the Web of Science Group, and the list of Highly Cited Scholars among Chinese plant researchers (ranked No 4). He was also selected in the Asian Scientist Top 100 list.

ARC Centre of Excellence in Plant Energy Biology

The ARC Centre of Excellence in Plant Energy Biology (PEB) has entered its final year of funding, with 2019 proving a fruitful year for outcomes and highlights:

- > Chief Investigator, Matthew Gilliam was announced as a 2019 Clarivate Analytics Highly Cited Researcher.
- > A review paper on the energy costs of salt tolerance was published in *New Phytologist* by a PEB-led group of international scientists. The paper (doi: [10.1111/nph.15864](https://doi.org/10.1111/nph.15864)), which provides a framework for the quantitative assessment of energy costs, was developed at a workshop run by PEB in Adelaide in 2018.
- > Dr Megan Shelden used a novel high-resolution technique, laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS) to finely map soluble ions in plant root tissues. The paper in *The Plant Journal* (doi:[10.1111/tpl.14599](https://doi.org/10.1111/tpl.14599)) provides insights into the link between sodium toxicity and root growth responses to salt stress. Megan was also a recipient of an ARC Discovery Grant with Stan Miklavcic from the University of SA; *Root-to-shoot: modelling the salt stress response of a plant vascular system*.
- > PEB again presented at Science Alive, held at the Adelaide Showgrounds in August, performing more than 1,800 take-home plant salinity experiments over three days.
- > In a collaboration with CSIRO in Adelaide, PhD student Melanie Ford has been developing advanced root imaging techniques, including a virtual reality approach that allows you to take a fly through roots from maize and *Plantago*.
- > PhD student Aaron Phillips has been collaborating with the Borevitz group at ANU to sequence wild rice accessions that show tolerance to a range of stresses. He

International Wheat Yield Partnership

The PEB Adelaide Node, in collaboration with nodes in Canberra and Perth, is working to produce new models of energy efficiency and novel markers and hyperspectral measures that can be deployed in breeding programs to enhance wheat yield potential in the International Wheat Yield Partnership (IWYP) project 'Improving Wheat Yield By Optimising Energy Use Efficiency'.

Hundreds of cultivars grown in The Plant Accelerator at the Waite have been screened for differences in respiration, metabolites and proteins.



Wheat plants in The Plant Accelerator

has completed a de novo assembly of the chloroplast for two of the species.

ARC Industrial Transformation Training Centre for Innovative Wine Production

The second iteration of this ARC Industrial Transformation Training Centre, again co-supported by the WRI, commenced in February 2018. The Centre was officially launched by then Minister for Education and Training, Senator Simon Birmingham, at the Waite Campus on 6 June 2018.

The Centre continued to grow in 2019, with recruitment of additional HDR students and an additional Research Associate bringing total personnel to 40. Project leaders continued to work alongside their industry

partners, including in field work.

During 2019, the Centre held two wine region workshops, the first in Margaret River and a second in the Barossa Valley. These workshops are held to promote the Centre and for researchers to present their projects and highlight the anticipated outcomes for industry.

The Centre's research was also well represented at the 17th Australian Wine Industry Technical Conference in July. Of the Centre's eight poster displays, PhD student Xiaoyi Wang and co-authors (Roberta De Bei, Stephen Lesefko, Sigfredo Fuentes, Cassandra Collins) won a prize for their poster *Influence of Canopy Management on Reproductive Performance of Grapevine cv. Semillon and Shiraz in a Hot Climate*. Research Associate Dr Dimitra Capone co-convened and presented her research in the workshop *Exploring Regional Diversity in Cabernet Sauvignon*, attended by winemakers, viticulturalists and other wine researchers.

A further highlight for the year included the Centre being named as a finalist in the 2019 South Australian Science Excellence Awards in the category of Excellence in Research Collaboration. Administered by The University of Adelaide, the Training Centre for Innovative Wine Production collaborating partners include AGRF, AWRI, CSIRO, Charles Sturt University, the NSW Department of Primary Industries, Pernod Ricard Winemakers, VA Filtration (SA), Coonawarra Grape and Wine, Chalmers Wines Australia, E&J Gallo Winery, Wine Australia, Availer and Lallemend Australia.



ARC Training Centre for Innovative Wine Production members visited Margaret River in May to present a workshop to local viticulturalists and winemakers. Photo: Eva Wang

Fight Food Waste CRC

The Round 19 Fight Food Waste Cooperative Research Centre (FFW CRC) commenced on 1 July 2018. The \$120 million, 10-year, 60-participant organisation is headquartered in the Wine Innovation Central Building on the Waite Campus, co-located with core participants The University of Adelaide, the South Australian Research and Development Institute (SARDI) and Food South Australia, and supporting participant Potatoes South Australia.

Throughout 2019 the FFW CRC focussed on establishing its project management system, recruiting key administrative and research coordination staff, and establishing its initial research portfolio of 30 projects.

2019 highlights included the launch of the National Food Waste Baseline by the Hon Melissa Price, the Federal Environment Minister, from the FFW CRC office on March 20, the commencement of global food waste expert Mark Barthel with the FFW CRC on August 6, a presentation on the FFW CRC at the Vatican Pontifical Academy of Sciences on November 12, and the Centre's first Annual Conference on November 20-21 at KPMG in Melbourne.

As well as the site of the FFW CRC headquarters, the Waite Campus will be a major research site for the CRC using the Adelaide Glycomics and SARDI facilities, with projects involving the potato, pork, packaging and abalone industries now underway. The WRI invested in this initiative as part of The University of Adelaide's significant overall contribution.

The Agrifood & Wine Industry Engagement Priority

The WRI again enabled the University's Agrifood & Wine IEP through 0.8FTE in-kind support in 2019. Formerly known as the Food Innovation Theme, the Agrifood & Wine IEP is one of the University's five IEPs, which are now formally recognised in the University's strategic plan as key areas of research strength (aligned with industry importance in South Australia). The WRI has supported the development of the Agrifood & Wine IEP across Faculties, campuses and disciplines. Through salary support for IEP Director (and WRI Deputy Director), Professor Andrew Lowe, Food Commercialisation Manager, Dr John Carragher, and the work of the WRI team, the Agrifood & Wine IEP is now leading the way in:

- > developing appropriate strategies and structures
- > facilitating cross-disciplinary efforts
- > supporting key partnerships and business development activities across the University, and
- > communicating widely with internal and external stakeholders.

2.2 Sponsored projects

SAGI-STH: Statistics for the Australian Grains Industry - Southern region

The largest single investment in 2019 for the WRI was its significant support of the Biometry Hub's multi-year, multi-partner Statistics for the Australian Grains Industry (Southern Growing Region) program (SAGI-STH), funded by the Grains Research & Development Corporation (GRDC).

Since its establishment in 2016/17, SAGI-STH has been value-adding and enhancing the quality of GRDC funded experimental research in the southern growing region. The objectives of SAGI-STH are to increase the statistical capacity in the region, while advancing research project outcomes from both regional and national GRDC investments.

More than 40 GRDC research projects have now been given direct SAGI-STH support, including the design and analysis of experiments as well as field sampling and processing of complex data. The total budget of the projects supported by SAGI-

STH exceeds \$70M and 20 joint papers have been published in international scientific journals. The impact of SAGI-STH has had on research in the region was acknowledged in the opening address at the GRDC Open Day in Adelaide in February 2019.

Effective integration of the Biometry Hub and the SAGI-STH program at the Waite Precinct has occurred on many fronts:

- > with a targeted appointment of a lead statistician to coordinate the statistical provision for research projects at SARDI
- > through direct projects with Australian Grain Technologies (AGT), now based at Roseworthy
- > in close research collaborations with many individual researchers in the University's School of Agriculture, Food and Wine,
- > by running a popular SAGI-STH training program in design and analysis of experiments and other statistical workshops at Waite
- > through presenting regular seminars and talks by SAGI-STH showcasing the power of statistics in biological research

In 2019, SAGI-STH also organised a meeting of the International Biometrics Society, attended by 110 statisticians. SAGI-STH staff currently supervise seven HDR research students and the team's expertise has expanded to include scientific computing and image analysis.

Expertise in bioinformatics, R-package development, scientific computing and programming ensures SAGI-STH is well placed to work with machine learning, applied mathematicians and software developers. A



Nick Gellie creating demonstration plantings for lucerne pollinators



Project partners Joyce Gibson (accredited geriatric dietitian), Cheryl Turner, Hannah Rohrlach (accredited dietitian) and Dr Matt Haren (Test Kitchen SA) preparing items for the nutrient-dense foods for healthy ageing project.

GRDC tender was awarded to AGT, the SAGI-STH group and the Australian Institute for Machine Learning at The University of Adelaide to demonstrate the value of combining statistics and machine learning to improve genetic gain in commercial wheat breeding.

Securing pollination reserves for agriculture through revegetation

The Rural Industries for Profit project 'Securing pollination for more productive agriculture' has entered its final year. In Adelaide, it is a close collaboration with Andy Lowe's group (School of Biological Sciences), Katja Hogendoorn's group (School of Agriculture, Food & Wine) and a large number of stakeholder organisations (PIRSA, DEW, Greening Australia, TERN, Trees for Life, Apple and Pear Growers SA, SA Apiarist Association, Lucerne Australia, Almond Board, NRM/Landscape boards, O'Connor NRM).

The project has:

- > created six hectares of demonstration sites in the state (Nick Gellie, Biological Sciences)
- > investigated the value of revegetation for pollination through a reverse auction (Patrick O'Connor)
- > developed barcodes for 300 South Australian plant species (Kor-Jent van Dijk, BS) and more than 1000 bee species (Remko Leijts, AFW), allowing molecular identification of bee species and of the pollen on their legs

The project is currently finalising:

- > an evaluation of the importance of biodiverse plantings for the recovery of the bee fauna (PhD student Dona Kireta, BS)
- > an assessment of the drone capture method to estimate feral hive density (AFW Honours student Elisabeth Williamson)

- > papers on the importance of native vegetation for the pollination of lucerne and the quality of apples (Scott Groom, AFW)
- > extension materials, which include; an on-line plant selector that allows growers of pollination-dependent crops to select location and crop specific plants for crop pollinators (Nick Gellie, BS); a package which allows cost estimation for plantings, fencing etc, and future benefits (Andrew Tokmakoff, TERN); fact sheets (together with PIRSA) and a video animation to attract uptake of these extension materials by growers.

International Agroinformatics Alliance

The International Agroinformatics Alliance (IAA) is a coalition of public and private institutions that are cooperating to develop a platform for computationally advanced collaborative analysis of agricultural data. By combining large agricultural data sets with advanced analysis techniques, IAA seeks to catalyse agricultural research, leading to improved agricultural productivity and stability.

IAA has constructed a platform that combines Jupyterhub web notebooks for interactive data analysis, relational databases for storage of crop genetic and geospatial data, and the Globus file transfer system for efficient data transfer and authentication. The platform uses a data permissions system that allows users to share data with collaborators.

The central platform is located at the Minnesota Supercomputing Institute, at the University of Minnesota, which allows access to the large storage and computer resources required for advanced agroinformatics analysis pipelines.

In 2019, the WRI again supported The University of Adelaide's involvement in this

venture, which assisted in the development of an AIML-led multi-partner bid for a GRDC Machine Learning Tender. The bid was funded for \$1.5m and aims to deliver accurate localised weather forecasts to grain growers.

Nutrient-dense foods for healthy ageing

During 2019, the WRI supported University of Adelaide involvement in a collaborative project on Nutrient-dense Foods for Healthy Ageing, funded through a PIRSA Advanced Food Manufacturing grant. The project aimed to assess protein fortification of real foods that older people like to eat for nutritional benefit and consumer acceptance.

Sixteen products (including breakfast, savoury, sweet and snack foods) were supplemented with different protein types (lentil, pea, soy flours, etc), their nutritional content was analysed and then they underwent sensory trials with people aged 65+ in aged care and community settings.

The project found different types of protein responded differently in various product forms, and there were challenges to overcome in maintaining taste and texture. Ten products were selected for potential commercialisation and are the subject of discussions with established food manufacturers.

The clear market need for foods that appeal to this demographic, which also address the changing nutritional needs of seniors, will hopefully be better met in future as a result of this work.

3 Enhancing excellence through researcher development

The WRI has invested heavily in the leadership training and mentoring of the School of AFW's early to mid-career researchers since 2011, and continues to make the area of researcher development a priority.

In addition to the flagship Research Leadership Development Program, developed by the WRI in conjunction with executive coach Karilyn Fazio of the Impetus Team, the WRI also periodically funds short professional development and mentoring workshops on a range of relevant topics, open to early and mid-career researchers from across its membership. In-kind and sponsorship support is also regularly provided to various initiatives involving ECR networking, such as the Mathematical Sciences/AFW 'speed dating' session held in August 2019.

The WRI's Research Leadership Development Program has been run six times since 2011. It was designed to increase and foster the leadership skills, behaviours and personal ambitions of the participants. The full benefits of these investments in individuals often take time to be fully realised, but several members of the early cohorts to undertake this program demonstrated dramatic improvement and accelerated achievement across a range of areas within 12 months – and these benefits are still unfolding. The School of AFW and the Waite more broadly are reaping the rewards of investment in this younger generation of researchers.

Some of the 2019 career developments and highlights for graduates of the program included:

Professor Rachel Burton won an ARC Linkage grant and had an extremely busy year developing research partnerships exploring the potential of various novel crops.

A/Professor Tim Cavagnaro, now Deputy Head of School (Learning & Teaching) for AFW, was promoted to Professor whilst juggling Wine Australia and ARC Discovery projects.

A/Professor Stuart Roy was confirmed as Director of the ARC Industrial Transformation Research Hub for Wheat in a Hot, Dry Climate.



Dr Rhiannon Schilling receiving the VC's Award for Excellence in Research (ECR)

Dr Rhiannon Schilling and colleagues at SARDI and UA won major GRDC grants in two new areas of grains research for Waite – acid soils management and machine learning applications. She also won both the Vice-Chancellor's Award for Excellence in Research (ECR) and the Edith Dornwell Medal for Early Career Research Excellence.

Professor Vladimir Jiraneck and **A/Professor Cassandra Collins** were awarded Adelaide Convention Bureau grants to support their yeast and viticulture conference bids. They were also recognised in the ARC Training Centre for Innovative Wine Production team, which was named a finalist in the 2019 SA Science Excellence Awards 'Excellence in Research Collaboration' category, along with other WRI program graduates **A/Professor Paul Grbin**, **A/Professor David Jeffery**, and **Professor Kerry Wilkinson**.

Dr Caitlin Byrt won an ARC Discovery Grant and Future Fellowship, but transferred the latter to Australian National University when offered a position; Caitlin remains a WRI affiliate.


Professor Matt Gilliam was invited to join the Premier's Science & Innovation Advisory Council, and was appointed Director of the Waite Research Institute from 1 July 2019. In addition to being named on the 2019 global Highly Cited Researchers list, Matt was also presented with the 2019 Research Leadership Award by the Faculty of Science.

Professor Kerry Wilkinson won the Faculty of Sciences 2019 Excellence in Teaching Award for more than five years experience.

Dr Stefanie Wege was one of 20 applicants selected worldwide to attend an EMBO workshop on functional live imaging of plants in Nagoya, Japan.

3.1 Targeted support of Early- & Mid-Career Researchers

In 2019, the WRI supported the cost of a three-month facilitated peer mentoring program for a group of Early- & Mid-Career Researchers. Run by Maria Gardiner of Thinkwell, the purpose of the program was for each researcher to have a substantially crafted grant or fellowship application ready



by the end of the 12 weeks. The program ran from September through to December 2019, involving review of drafts by the facilitator from a narrative and impact perspective, and group feedback sessions.

Nine researchers completed the program, with seven grant/fellowship applications subsequently submitted and two in the pipeline for submission in the near future. These included three ARC Future Fellowship, an ARC DECRA, an ARC Linkage, an ARC Discovery Project, and two AgriFutures project applications. Feedback received from participants will shape future professional development offerings in the ECR space, and we wish the 2019 participants every success with their application outcomes!

The WRI also continues to provide various types of in-kind assistance to members, many of whom are EMCRs. Facilitating and supporting award nominations for high-achieving young researchers is one of these, as this kind of recognition is an important facet of academic/research career progress.

3.2 Grant writing support

The WRI has long provided a grant writing resource to assist its researchers in developing winning applications. These have included large, complex Centre bids, early career and more prestigious fellowships, and project grant applications of various types.

More recently, an additional two grant writing/editing resource options have been utilised on WRI member project applications. Outcomes are still pending on most of these, but this kind of support has the potential to bring about very large returns on a relatively small cost investment.

Past successes that are still bringing in funding to the University and which were supported by grant writing paid for by the WRI include the Centre of Excellence in Plant Energy Biology and the ARC Industrial Transformation Training Centre for Innovative Wine Production.

4 Connecting researchers with industry



The WRI is underpinning the efforts by the University to more effectively respond to industry needs

The University of Adelaide and PIRSA/SARDI Partnership was celebrated at a launch event at the National Wine Centre in May

In conjunction with the University's Agrifood & Wine Industry Engagement Priority (IEP), led by Professor Andrew Lowe, the WRI has assisted in facilitating and streamlining the University's engagement with the highly commodified and fragmented agricultural sector. Engagement with industry leaders via the University's Agrifood & Wine External Advisory Board has led to the fast-tracking of initiatives identified as priorities, such as upskilling the workforce with short course qualifications and building work placements and internships into relevant degrees.

Corresponding efforts to improve internal communication have included the joining up of research partnership and communication/engagement/marketing resources between the relevant Schools, Faculties, divisions and campuses, and providing a forum for research leaders from across a wide range of pertinent disciplines to come together regularly and discuss opportunities. By providing significant resources and support to the University's Agrifood & Wine Industry Engagement Priority (IEP) throughout the 2019 year, the WRI is underpinning these efforts by the University to more effectively respond to industry needs.

The IEP has also entailed increased interaction between researchers at Waite and their counterparts in the Centre for Global Food & Resources (Faculty of the

Professions), as well as the Schools of Animal & Veterinary Sciences (Roseworthy) and Biological Sciences. This has helped bring about an expansion of the WRI's remit and scope in late 2019 beyond the Waite precinct, to reflect this broader, cross-campus approach to agriculture, food and wine research, which has long been a key pillar and strength area of The University of Adelaide (and formerly the Roseworthy Agricultural College).

The University's five IEPs aim to connect and facilitate research, teaching and engagement efforts in relation to external partners in key areas of strength, coordinating responses and enabling the best interdisciplinary teams to be brought to any given project or partnership opportunity. The WRI team is central to these efforts, given the common ground shared by the WRI and the AF&W IEP.

Key partnerships that were developed in 2019 include the GRDC, Wine Australia, PIRSA-SARDI and Elders.

The WRI also continued to play a key role in supporting the Waite precinct partnerships and enhancing collaboration at the Waite during 2019. Providing a central coordination and communication point for the Waite partner organisations on a wide range of matters, the WRI has become an invaluable part of the fabric of the Waite precinct.

4.1 Communications and engagement

The Waite website

The WRI, with support from Arris Pty Ltd, designed and developed the shared Waite website (www.thewaite.org), which since 2016 has provided a streamlined and comprehensive online portal to the Waite research precinct. The WRI continues to resource and maintain this website on behalf of the campus partners, and its high quality content has seen increasing use of the site as an agricultural science resource by media outlets, government agencies and the wider University community. Weekly Alert subscription numbers continued to grow in 2019, and the site has evolved to include, for example, an online interface for requests and bookings to the Why Waite? school student activities/visits program.

The site offers an overview of the Waite's history and key features, contact information and details for all the organisations and centres based at the Waite, a cross-institutional capability directory, a list of user-pays services and facilities and prospective student and visitor information. As well as providing a landing place for a wide range of external stakeholders, the site is also

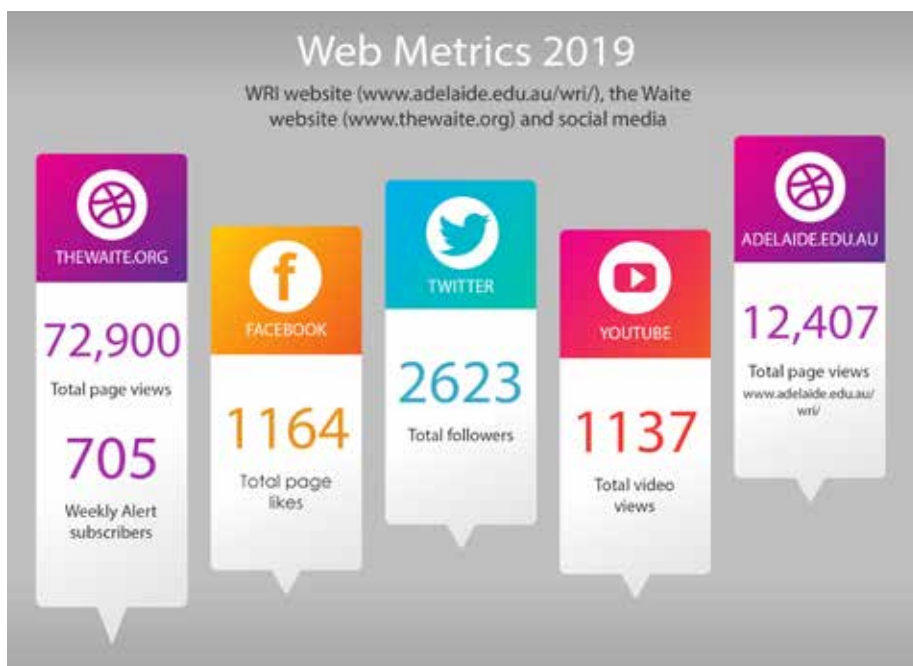
designed to be a useful resource to staff and students, with a news feed, campus notices, employment opportunities and a shared events calendar. The WRI also manages a YouTube channel and active @waitersearch social media accounts on facebook, twitter and instagram.

Waite Communicators group

The WRI convenes and facilitates the Waite Communicators Group, comprising media, communications and marketing personnel from all the Waite partner organisations. Members of this Group have contributed significantly to improvements during the last few years in the quality and flow of information between the organisations at the Waite. The Group has shared and overlapping interests in events, media liaison, high-profile visitors to the Campus, science communication, publications and display materials, and has made progress in the linking of various websites and the consistency of online content, as well as developing ideas for shared resourcing of activities.

In 2019, members of this Group engaged in:

- > *Waite in the Spotlight* event planning and development
- > Waite website content and research story contributions
- > Campus tours/activities/events updates and sharing of relevant information
- > Opportunities to develop joint outreach offerings (such as a structured, shared work experience program) and marketing materials.



Campus tours, events and visits

Given the large number of organisations, centres and facilities co-located at the Waite precinct, and the critical mass in plant, wine, natural resource management and agricultural research they represent, the Waite receives hundreds of visitors each year, from secondary school students to diplomats and international researchers and business leaders.

The WRI continued to provide a ‘front door’ service to the Waite precinct in 2019,

planning and hosting many tours of the unique facilities located here in collaboration with the Waite partner institutions. This activity supports the development of new collaborative relationships with national and international researchers and institutions.

During 2019, the WRI hosted, facilitated and/or coordinated Waite tours and meetings for around 200 visitors, including the national Soils Advocate, Major General Hon Michael Jeffery; Fraser Ellis MP; the Mayor of Mitcham, Dr Heather Holmes-Ross; and senior leaders of the University of California (Riverside).



Waite in the Spotlight 2019

In 2019, the WRI again won a National Science Week grant to support the costs of running a public event to raise the profile of agricultural science and engage a broad cross-section of the community with thought-provoking discussion of topical issues.

This event was staged in a panel format to tease out a range of questions around the theme *Food and wine in a changing climate*. MC Belinda Cay of AgCommunicators was joined by Peter Hayman and Paul Petrie (SARDI), and Kerry Wilkinson, Rachel Burton and Doug Bardsley (The University of Adelaide).

The result was a wide-ranging, highly engaging discussion about the impacts of a changing climate on the food we eat and wine we drink, and how research and innovation is helping to ensure these industries can adapt.

The panel then discussed research that is helping our agricultural industries and communities, including improved farming systems and management techniques, better water use, innovations in winemaking processes, growing alternative varieties and new technologies in plant breeding including GM crops.

The panel also gave their top tips for things everyone can do at home, such as being a more flexible consumer and trying new varieties, being open to the idea of alternative sources of protein such as edible insects, growing your own food and minimising food waste, and supporting producers and regions that are proactively adapting their business to be more responsive to climate challenges.

A lively Q&A session with the engaged audience followed, and the conversations continued over nibbles and drinks.



The speaker panel fielding questions at Waite in the Spotlight 2019

Branding and marketing collateral

The roll-out of the WRI re-branding continued, along with an update of Institute materials, for a consistent, refreshed look and feel across all University Institutes.

In 2019 this included new standing banners, business cards and powerpoint templates. A WRI Partnership Profile booklet was also developed and printed and the WRI website (www.adelaide.edu.au/wri) updated.

WRI staff also coordinated the review and production of an updated AFW IEP website (www.adelaide.edu.au/agrifood-wine/), quarterly email newsletter, and printed collateral including a Capability Statement and external Prospectus document.

4.2 Waite Precinct support

One of the major benefits arising from the unique co-location of several complementary R&D organisations at the Waite is the ability to share resources and co-invest in infrastructure, people and technology to mutual benefit with reduced cost and duplication.

Some examples of shared initiatives and activities facilitated and supported by the WRI are:

- > The development of a business case to support a forthcoming bid for expansion and redevelopment of the Waite winery. The winery is the home of WIC winemaking

services, a joint venture between the University and the Australian Wine Research Institute, and is heavily used by researchers from across the campus.

- > The resourcing and management of the Waite website, www.thewaite.org (see 4.1).
- > The annual *Waite in the Spotlight* event, which showcases the breadth and quality of research across the precinct for the widest possible audience, and communicates why agricultural science is important.
- > The coordination and hosting of regular tailored visits to the Waite by external stakeholders and VIPs; the WRI works closely with relevant staff at the Waite partner institutions to incorporate their facilities and personnel in these tours for maximum exposure, impact and efficiency.
- > Co-investment in the Waite node of Adelaide Microscopy, which is available to all researchers across the campus.
- > Facilitating and supporting the Waite Strategic Leadership Group and the Waite Communicators Group.
- > Sponsoring and organising a range of regular and ad hoc activities that are of mutual benefit to the Waite partners or which build trust, communication, networking, a collegiate atmosphere and shared interests. Examples include the annual Peter Waite Day event and seminars organised around eminent visiting scientists.

Waite Strategic Leadership Group

The Waite Strategic Leadership Group is a consultative and advisory group comprising the leaders of the Waite organisations. Meeting quarterly, it aims to foster a shared strategic direction for collaborative research activities at the Waite Campus.

The Group's goal is to identify emerging opportunities and ensure that the Waite organisations are working together to deliver on them, whilst building capacity for step improvements in Australian agriculture.

The WRI continues to facilitate and support the activities of the Waite Strategic Leadership Group through the provision of secretariat services and the funding and coordination of shared campus initiatives such as the Waite website.

Peter Waite Day - building the campus community

Peter Waite Day is an informal campus community-building and networking activity that coincides with the anniversary of Peter Waite's birthday on 9 May each year. Peter Waite's generous bequest to The University of Adelaide for the purpose of agricultural research and education, and the legacy of his foresight embodied in the Waite Campus today, are celebrated and remembered on this occasion each year.

Held in picturesque locations around the Campus, this WRI-sponsored annual networking event has become a highlight of the Waite calendar, enjoyed by an average of 140 staff from across the Waite partner organisations and featuring a fiercely-contested knockout bocce tournament.

In 2019, Peter Waite Day was held in the Urrbrae House gardens, with 12 teams competing for the Peter Waite Bocce Trophy. The cup was won by the team from the APPF — the Macrame Owls — who overcame CSIRO's Bowleriffics in the final.

Special mention goes to the Italian themed 'Boconcini' team for best costume and 'Correct Waite' for best team name.

Ian Reed and David Price from Urrbrae Agricultural High School and Greg Rolton from Unley High School attended the celebrations this year, and we were also delighted to have Mayor of Mitcham Dr Heather Holmes-Ross join us and present the trophy to the winning Bocce team.

Mayor of Mitcham Dr Heather Holmes-Ross awards the Peter Waite Bocce Cup to the Macrame Owls at the 2019 Peter Waite Day



4.3 Business Development

The WRI engaged in both internal and external business development activity during 2019, partly through substantial support of the Agrifood & Wine IEP, but also as a primary point of contact/support for the wide range of agriculture, food and wine research activity across the Waite precinct and the wider university.

From connecting the most appropriate researchers with potential industry partners to facilitating meetings, site visits, and project support, the WRI worked across a wide range of topics in 2019, including plant-based proteins, fertiliser product trials, ag-tech and national genomics capability planning.

Attendance at and sponsorship of national conferences and industry events such as the Food SA Summit and the Premier's Food Industry Awards led to valuable knowledge building and networking.

The WRI's support of the SARDI-University partnership launch event, as well as our own Research Showcase, which featured industry speakers and many invited external guests, are further examples of the WRI's presence in this area.

4.4 Sponsored events

The WRI has regularly sponsored and/or coordinated events that support the career development, collaborations and networking of its members.

Crawford Fund Forum 2019



The WRI and the Centre for Global Food & Resources (Faculty of Professions) co-sponsored UA's presence at the 2019 annual Crawford Fund Conference. The theme was '*Weathering the Perfect Storm: Addressing the Agriculture, Energy, Water, Climate Change Nexus*'.

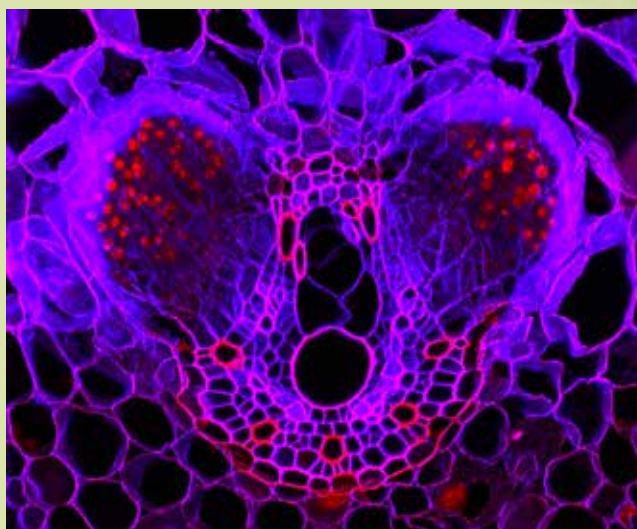
Forty-four young scholars were chosen from across Australia after a competitive selection process to attend the conference, which was held at Parliament House in Canberra from 12-14 August 2019. Professor Wendy Umberger, Professor Sarah Wheeler and A/ Professor Chris Ford attended, and the South Australian scholarships were awarded to:

- > Dr Tara Garrard (Plant Pathologist, SARDI)
- > Natasha Hallet (third year University of Adelaide agricultural science undergraduate student)
- > Anh Duc Nguyen (PhD student at the Centre for Global Food and Resources)
- > Dr Josh Philp (School of Agriculture Food and Wine, University of Adelaide).

Building and maintaining capacity

The WRI continues to co-invest in and support initiatives, facilities and resources that underpin and enable research capability and capacity as needs and opportunities arise. Examples include LIEF large equipment bids, the University's recent upgrade to high-speed computational capacity, Adelaide Microscopy's Waite node staffing with a technical officer, bridging salary support for key researchers, and initiatives that develop or strengthen a critical aspect of agricultural research, such as the Biometry Hub's flagship program on statistics for the grains industry.

More recently, the WRI has supported the purchase of a water vapour sorption analyser, the only instrument of its kind in Australia, by the Fertiliser Technology Research Centre. The Centre signed a further \$5.5m, 5-year agreement with The Mosaic Fertilizer Company in late 2019.



A transverse section from a nematode infected wheat root stained with calcofluor white and propidium iodide taken on the confocal microscope at the Adelaide Microscopy Waite node. Photo by Kara Levin.



WRI Research Showcase

The major agrifood and wine event for the University in 2019 was the annual WRI AgriFood & Wine Research Showcase, formerly known as AFW Research Day. Held on Friday 8 November at the National Wine Centre, this event was hosted and organised by the WRI on behalf of the School of AFW Research Committee, and brought researchers from SARDI, Roseworthy, and other faculties of The University of Adelaide together with AFW staff and HDR students, as well as invited industry and state

government partners – a total attendance of around 260.

The full-day program of talks featured even greater diversity than usual, covering current research and partnerships in ag-tech, wine, edible insects, livestock, horticultural innovations, food trends, grains, climate-related challenges, food in the media, international projects and more. As always, this event also celebrated the achievements and successes of the year.

There was excellent networking in evidence throughout the day, particularly during the closing drinks, which featured a pop-up gin bar (courtesy of Australian Distilling Co) with tastings of Adelaide Gin, co-developed by WRI member Adjunct Assoc. Professor Graham Jones, and its counterparts from Brisbane, Sydney, Melbourne and Perth.



Around 260 WRI members, collaborators and industry partners attended our Research Showcase in November

The Waite Precinct partners

The WRI keeps alive the vision of Peter Waite by supporting the collective interests of the Waite Precinct and its role in enabling science that transforms and improves agriculture for SA and beyond. The Waite is unique in the number of non-University research partners co-located there. These partners include Federal and State government agencies as well as national research centres and industry-funded organisations such as the Australian Wine Research Institute.

Some partners have been on the campus for many decades but, irrespective of their period of residency, all have added greatly to the richness of the research environment. They have co-invested in buildings and other infrastructure and have formed effective collaborative relationships with each other. The Wine Innovation Cluster is an example of the latter but there are also numerous bilateral links, notably the PIRSA-SARDI and University of Adelaide partnership, which was formed in 2019.

The co-location model that epitomises the Waite Precinct has been widely emulated and has helped maintain the reputation of the campus, and therefore the University, as a leading academic agricultural research institution in Australia.

University partners



THE UNIVERSITY
of ADELAIDE

School of Agriculture, Food & Wine (AFW)

<https://sciences.adelaide.edu.au/agriculture-food-wine/>

*LOCATION: Ag, Food and Wine Building
Hartley Grove, Waite Campus, Urrbrae*

The School of Agriculture, Food & Wine (AFW) is one of four Schools within the Faculty of Sciences at The University of Adelaide. The School is a world-class concentration of scientific research, education and product-conferring capability, the centrepiece of the Southern Hemisphere's largest collection of expertise in plant genomics, crop improvement, sustainable agriculture, animal science, dry land

farming, horticulture, viticulture, oenology, wine business and food and health.

The School comprises more than 220 research active staff, and several hundred postgraduate and undergraduate students move through the School's suite of degrees each year. The School is organised into three departments – Agricultural Science, Plant Science and Food & Wine Science - and incorporates several research groups including:

- > Farming Systems
- > Food & Nutrition
- > Plant Breeding & Genetics
- > Plant Protection
- > Plant Physiology, Viticulture & Horticulture
- > Soil Science
- > Wine Science
- > Biometry

The School of Agriculture, Food and Wine hosts a number of specialist research centres and entities:



Australian Plant Phenomics Facility (APPF) - The Plant Accelerator

www.plantphenomics.org.au

LOCATION: The Plant Accelerator, Hartley Grove, Waite Campus, Urrbrae



The Plant Accelerator, a national facility established under the Commonwealth National Collaborative Research Infrastructure Scheme (NCRIS), is a world-leading plant phenomics facility offering state-of-the-art plant growth environments and the latest technology in high throughput plant imaging for the repeated measurements of the physical attributes (phenotype) of plants automatically and non-destructively.

The services enable academic and commercial plant scientists to better understand the factors controlling the performance of particular crops, including the genetic make-up of the plants, the soil conditions, chemical and nutrient treatments, and environmental stresses. This facilitates an acceleration of crop improvement - generating crops that are more productive, disease tolerant and viable in marginal conditions. The APPF has two nodes; The Plant Accelerator involving the research institutions at the Waite and The High Resolution Plant Phenomics Centre involving CSIRO Plant Industry and the Australian National University in Canberra.



plant energy biology
ARC CENTRE OF EXCELLENCE

ARC Centre of Excellence in Plant Energy Biology (Adelaide node)

www.plantenergy.edu.au

LOCATION: Plant Research Centre, 2b Hartley Grove, Waite Campus, Urrbrae



The University of Adelaide established a node of the ARC Centre of Excellence in Plant Energy Biology (PEB) in 2011. The current version of the centre began in 2014 with Professor Steve Tyerman and Professor Matthew Gilliham as Chief Investigators. Professor Rachel Burton joined as a CI in 2018.

The Centre comprises The University of Western Australia, Australian National University, The University of Adelaide and La Trobe University, ten Chief Investigators and over 130 internationally competitive staff and students. It is funded primarily through the Australian Research Council (\$26 million) and \$14 million from the partner universities through to 2020.

The research focus of the Centre is to better understand the way in which plants capture, convert and use energy in response to environmental change. The long-term goal is to enhance energy efficiency to improve sustainable productivity of plants. At the Adelaide node the aim is to improve

the efficiency of plant energy use by manipulating the transport properties of gatekeeper cells for water, carboxylates, phosphate and salt.



ARC Industrial Transformation Research Hub for Wheat in a Hot and Dry Climate

www.wheatHub.com.au/



The Australian Research Council Industrial Transformation Research Hub for Wheat in a Hot and Dry Climate marks a new era in wheat breeding and research in Australia. It brings together researchers and Australia's three major wheat breeding companies to exploit global diversity for wheat and advanced genomic technologies for faster development of heat and drought tolerant varieties which make better use of nitrogen fertiliser.

It is funded by the Australian Government through the ARC's Industrial Transformation Research Hubs scheme and the GRDC. Partners include breeding companies AGT, LongReach Plant Breeders and Intergrain, the Universities of Adelaide, Sydney, South Australia and the ACPFG.

The Research Hub aims to enhance productivity and secure high grain quality of wheat in the hot and dry Australian climate by:

- > Developing wheat with combined heat and drought tolerance by advancing existing knowledge and technologies and transferring wheat material and know-how to breeding programs
- > Elucidating mechanisms and molecular markers for combined heat and drought tolerance by exploring wheat genetic diversity
- > Identifying mechanisms and genetic

diversity for high yielding wheat with efficient nitrogen recycling and high grain protein

- > Building human capacity in molecular breeding and providing breeders access to the latest scientific developments and technologies
- > Developing and testing high-throughput field phenotyping tools for Australian breeders



ARC Industrial Transformation Training Centre in Innovative Wine Production

www.arcwinecentre.org.au/

LOCATION: Roseworthy-Hickinbotham Wine Science Laboratories, Hartley Grove, Waite Campus, Urrbrae

Based at The University of Adelaide's Waite Campus, research projects within the multi-partner ARC TC for Innovative Wine Production fall into two broad themes: Responding to Challenges and Increasing Profitability. Research spans the winemaking process investigating aspects of viticultural management, oenology including wine microbiology, wine chemistry and sensory science and winery process optimisation.

Incorporating 13 partners, the Centre represents a unique and exciting training opportunity for PhD and postdoctoral researchers to work closely with leading research centres and Australian and international companies from the wine and food sector.

wineinnovationcluster.com
Synergy in grape & wine research

The Wine Innovation Cluster (WIC)

www.thewaite.org/waite-partners/wine-innovation-cluster/

LOCATION: Wine Innovation Central Building, Cnr Hartley Grove and Paratoo Road, Waite Campus, Urrbrae

The WIC is a virtual entity and partnership of four leading Australian grape and wine research agencies. Established in 2008 and based on the Waite Campus, the WIC strives to build collaboration and create synergies in research and development across the co-

located partner organisations for the benefit of Australia's multi-billion dollar wine industry.

The WIC represents critical mass in terms of national wine R&D capability; almost 70 per cent of the total is located at the Waite Campus and incorporated in the WIC. The WIC was established in recognition of the fact that enhanced coordination and integration of R&D is necessary to build the quality outcomes and effective delivery needed by the wine and grape growing industries to meet the challenges of the future.

Collectively, the WIC partners cover the entire grape and wine research, development and extension spectrum and the WIC is continuously exploring opportunities for collaborative research projects.

Non-University partners



Commonwealth Scientific and Industrial Research Organisation (CSIRO)

www.csiro.au

LOCATION: Prescott, Taylor, Cornish and WIC West buildings, Waite Campus, Urrbrae



CSIRO, the national research provider, innovates for tomorrow and offers solutions and technologies today – for its customers, all Australians and the world. CSIRO's research at the Waite Campus seeks to create value for its customers through innovation that delivers economic, environmental and social impact, with particular focus on Australia's agricultural, environment (land and water) and mineral resources sectors.

CSIRO's Waite-based agricultural research is focused on southern farming systems, wine grapes and horticulture, genomic science for

crop performance, soil carbon and nutrient cycling and agricultural adaptation to and mitigation of global change.

CSIRO Land and Water's research focuses on environmental resilience, environmental toxicology, managing terrestrial and aquatic ecosystems, water in the resources sector, economics, productivity and sustainability. In the minerals sector, CSIRO's Waite-based research focuses on intelligent mining and resource management.

All of this work is conducted in partnership with a range of research, industry and commercial partners, including the other organisations based at the Waite. Further information is available at:

www.thewaite.org/waite-partners/csiro/



The Australian Wine Research Institute

Australian Wine Research Institute (AWRI)

www.awri.com.au

LOCATION: Levels 2 & 3, Wine Innovation Central Building, cnr Paratoo Road & Hartley Grove, Waite Campus, Urrbrae



The AWRI is the Australian grape and wine industry's research organisation. It supports a sustainable and successful grape and wine industry through world class research, practical solutions and knowledge transfer. Established in 1955, the AWRI is governed by an industry-led, skills-based Board and is a member of the WIC. The AWRI's activities are guided by its mission and values, an industry-endorsed research, development and extension plan and an internal business plan. AWRI Commercial Services is the commercial arm of the organisation and provides advanced analytical and consulting services on a fee-paying basis.

The AWRI supports grapegrowers and winemakers by:

- > Undertaking strategic and applied research based on the priorities of the Australian

grape and wine industry

- > Providing a helpdesk service to answer queries from producers and conduct problem-solving investigations
- > Presenting roadshow workshops and seminars in Australian wine regions
- > Delivering technical information and producing publications
- > Conducting events including the triennial Australian Wine Industry Technical Conference, the Advanced Wine Assessment Course and Research to Practice modules
- > Providing NATA-accredited analysis and assistance with wine export
- > Supervising postgraduate students and providing lectures to undergraduate students.



South Australian Research and Development Institute (SARDI)

pir.sa.gov.au/research

LOCATION: : Plant Research Centre, 2b Hartley Grove, Waite Campus, Urrbrae



SARDI, a Division of the South Australian Department of Primary Industries and Regions (PIRSA), is the SA Government's principal research institute for primary industries creating opportunities to ensure the agriculture, food, aquatic and bioscience industries are internationally competitive and ecologically sustainable.

SARDI focuses on value-chain linkages, food security, natural resource and climate adaptation, product integrity requirements, innovation capability and enabling technologies, supplier competitiveness and biosecurity.

SARDI science programs are aquatic sciences, livestock and farming systems, and sustainable systems. SARDI has

350 scientific, technical and support staff working at 10 regional research centres in South Australia.



Fight Food Waste Cooperative Research Centre (FFW CRC)

<https://fightfoodwastecrc.com.au/>

LOCATION: Level 1, WIC Building, cnr Paratoo Road and Hartley Grove, Waite Campus, Urrbrae

The Fight Food Waste Cooperative Research Centre brings together industry, research and the community to capitalise on Australia's food waste opportunities. Winning this fight will save Australia \$20 billion per annum in food waste through increased industry profitability and reduced food insecurity, as well as enhancing Australia's reputation as a sustainable and trusted producer of premium food products.

Through three research and development programs, the FFW CRC will REDUCE food waste across the supply chain, TRANSFORM unavoidable waste into innovative high-value co-products, and ENGAGE with industry and consumers to deliver behavioural change.



Plant & Food Research (Australia)

www.plantandfood.com.au/

LOCATION: Northern Barns, Building 4G Waite Road, Waite Campus, Urrbrae

Plant & Food Research is a science and innovation company. It is a subsidiary of Plant & Food Research New Zealand Ltd which is a Crown Research Institute.

At its core, Plant & Food Research aims to enhance the value and productivity of horticultural, arable, seafood and food and beverage industries to contribute to economic growth and the environmental and social prosperity of our clients and the communities they live in.

Already working with The University of Adelaide on agricultural product development, and almond orchard systems and harvest technologies, the Waite node will drive research collaborations aimed at

enhancing production, sustainability and value-adding in the horticulture, food and agriculture industries.



Arris Pty Ltd

www.arris.com.au

LOCATION: Hartley Grove, Waite Campus, Urrbrae

Arris is an innovative Australian-owned consulting and communications company, providing services in two distinct areas: agricultural & environmental services, and marketing/communications. The Arris team has a unique mix of qualifications and experience in science, agriculture, communications, event management, education and training, graphic design, web design and computer technologies and provides services for a diverse range of clients.



Australian Genome Research Facility (AGRF)

www.agrf.org.au

LOCATION: Plant Genomics Centre, Hartley Grove, Waite Campus

AGRF is a not-for-profit company, established in 1997 under the Commonwealth Major National Research Facility (MNRF) Program, and currently supported by NCRIS through BioPlatforms Australia. It is Australia's largest provider of genomics services and solutions. AGRF has laboratories in Adelaide, Brisbane, Melbourne, Perth and Sydney.

The Adelaide node provides a range of services to industry and academia, including Illumina and Ion Torrent "Next Generation" sequencing, Sanger DNA sequencing, nucleic acid extraction, controlled environment growth rooms, and varietal identification services.

The Adelaide node provides a direct link to the specialist, large scale, and Bioinformatics services provided by AGRF's national network, and is accredited by NATA to ISO17025:2005.



Appendices

Appendix 1

WRI Members

(Active AFW researchers and affiliates in 2019)

Able, Amanda	Byrt, Caitlin	Doolette, Ashlea
Able, Jason	Cao, Shifeng	Draycott, Sally
Adu-Yeboah, Patricia	Capone, Dimitra	Dry, Peter
Akomeah, Belinda	Cargill, Margaret	Dundas, Ian
Alperstein, Lucien	Carragher, John	Edwards, James
Amalraj, Amritha	Cavagnaro, Timothy	Edwards, Petra
Andelkovic, Ivan	Chalmers, Kenneth	Erinle, Kehinde
Armstrong, Claire	Chen, Liang	Esteves Leghi, Gabriela
Asenstorfer, Robert	Churchman, Gordon	Ferrante, Ariel
Asif, Ahsan	Clarke, Stephen	Fincher, Geoffrey
Badu, Manoj	Coad, Bryan	Fisk, Ian
Baird, Roslyn	Collins, Cassandra	Fleet, Benjamin
Baker, Greg	Collins, Helen	Fleury, Delphine
Baldock, Jeffrey	Collins, Nicholas	Ford, Christopher
Ballard, Ross	Coqui da Silva, Rodrigo	Ford, Melanie
Barnett, Stephen	Cossani, Cesar	Fox, Rebecca
Bartowsky, Eveline	Coventry, David	Francis, Ian (Leigh)
Bastian, Susan	Coventry, Stewart	Franco Garcia, Alex
Baumann, Ute	Cozzolino, Daniel	Fruzangohar, Mario
Berger, Bettina	Crisp, Peter	Fung, Elisabeth
Betteridge, Alice	Croxford, Adam	Garcia, Melissa
Betts, Natalie	Cu, Suong	Gardner, Jennifer
Bianco-Miotto, Tina	Culbert, Julie	Garnett, Trevor
Blake, Sara	Daly, Jamee	Gautam, Deepak
Bose, Jayakumar	Danner, Lukas	Genc, Yusuf
Boss, Paul	Davey, Rowena	Gibson, Robert
Boutsalis, Peter	David, Rakesh	Gill, Gurjeet
Bowring, Frederick	Davidson, Jennifer	Gilliam, Matthew
Brewer, Philip	Davies, Kerrie	Glatz, Richard
Brien, Chris	De Bei, Roberta	Gogel, Beverley
Bruning, Brooke	Degryse, Fien	Gong, Xue
Brunton, David	Delaporte, Kate	Grant, Cameron
Buhl, Jerome	Denton, Matthew	Grbin, Paul
Bulone, Vincent	Derkx, Adinda	Greenwood, Emma
Burton, Rachel	Dockerill, Jacinta	Groom, Scott
Buyinza, Joel	Dolman, Fleur	Habili, Nuredin

Haefele, Stephan	Koopman, Darren	Melino, Vanessa	Puglisi, Carolyn	Smith, Sally	Walker, Robert
Hanold, Dagmar	Kovalchuk, Nataliya	Merriam, Alicia	Qiu, Jiaen	Sosnowski, Mark	Wallwork, Hugh
Hayes, Julie	Kravchuk, Olena	Mosley, Luke	Qu, Yue (Julian)	Stewart, Sue	Walter, James
Hayman, Peter	Krishnan, Mahima	Muhlack, Richard	Ramesh, Sunita	Stiglingh, Andrea	Wassie, Molla Mesele
Henderson, Sam	Kuchel, Haydn	Muhlhausler, Beverly	Randles, John	Stirling, Erinne	Watson, Tommaso
Henschke, Paul	Kustos, Marcell	Nash, Michael	Rengasamy, Pichu	Stockley, Creina	Watson-Haigh, Nathan
Herderich, Markus	Kwiatkowski, Maria	Navarro, Divina	Riggs, Karina	Summy, Krista	Watts-Williams, Stephanie
Hill, Kelly	Langridge, Peter	Nielsen, Sharon	Ristic, Renata	Summers, David	Waugh, Robbie
Hogendoorn, Katja	Langridge-Reimold, Ursula	Niimi, Jun	Roche, Nathan	Sundstrom, Joanna	Wege, Stefanie
Hranilovic, Ana	Lanyon, Sasha	Nuberg, Ian	Rodriguez Lopez, Carlos	Sutton, Timothy	White, Thomas
Hrmova, Maria	Lee, Wendy	O'Brien, Patrick	Roy, Stuart	Swinbourne, Alyce	Whitford, Ryan
Hsieh, Yves	Leigh, Roger	Oakey, Helena	Ruggiero, Kathy	Sznajder, Beata	Wilkinson, Kerry
Huang, Chunyuan	Li, Gang	Okada, Takashi	Ryder, Maarten	Tavakkoli, Ehsan	Wirthensohn, Michelle
Huang, Shan	Li, Juqi	Okamoto, Mamoru	Saarela, Maria	Taylor, Julian	Wood, Katie
Hume, Ruby	Li, Yongle	Oliver, Stephen	Sadras, Victor	Tester, Mark	Xu, Bo
Hunt, Shannon	Lines, Thomas	Ouyang, Jingyun	Salomon, Matthias	Thephavanh, Manithaythip	Yang, Xiujuan
Iqbal, Nasir	Little, Alan	Pagay, Vinay	Sarpeleh, Abolfazl	Timmins, Andy	Yazdani, Maryam
Islam, A	Liu, Haipei	Paull, Jeffrey	Schilling, Rhiannon	Tricker, Penny	Zerner, Michael
Ismail, Ismail Ahmed	Liu, Huajian	Pearson, Allison	Schultz, Carolyn	Trueman, Austin	Zhang, Dabing
Iwasaki, Jay	Long, Yu	Penfold, Chris	Schwerdt, Julian	Tucker, Matthew	Zhang, Jin
Janik, Les	Longbottom, Mardi	Peter, Josephine	Scott, Eileen	Turnbull, Alison	Zhou, Jo
Jansz, Jackson	Loveys, Beth	Petrie, Paul	Selva, Caterina	Tyerman, Stephen	Zhou, Yi
Jarrett, Richard	Lyons, Graham	Petrovic, Tijana	Shelden, Megan	Unkovich, Murray	Zhu, Ying
Jefferies, Stephen	Macdonald, Lynne	Philp, Joshua	Shi, Bu-Jun	Vandeleur, Rebecca	Zhu, Yongguan
Jeffery, David	Malone, Jenna	Philpot, Amanda	Shirley, Neil	Van Helden, Maarten	Zwer, Pamela
Jenner, Colin	March, Timothy	Plett, Darren	Singh, Rohan	Vassos, Elysia	
Jewell, Nathaniel	Mares, Daryl	Potumarthi, Ravichandra	Smernik, Ronald	Verbyla, Arunas	
Jiranek, Vladimir	Markovic, Marijana	Preston, Christopher	Smith, Andrew	Walker, Michelle	
Johnson, Trent	Marschner, Petra				
Jones, Graham	Mason, Sean				
Kabiri, Shervin	Mather, Diane				
Kaiser, Brent	Mayo, Gwenda				
Kalenahalli, Yogendra	McBeath, Therese				
Kang, Wenyu	McDonald, Glenn				
Keller, Michael	McGaughey, Samantha				
Kesser, Merek	McKay, Alan				
Khoo, Kelvin	McLaughlin, Michael				
Kimber, Rohan	McLean, Hylton				
Knight, Emma	McNamara, Imogen				
Koltunow, Anna	McNeill, Ann				
Kookana, Rai	McQuillan, Maximilian				



Appendix 2

2019 Financial statements

Expenditure in 2019	
	2019 Actual
WRI Areas of Activity	\$
Sustainable intensification of agriculture	440,092
Connecting researchers with industry	19,927
Building large scale initiatives	190,387
Researcher development	28,103
Subtotal	678,509
Staffing	237,949
Administration & office costs	29,156
Total Spend in 2019	\$945,614

Income (to members of WRI) in 2019	
	\$
Research income across categories 1-4 (HERDC eligible)	26,457,625
Bequest income	2,667,437
APPF income (NCRIS)	3,369,103
Total in 2019	32,494,165

Appendix 3

2019 Publications

To view or download the full list of AFW publications from the 2019 calendar year go to www.adelaide.edu.au/waite-research-institute/about#publications



Books & Book Chapters 12



Journal Articles 488



Conference Proceedings & Reports 31



Patents & Plant Breeders Rights 2

Appendix 4

List of Relevant Acronyms

ACPGF	Australian Centre for Plant Functional Genomics	ERA	Excellence in Research Australia	Regions South Australia	
AFW	The University of Adelaide's School of Agriculture, Food & Wine	FFW	Fight Food Waste Cooperative Research Centre	RDC	Research & Development Corporations
AF&W IEP	Agrifood and Wine Industry Engagement Priority	GRDC	Grains Research & Development Corporation	SAGI-STH	Statistics for the Australian Grains Industry - Southern region
AGRF	Australian Genome Research Facility	HDR	Higher Degree by Research	SAHMRI	South Australian Health and Medical Research Institute
AGT	Australian Grain Technologies	HERDC	Higher Education Research Data Collection	SARDI	South Australian Research & Development Institute
ARC	Australian Research Council	HIA	Horticulture Innovation Australia	SJTU	Shanghai Jiao Tong University
APPF	Australian Plant Phenomics Facility (The Plant Accelerator)	IAA	International Agroinformatics Alliance	TC-IWP	Training Centre for Innovative Wine Production
AWRI	Australian Wine Research Institute	LIEF	Large Infrastructure & Equipment Funding	TERN	Terrestrial Ecosystem Research Network
BS	The University of Adelaide's School of Biological Sciences	NCRIS	National Collaborative Research Infrastructure Strategy	UA	The University of Adelaide
CSIRO	Commonwealth Scientific & Industrial Research Organisation	NRM	Natural Resource Management	UAV	Unmanned Aerial Vehicle
DEW	Department for Environment & Water	NWGIC	National Wine and Grape Industry Centre	WA	Wine Australia
DVCR	Deputy Vice Chancellor Research	PCW	ARC Centre of Excellence in Plant Cell Walls	WIC	Wine Innovation Cluster
ECMS	Faculty of Engineering, Computer and Mathematical Sciences	PEB	ARC Centre of Excellence in Plant Energy Biology	WRI	Waite Research Institute
ECR	Early career researcher	PIRSA	Department of Primary Industries &		

For further enquiries

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