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Annual Report 2015

# Waite Research Institute

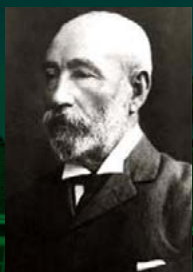
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*seek* LIGHT

# 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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# The Waite at a glance

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

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

- > The University of Adelaide's School of Agriculture, Food and Wine (AFW)
- > CSIRO (Agriculture and Land & Water)
- > South Australian Research and Development Institute (SARDI)
- > Australian Wine Research Institute (AWRI)
- > Australian Genome Research Facility (AGRF)
- > Australian Grain Technologies Pty Ltd (AGT)
- > Arris Pty Ltd
- > Urrbrae House Historical Precinct, including the Waite Arboretum
- > Food SA

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

- > Australian Centre for Plant Functional Genomics (ACPFPG)
- > Australian Plant Phenomics Facility (The Plant Accelerator)
- > ARC Centre of Excellence in Plant Cell Walls
- > ARC Centre of Excellence in Plant Energy Biology (node)
- > ARC Industrial Transformation Training Centre in Innovative Wine Production
- > FOODplus Research Centre
- > Wine Innovation Cluster (WIC)
- > ARC Industrial Transformation Research Hub for Wheat in a Hot, Dry Climate
- > The University of Adelaide/Shanghai Jiao Tong University Joint Lab for Plant Science and Breeding
- > The Mosaic Fertiliser Research Centre



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 agriculture 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 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.

**14** world-class research organisations and centres

**1100** research and technical staff

**550** undergraduate students

**295** postgraduate students

**\$120+** million research income/ expenditure per annum

**\$270** million research and teaching infrastructure

A consistent high-impact publication record

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



## Key WRI achievements in 2015

WRI initiatives and targeted investments have been highly effective in producing significant outcomes for the University's School of Agriculture, Food and Wine (AFW) and the Waite.

The 2015 calendar year saw the WRI's past strategic investment continue to bear some impressive fruit.

The establishment of The University of Adelaide and Shanghai Jiao Tong University Joint Laboratory for Plant Science and Breeding was the largest new investment of the WRI in 2015. This lab, led by Professor Dabing Zhang who holds a half-time appointment at The University of Adelaide, focusses on cereal reproduction and brings together the academic and research strengths of the two partners.

In 2015, the WRI continued to support activities and initiatives aligned with its designated goals. The School of Agriculture, Food and Wine's Research Committee was responsible for the assessment of opportunities and the allocation of funding, committing around \$420K of WRI funding to strategic projects, people development and equipment purchases.

Projects previously awarded WRI funding (in 2013) are still producing outcomes. A

number of large grants for spin-off projects, worth in excess of \$2.5m to the School and University, and at least six high-impact publications have now arisen directly from initial WRI investment over the past two years.

The WRI's highly successful Research Leadership Development Program ran for a fourth cohort of selected early-mid career researchers in 2015. This program has now ensured timely transition between two generations of research leaders, and succession from a small number of key senior researchers to a larger pool of mid-career and rising stars. Outcomes from graduates now include prestigious fellowships, three successful ARC Centre applications and an impressive array of large grants.

WRI initiatives and targeted investments have been highly effective in producing significant outcomes for the University's School of Agriculture, Food and Wine (AFW) and the Waite. With targeted use of limited resources in its six full years of operation, the WRI has

now generated, catalysed, supported or facilitated the following:

- > Publications in high-impact journals – peer-reviewed publications for the Waite are at their highest ever level
- > Increased annual competitive research grant income to the School of AFW year on year – it was again around the \$30m mark in 2015, an outstanding result in the current fiscal and R&D environment, and WRI-supported projects and people have directly assisted in securing much of this
- > Improved communication and collaboration at the Waite, as demonstrated by multi-partner bids for both internal and external opportunities, attendances at campus community building activities and new shared initiatives such as the Waite research precinct website
- > Key facilities, partnerships and initiatives such as the Genome Australia proposal, the Waite node of Adelaide Microscopy and the joint Shanghai Jiao Tong/ University of Adelaide Laboratory for Plant Science and Breeding.

The WRI's key investments, outcomes and activities in 2015 are detailed from page 9.



# Major AFW funding successes in 2015



## Australian Research Council

### **ARC Industrial Research Transformation Hub - Legumes for Sustainable Agriculture (Adelaide Node)**

**Primary Investigator:** Matt Denton\*

**Funding amount (total from all sources awarded to multiple partners, led by the University of Sydney):** \$14,485,267 over 5 years (2016-2020)

#### **Project summary:**

This project aims to 1) develop grain legumes for increased resilience to abiotic stress, 2) optimise plant resource partitioning to enhance the efficiency of yield production under stress and 3) enhance N<sub>2</sub>-fixation of grain legumes for annual and rotational crop production.

This Research Hub seeks to provide Australian growers and industrial stakeholders with improved plant materials to maximise production, environmental sustainability and profitability. In particular, improving the nitrogen delivery capacity of legumes and their resilience to abiotic stress will be an important consideration as our climate changes. Grain legumes are often grown in rotation with cereal crops for their high nutritional seed value and their unique ability to develop a self-sufficient nitrogen-fixing symbiosis with soil bacteria. Maintaining legume productivity against the challenges of climate change and the need for increased food production is important to the future of Australian agriculture.

### **ARC Discovery Grant**

**Project title:** Cell wall structure and dynamics in emerging fungal pathogens of crops

**Primary Investigator:** Vincent Bulone

**Funding amount:** \$576,450

#### **Project summary:**

The project aims to understand the role of fungal cell wall biosynthetic enzymes in cell wall stability. The fungal cell wall is a dynamic structure whose composition constantly changes in response to biotic and abiotic stresses and at different developmental stages. The devastating fungal crop pathogen *Fusarium graminearum* is responsible for the head blight disease in cereals. The project aims to understand the molecular events that govern metabolism and dynamics of the cell wall of *F. graminearum*. The project also plans to characterise the molecular

interactions involved in plant defence against fungal pathogens and fungal responses to plant immune factors called defensins. Expected long-term outcomes include the development of novel strategies for disease control and crop protection.



**Picture:** Dr Stefanie Wege

### ARC DECRA Fellowship

**Recipient:** Stefanie Wege<sup>^</sup>

**Project title:** Controlling chloride in plants

**Funding amount:** \$370,000

#### Project summary:

We currently understand very little about how the nutrient chloride is managed in plants. The mechanisms that regulate tissue chloride concentration are largely unknown and the proteins involved are unidentified. This project addresses two significant problems: 1) Chloride is one of the two ions that commonly cause salt stress, the other being sodium. Compared to sodium, our knowledge about chloride management under salt stress is scarce. 2) Chloride is a major plant solute, yet its functions and impact on plant growth under non-stressed conditions are poorly understood. Chloride is a micronutrient, required only in very small amounts, yet, there is indication that chloride concentrations above micronutrient levels are beneficial. Yield gains could be achieved by selecting for improved chloride management traits, especially in combination with the macronutrient nitrate. The anticipated outcome of this project is to equip crop improvement programs with knowledge that will increase crop tolerance to soil salinity and crop performance under non-stressed conditions.

## Grains Research & Development Corporation

**Project title:** Protecting Your Crop: Seed-bank biology of emerging weeds (2015-2020)

**Primary Investigator:** Gurjeet Gill

**Funding amount:** \$2,787,280 over 6 years

#### Project summary:

Widespread development of herbicide resistance in many Australian weed species has increased focus on integrated weed management (IWM) systems. These IWM systems require greater level of information on weed biology, including information on the longevity and general behaviour of weed seed-banks in local farming systems. Weed species can persist in farming systems due to tolerance to weed control methods (e.g. herbicide resistance) or avoidance of control methods (e.g. delayed germination due to increased dormancy). While there is extensive information on herbicide resistance in Australian weed species, there has been little work on investigating changes in the behaviour of weed seed-banks in response to management practices. We have recently published evidence for increased seed dormancy in barley grass (Fleet and Gill 2012) and brome grass (Kleemann and Gill 2013) due to selection pressure imposed by crop management practices. This increased seed dormancy in barley and brome grasses is likely to be related to selection of vernalisation genes within weed populations. It is likely that other weed species in continuously cropped systems have also evolved greater seed dormancy. Obtaining information on dormancy patterns of emerging weed species as well as the

level of persistence of weed seed-banks under current management systems would allow growers to make informed decisions about their weed management programs. This national project will undertake research on seed dormancy, seed-bank persistence, seed dispersal and competitiveness with crops of 10 important emerging weed species in each region (southern, western and northern).

## ACIAR

**Project title:** Management practices for profitable crop-livestock systems in Cambodia and Lao PDR

**Primary Investigator:** Matt Denton\*

**Funding amount:** \$1,900,000 over 4 years (2016-2019)

#### Project summary:

The aim of this project is to improve the profitability of lowland, predominantly rice-based farming systems on sandy landscapes in Laos and Cambodia by conducting research that leads to increased intensification and integration of crop and livestock systems resilience of crop and livestock production through improved forage and fodder production and improved use of water and nutrients.

<sup>^</sup> Applications that received WRI input/support/investment in development

\* Graduates of the WRI's Research Leadership Development Program

**Picture:** Rice plants ready for harvest



# The WRI's vision and objectives

The Waite Research Institute (WRI) is an initiative of The University of Adelaide to bring together world-leading researchers with a multi-disciplinary focus, to support collaboration between the Waite Campus partner and other organisations, to drive research for the benefit of Australia's agriculture, food and wine industries and to facilitate the career development of the next generation of Waite researchers.

In 2015, the WRI's activities continue to be focussed on the broad goals of:

1. Growing the quality of Waite science
2. Enhancing the reputation of the Waite as "world leading"
3. Increasing collaboration across the Waite
4. Developing Waite people for the future.

## WRI Structure and Governance

In 2015, the WRI's investment decisions were managed by the School of Agriculture, Food and Wine's Research Committee. The Research Committee, convened by Professor Diane Mather, the School's Deputy Head (Research), replaced the former WRI Science Advisory Committee and met quarterly to assess opportunities and review applications.

The WRI, in conjunction with the School's Research Committee, 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 the School of AFW, the Waite 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.

The School of AFW also has financial reporting responsibility for the WRI.



## WRI Staff

The WRI was supported by a small team of two part-time staff (1.1 FTE) in 2015.



**Professor Mike Keller**

Director



**Ms Carolyn Gadd**

Executive Officer (0.6FTE)



**Mrs Lisa Dancer**

Administrative Officer (0.5FTE)

# Director's Report

The 2015 calendar year saw the Waite Research Institute relocate to the School of Agriculture, Food & Wine Office, reflecting the close alignment and relationship between these two University business units. The 'membership' of the WRI is all research-active staff and affiliates within the School of Agriculture, Food & Wine and its related Centres at the Waite. The School's Research Committee was the body responsible for WRI investment decisions. The WRI and the School are aligned, with the WRI also playing a pivotal role in boosting research excellence and enhancing the important partnerships with the other organisations based at the Waite precinct, which is far more than a University campus.

As in previous years, the majority of the WRI's 2015 funding was spent directly on building research capacity and excellence at the Waite through investment in equipment, strategic support of key projects and the development of people. In a tight funding environment, the ability of the WRI to allocate resources to the initiatives with the greatest potential strategic benefit has strengthened research capacity at the Waite.

The 2015 year for the wider Waite was characterised by the new resolve of the Waite leaders to develop more shared and collaborative activities; the WRI has been central in supporting these efforts. A Waite leadership retreat in mid-2015 generated a range of ideas and shared priorities, the first and most important of which is a collective Waite website, [www.thewaite.org](http://www.thewaite.org), to be launched in 2016. It will be shared and used by all partners as an online entry point to the precinct, enhancing communication between and across the organisations and more clearly enunciating the Waite brand to a wide range of external stakeholders. The WRI will drive the development of this collective portal and will continue to support and resource it.

With the retirements of a handful of the Waite's research stars of the past two decades now having occurred, the WRI's investment in research leadership coaching for the most promising early to mid-career scientists within the School during the past three years has proved to be perfect timing. The WRI's highly successful Research Leadership Development Program ran again in late 2015 for a fourth cohort and

will continue to be supported by the WRI into a fifth year because its graduates have excelled, repaying the investment in their personal and career development many times over and outperforming their peers on a range of key measures.

Student enrolments into undergraduate degrees hosted at the Waite have continued to improve, with first preference numbers well up for all agriculture, food and wine degrees in 2015. Some of these students will go on to pursue research careers; if this is an indicator of the future health of the agriculture, food and wine sectors, then we are in a good place.

I am honoured to lead such an outstanding team of colleagues and research students. Together we are grateful to the University of Adelaide for its ongoing support for our research activities.

A handwritten signature in black ink that reads "Michael A. Keller".

**Professor Mike Keller**

The background of the image is a microscopic view of plant cells, showing a network of bright yellow cell walls against a dark background. A solid black rectangular box is positioned in the upper-left quadrant, containing white text.

# WRI activities and outcomes in 2015

# 1 Growing the quality of Waite science

## 1.1 Collaborative and strategic partnerships

Through targeted co-funding support for initiatives and activities of strategic importance, as well as the continuously available and well-utilised practical assistance of a professional grant application writer, the WRI continues to invest in and support a range of projects, events, individuals and groups from across the research disciplines at the Waite.

Some of the key centres, groups and activities benefiting from WRI funds in 2015 are listed below.

### ARC Industrial Transformation Training Centre for Innovative Wine Production

The WRI's support of the \$2.4 million ARC Industrial Transformation Training Centre for Innovative Wine Production continued through the Centre's second year with a \$26K contribution towards the development of postdoctoral research staff and PhD students. The Centre involves no less than 12 partner organisations, and will provide new knowledge, methods and technologies, as well as skilled researchers to work at the interface with industry, to help the wine sector tackle challenges such as climate change, compressed harvests, water scarcity, changing consumer preferences, and reducing alcohol levels.

See <https://www.adelaide.edu.au/itc-iwp/> for more details on the ARC Training Centre.

**Picture: Deputy President of Shanghai Jiao Tong University, Professor Lin Zhongqin and Deputy Vice-Chancellor (Research) at The University of Adelaide, Professor Mike Brooks, mark the official opening of the joint laboratory in Plant Science and Breeding in the Plant Genomics Centre (see page 10)**

**Opposite Picture: Wide-field fluorescence image of wheat root, taken on the new Nikon Ni-E compound microscope co-funded by the WRI)**

### The Waite node of Adelaide Microscopy

The Waite node of Adelaide Microscopy opened in September 2013 and has since provided an invaluable local service to Waite researchers. The WRI co-funds the annual costs of Adelaide Microscopy at the Waite, which include a full-time technical officer/supervisor, and has supported the purchase of two advanced microscopes and ancillary equipment through past equipment rounds. In 2015, the WRI (via the School of AFW Research Committee) allocated \$50K towards the purchase of a top-of-the-range Nikon Ni-E compound microscope with fluorescence, as well as a freeze substitution unit and a critical point dryer, both vital to addressing the particular problems of plant microscopy.

Adelaide Microscopy's Waite Facility supports researchers on the Waite Campus, providing microscopy instrumentation, expertise, technical advice and training in advanced microscopy. The facility provides a conduit to the North Terrace-based Adelaide Microscopy facility, and nationally to NCRIS-funded Australian Microscopy and Microanalysis Research Facilities.

There has been steady ongoing demand through 2014-2015 for Adelaide Microscopy's Waite Facility, in particular for the high quality confocal and stereo microscopes, by students



**Picture: Professor Dabing Zhang (centre) and his group**

and researchers from the University and co-location partners CSIRO and SARDI. High-impact research project outcomes that have been supported by this facility include pinpointing the mode of action of a male fertility gene sequence that is now being deployed through a proprietary hybrid wheat seed production platform (in a collaborative program with DuPont-Pioneer), and delineation of the changes in the barley leaf epidermal cell wall that occur in response to fungal attack.

Expertise is critical to successful research outcomes, and staff development in plant microscopy techniques has increased the Waite Facility's capabilities. The facility's supervisor, Gwen Mayo, visited two Centres for Microscopy and Microanalysis, at the University of Queensland and The University of Sydney in 2015, and regularly attends Australian Microscopy and Microanalysis conferences and workshops.



## Global engagement with priority partners

As part of a larger program of exchange and partnership between The University of Adelaide and **North Carolina State University (NCSU)**, discussions with representatives of NCSU continued in 2015 on arrangements for a 50/50 matching funding program to facilitate joint projects aligned with the Waite's strategic directions and delivering mutual benefit and complementarity. The WRI provided support to these meetings and has committed funds to the development of this partnership via travel support and seed funding for projects.

This support included enabling four academic staff from the School of AFW to participate in the Frontiers in Plant Phenomics Workshop at North Carolina State University on 1-3 June 2015. The workshop brought together plant scientists, crop breeders, and technologists from Adelaide, Nottingham, Shanghai and North Carolina, and was partly sponsored by the Academic Consortium for the 21st Century (AC21). It included tours of the NC Biotechnology Center, Monsanto, and Bayer CropScience, in addition to presentations, working sessions and discussions held at NC State. The workshop aimed to leverage complementary strengths of each participating institution and to establish a virtual research centre in plant phenomics that links biology and technology. The ultimate aim is to use advanced technologies and analytical methods to enable better understanding of how genes influence the quality and quantity of crop yields.

The University of Adelaide's partnership with **Shanghai Jiao Tong University (SJTU)** led to the establishment of a Joint Centre in Agriculture and Health in mid-2014. To date, this Centre is primarily embodied in the establishment of the Joint Laboratory in Plant Science and Breeding at the Waite's Plant Genomics Centre and the joint appointment of its leader, Professor Dabing Zhang. The Joint Lab was officially opened in September 2015.

The UA-SJTU Joint Lab in Plant Science and Breeding is substantially supported by the WRI, enabling the recruitment of a postdoctoral fellow, Dr Gang Li, and a PhD



student, Xiujuan Yang in its set-up phase. Working primarily on the mechanism behind the development of cereal inflorescences, and molecular control of male fertility in rice, the lab also promoted the substantial collaboration between UA and SJTU in the agricultural, food and health sciences by organising joint workshops between UA and SJTU. In addition, Professor Zhang developed various joint projects with Waite colleagues such as Professor Vincent Bulone, Professor Diane Mather and Dr Iain Searle. Further strengthening ties between UA and another priority partner, **The University of Nottingham**, Professor Zhang accepted the title of Honorary Professor with the latter in July 2015.

## ARC Centre of Excellence in Plant Energy Biology

The ARC Centre of Excellence in Plant Energy Biology (ARCPEB), the Adelaide node of which is led by Professor Steve Tyerman and Associate Professor Matt Gilliland, was awarded almost \$5m further funding for 2014-2020. The 2013 bid for extension (including the establishment of the Adelaide node) was supported with grant-writing assistance and incorporated work on the Gilliland GABA signalling project, both funded by the WRI. Leveraged funding from both The University of Adelaide and the SA Government strengthened the bid.

The Adelaide node of ARCPEB went from strength to strength in 2014/15, producing several high-impact publications and gaining media attention for its research (see section 1.2).

## FOODplus Research Centre

The WRI supports the FOODplus Research Centre, a joint venture between the University of Adelaide and the South Australian Health

**Picture: A skin-prick test for food allergy in a child - part of a clinical trial run by FOODplus**

and Medical Research Institute (SAHMRI). FOODplus aims to enhance the nutritional value of food plants and animals through agronomic means and works with food manufacturers to develop these into new food products and prove the clinical value of foods through large scale, high-quality, randomised, controlled trials. The range of FOODplus' research activity crosses from agriculture into human health and nutrition, with consumer research and commercialisation strands aiding in 'connecting the dots' between paddock and plate, growers and consumers, food and health. FOODplus aims to enhance the nutritional value of food plants and animals through agronomic means and works with food manufacturers to develop these into new food products and prove the clinical value of foods through large scale, high-quality, randomised, controlled trials.

In 2015, FOODplus

- > worked with Adelaide egg producer Solar Eggs to develop a new commercial range of omega-3 enhanced eggs using sustainably sourced plant oil diets
- > recruited almost 4,000 pregnant women in the world's largest randomised controlled clinical trial (the ORIP trial) to determine if fish oil reduces the incidence of early pre-term birth
- > with Potatoes South Australia carried out a survey of 1,200 Australian consumers on their knowledge and beliefs about the nutritional value of potatoes.
- > licenced the PUFACoat dried blood spot fatty acid stabilising system to Xerion Limited for worldwide commercialisation.

**Picture: The Plant Genomics Centre at the Waite**





**Picture: Salt-tolerant and salt-sensitive soybean varieties after exposure to salt**

## Genome Australia Bid

The interim extension of Commonwealth government funding to the National Collaborative Research Infrastructure Scheme (NCRIS) until June 2016 has provided both the opportunity and the imperative for the Australian genomics research community to consider longer-term directions for genomics. Genomics is now acknowledged worldwide as a transformational technology playing a fundamental role in addressing some of the most significant global issues such as human health, sustainability of the environment, food security and clean energy, and the demand in this area is projected to continue to grow exponentially. These discussions resulted in two initiatives between the Australian Genomics Research Facility (AGRF) and The University of Adelaide, co-funded by \$20K from the WRI.

The first was participation in the development of a national Genomics Australia (GA) proposal to present to the Australian Government addressing post-June 2016 needs. As part of this, AGRF and The University of Adelaide proposed the Waite would be designated the national hub for environmental and agricultural genomics via a working group, convening a series of local workshops in the thematic areas of crops, animal production and environmental as well as national workshop in Canberra on environmental genomics. The working group is continuing to develop this initiative and is contributing to the national discussions.

The second was joint investment in three small-scale projects, across areas as diverse as ancient DNA/evolutionary biology and the eco-genomics of wine terroir, designed to showcase the capability of The University of Adelaide's researchers to address issues of national significance through genomics. The projects were selected via a merit-based process and designed to demonstrate new linkages and new cross-disciplinary collaborations between the university and AGRF, provide a foundation towards an integrated genome hub in Adelaide and

develop a route for delivery of the science into benefits for industry, environment and/or community well-being.

## 1.2 Sponsored project outcomes in 2015

### Soil salinity tolerance gene identified in soybean

A collaborative project between the Waite-based node of the ARC Centre of Excellence in Plant Energy Biology (supported by WRI) and the Chinese Academy of Agricultural Sciences identified a major gene (*GmSALT3*) in soybean that confers tolerance to soil salinity. Soybean, which is the fourth largest crop in terms of global yield, is a major source of food, fuel and feed. Soybean crop losses due to soil salinity are a growing issue for meeting food security targets. *GmSALT3* functions in the root and stem to limit the movement of sodium ions to the shoot. This work, led by PhD student Yue (Julian) Qu and Matthew Gilliam from ARCPEB and Rongxia Guan and Lijuan Qiu from the Institute of Crop Science in Beijing, was published in *The Plant Journal*, highlighted on ABC Radio and numerous online science news sites in 2015.

Markers are now available to breeders to breed salt resistance in new soybean cultivars. The role of related genes in other crop species is also being investigated as a new source for improving their salt tolerance.

## Flying Doctors

The 2013 WRI-funded project on using bees to deliver biocontrol agent to grape flowers led directly to Dr Katja Hogendoorn winning a DAFF Caring for Our Country grant worth \$628K for her 'Flying Doctors' project, which also attracted significant media attention in 2015.

Partly based on this track record, Dr Hogendoorn gained further WRI support in 2015, with a \$50K per annum cash commitment for a multi-partner proposal to the Rural Industries Research & Development Corporation. This project aims to secure pollination for a more productive agricultural sector and involves research collaborators from the School of Biological Sciences and Environment Institute at The University of Adelaide, as well as the Universities of Sydney and New England and numerous horticultural industry and NRM stakeholders.

If successful, this project will increase the profitability and security of pollinator-dependent crops by managing and improving natural resources on or near farms to improve the health, diversity and abundance of managed and wild pollinators.

**Picture: The native blue-banded bee**



## High impact publications in Peer-Reviewed Journals

Key research publications accepted and/or published in 2015 arising from projects directly funded by the WRI included:

- Ramesh SR, Tyerman SD, Xu B, Bose J, Kaur S, Conn V, Domingos P, Ullah S, Wege S, Shabala S, Feijó JA, Ryan PR, Gilliham M (2015) GABA signalling modulates plant growth by directly regulating the activity of plant-specific anion transporters. *Nature Communications* 6: 7879. [ESI Highly Cited Paper, F1000 Recommended]
- Gilliham M, Tyerman SD (2016) Linking metabolism to membrane signalling: the GABA-malate connection. *Trends in Plant Science* 21:295-301
- Hogendoorn, K, Anantanawat, K & Collins, C (2015) Cap removal by honey bees leads to higher pollen rewards from grapevine flowers. *Apidologie*, doi: 10.1007/s13592-015-0419-1
- Timothy I. McLaren, Ronald J. Smernik, Mike J. McLaughlin, Therese M. McBeath, Jason K. Kirby, Richard J. Simpson, Christopher N. Guppy, Ashlea L. Doolette, and Alan E. Richardson (2015) Complex Forms of Soil Organic Phosphorus – A Major Component of Soil Phosphorus. *Environmental Science & Technology* (49) 22:13238-13245
- Zieleniecki J, Nagarajan Y, Waters S, Rongala J, Thompson V, Hrmova M, Köper I (2016) Cell-free synthesis of a functional membrane transporter into a tethered bilayer lipid membrane. *American Chemical Society* 32, 2445-2449
- Nagarajan Y, Rongala J, Luang S, Shadiac N, Hayes J, Sutton T, Gilliham M, Tyerman SD, McPhee G, Voelcker NH, Mertens HDT, Kirby NM, Sing A, Lee J-G, Yingling YG, Hrmova M (2016) A barley efflux transporter operates in a Na<sup>+</sup>-dependent manner, as revealed through a multidisciplinary platform. *Plant Cell* 28, 202-218

# 2 Enhancing the reputation of the Waite

## 2.1 Communications and media

In 2015, the WRI's investment and activities in this area were scaled back temporarily to allow for extra funding of research initiatives under the new Director, Professor Mike Keller, as well as a review of the reach and scope of various communication and outreach options. In the interim, the WRI continued to contribute to the cost of running a weekly Radio Adelaide *Sounds of Science* radio program, which featured stories and interviews from across the Faculty of Sciences, including 24 from the School of Agriculture, Food & Wine.

In the second half of 2015, in conjunction with the decision to develop and resource a shared Waite Campus website (see below), to be overseen and managed by the WRI, a new Waite Science Communications Officer position was created. To be filled in early 2016, the role will also encompass the development and translation of Waite research stories for a broad audience and to raise the profile of the Waite and agricultural science/R&D via a range of media.

## Waite website

The WRI, with support from Arris and members of the Waite Communicators Group, has resourced, designed and developed a new shared Waite website ([www.thewaite.org](http://www.thewaite.org)), which will provide a streamlined and comprehensive online portal to the Waite research precinct. The site will include 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 website was in development for the last few months of 2015, and will be officially launched in 2016.



The Waite ▾ Research ▾ Education ▾ Waite Partners ▾ Participate ▾ News & Events ▾ Employment ▾ Contact 🔍

## Waite Research among SA Science Excellence Award Finalists

Two programs based here at the Waite are finalists in the Excellence in Research Collaboration category

[Read More](#)



### Welcome to the Waite

This website is the online portal to the Waite Campus, the largest agricultural research and teaching precinct in the Southern Hemisphere. Established in 1924 and located at Urrbrae in Adelaide, South Australia, 'The Waite' is a co-located partnership of 14 complementary organisations and centres engaged in world-class R&D in plant, agricultural, food, wine and natural resources science.

In an increasingly food-insecure world with serious climate and economic challenges facing us, the vision of Peter Waite, to harness science in support of agricultural productivity, has never been more important or relevant.

The Waite is a world-renowned brand in agricultural research and education, and a leading centre of Australian research capability in wine, grains, soil and plant breeding.

The aim of this website is to bring together in one place the relevant

### EVENTS NEWS NOTICES

#### PLANT BREEDING AND GENETICS SEMINAR

Nicolaas Hendrik and Debbie Davis will be presenting their introductory seminars as part of their Ph...

AUG 8, 12:00 PM - 1:00 PM

#### MYUNI TRANSFORM ROADSHOW

As a special session of Innovative Teaching @Waite, the MyUni Transform Project Team will be coming...

AUG 8, 1:00 PM - 2:00 PM

#### TWILIGHT CONCERT AT URRBRAE HOUSE

Piano recital featuring Marjje Bejalica...

AUG 8, 5:30 PM - 7:30 PM

### Weekly Alert

To keep up to date with the latest posts and upcoming events, subscribe to our weekly email alert.

## 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.

## 'The Waite' newsletter

To better reach the Waite's large range and number of external stakeholders, including alumni, staff of relevant organisations, governments, funding bodies and primary producers, and keep them up to date with all things Waite, a quarterly School of AFW newsletter was established in early 2015. 'The Waite' newsletter incorporates news items from across the campus partners and captures the 'flavour' of the wider Waite precinct. The publication has been well received and its circulation (500 direct recipients, plus several hundred more staff and members of various associations and organisations) continues to grow. The newsletter is produced and disseminated by the WRI.

## 2.2 Awards and Honours

Major awards to AFW researchers and academics in 2015 included the following:



**Picture: Dr David Jeffery**

**Dr David Jeffery\***, Senior Lecturer in Wine Science, was awarded the Royal Australian Chemical Institute's Peter Alexander medal for 2015. The Peter W. Alexander Medal (formerly known as the Robert Catrall Medal) is awarded for excellence in pure or applied scientific work in analytical chemistry in Australia, and for service to Analytical Chemistry. This award specifically recognises these contributions from individuals within the first 10 years of their careers.

**Professor Michael McLaughlin** was elected a Fellow of the Australian Academy of Science, one of Australia's highest honours for achievement in the sciences, in 2015.

He also won the 2015 IFA Norman Borlaug Award laureate, awarded by the International Fertilizer Industry Association for research that has led to significant advances in crop nutrition. Recipients of this prestigious award must also be effective in knowledge transfer and successfully communicating the outcomes of their work to farmers. He was nominated by The Mosaic Company and was selected from an international field of ten other excellent nominees.



**Picture: Dr Caitlin Byrt**

**Dr Caitlin Byrt\*** was a 2015 recipient of the prestigious Young Tall Poppy Science Award. Her research involves engineering plants to improve their productivity for the food and fuel industries and has already contributed to significantly increasing the yields of durum wheat in saline soils. Dr Byrt has also been proactively involved in science communication and outreach activity, and as a 2015 Tall Poppy, she was engaged in community outreach programs, becoming a role model to inspire school students and the broader community about the possibilities of science.

**Dr Stefanie Wege**, a postdoctoral researcher with the ARC Centre of Excellence in Plant Energy Biology, was awarded a Discovery Early Career Research (DECRA) Fellowship AND the Edith Emily Dornwell Early Career Research Medal by The University of Adelaide during 2015 in recognition of early career research excellence.

*\*Both David and Caitlin are graduates of the WRI's Research Leadership Development Program (see section 4.1).*

## 2.3 Campus tours, events and visits

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



**Picture: Bianca Kyriacou running a lab activity with the ANZAAS students during their July 2015 site visit and tour**

The WRI continued to provide a 'front door' service to the Waite Campus in 2015, planning and hosting many tours of the Campus' joint facilities in collaboration with the Waite partner institutions. This activity supports the development of new collaborative relationships with national and international researchers and institutions.

During 2015, the WRI hosted, facilitated and/or coordinated the Waite visits of the following visitors/groups:

- > Professor Jerry Roberts, Assistant Pro-Vice-Chancellor Research, and Professor Zoe Wilson, Professor of Developmental Plant Biology, from The University of Nottingham
- > The Latin American Heads of Mission Delegation – Their Excellencies, the Ambassadors of Argentina, Brazil, Chile, Columbia, Cuba, Ecuador, El Salvador, Guatemala, Mexico, Paraguay, Peru, Uruguay and Venezuela – visited SARDI and The University of Adelaide
- > The Tumby Bay and Wolseley Agricultural Bureau groups, from the Lower Eyre Peninsula and the South East of South Australia respectively, toured the Campus and talked with researchers from various disciplines
- > A trade delegation from the Indian Ocean Rim, hosted by PIRSA and the Institute for International Trade, heard from University and SARDI speakers
- > A delegation from the College of Enology at Northwest Agriculture and Forestry University, Yangling, China
  - > A delegation from China Agriculture University, Beijing
  - > Professor Kazuhiro Sato and Professor Minoru Murata, Institute of Plant Science and Resources, Okayama University, Japan
  - > The Board and Managing Director of Elders
  - > Sixty science and maths-minded senior secondary school students from all over Australia did a site visit to the Waite as part of the ANZAAS Youth Conference in July
- > Shanghai Jiao Tong University representatives visited the Waite in August for a three-day workshop to develop plans for future activity and collaboration in the UA-SJTU Joint Research Centre for Agriculture and Health
- > Thirty Year 10 students from Scotch College, many of them boarders from rural areas
- > A high-level Shandong Province delegation, led by the Party Secretary, Mr Jiang Yikang and hosted by the Department of Premier & Cabinet and PIRSA, came to the Waite as part of a two-day program in Adelaide to develop an action plan to share R&D and build exchanges, collaboration and investment links between SA and Shandong. They visited The Plant Accelerator and laboratories at AWRI, then heard from FOODplus and SARDI researchers while tasting samples of functional foods
- > A group of retired Department of Agriculture leaders who maintain a keen interest in the sector
- > Senior executives from Limagrain and The Mosaic Company
- > A Vietnamese science and technology delegation
- > A Livestock Consultants group
- > A group of 20 international agents for the University.

Visits like these are an important part of the Waite's outreach and engagement activity, and 2015 was by far the busiest year on record in terms of demand, frequency and interest.

**Picture: Members of the Tumby Bay Agricultural Bureau group talking with Dr Peter Boutsalis about herbicide resistance in rye grass (courtesy of Graeme Stirling)**





# 3 Increasing collaboration across the Waite

The WRI continued to play a key role in increasing and enhancing collaboration at the Waite Campus during 2015 by:

- > providing a central coordination and communication point for the Waite partner organisations on a wide range of matters, including potentially developing joint initiatives, applications and other responses to external opportunities
- > stimulating collaborative activity and proposals by supporting internal competitive, merit-based funding opportunities for joint projects and shared equipment purchases
- > facilitating and supporting the Waite Strategic Leadership Group and the Waite Communicators Group
- > leading and resourcing the development of the shared Waite website (see section 2)
- > facilitating, sponsoring and organising a range of ad hoc activities that are of mutual benefit to the Waite partners or which build trust, communication, a collegiate atmosphere and shared interests. Examples include the annual Peter Waite Day event and the Research Leadership Development Program, which has now developed potential leaders and produced graduates from AFW, ACPFG and SARDI.

## 3.1 Shared investment, infrastructure and activities with Waite partners

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 (such as the WIC Building and the Waite node of Adelaide Microscopy), people and technology to mutual benefit with reduced cost and duplication.

Some examples of shared achievements and activities facilitated and supported by the WRI during 2015 are:

- > In early 2015, the WRI provided assistance and support in coordinating a well-attended series of 'Waite facilities tours' for staff and students across the Campus, to enhance awareness of other areas' research capability and availability of services as well as stimulating potential networking and collaboration.

This program will resume in 2016 and is set to become a regular feature of life at the Waite precinct.

- > The Waite leaders and other key staff from across the Campus partners gathered at a mid-year retreat to capture and define shared thinking around common goals and the key benefits arising from co-location, and to develop shared initiatives and strategies in building on them. Initiatives arising from this meeting included the development of the Waite website and a shared annual celebration of research excellence with speakers from across the Campus; videos of these inspirational sessions will be made available online. The inaugural 'Waite in the Spotlight' event is scheduled for mid-2016.
- > The WRI also coordinates and hosts regular tailored visits to the Waite by external stakeholders and VIPs, and works closely with relevant staff at the Waite partner institutions' to incorporate their facilities and personnel in these tours. In September 2015, staff from the WRI, SARDI, The Plant Accelerator, The

**Picture: Dr Bettina Berger (right) talking with members of the Shandong Province delegation, accompanied by the Minister for Agriculture, Hon Leon Bignell MP, and Professor Mike Brooks (DVC(R) at The University of Adelaide)**



Australian Wine Research Institute and FOODplus worked together on a PIRSA-hosted visit by the Shandong Province Party Secretary and a high-ranking delegation accompanying him from China to examine ways of strengthening Shandong's sister-state ties with South Australia.

In addition, the development throughout 2015 of the South Australian Food Innovation Centre (SAFIC) involved leaders and senior staff from the Waite partners as well as a number of external stakeholders. SAFIC won funding and support by the State Government and will have its headquarters located at the Waite from 2016. The Director of the WRI, Professor Mike Keller, continues to be involved in the Steering Committee of the new Centre.

**Picture: Urrbrae House - former family home of Peter Waite**

### 3.2 Waite Strategic Leadership Group

The Waite Strategic Leadership Group is a consultative and advisory group comprised of 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 support services.

### 3.3 Peter Waite Day - Building the Campus Community

Peter Waite Day is an informal campus community-building exercise 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, the 2015 event was enjoyed by around 140 staff and higher degree students.



# 4 Developing Waite people for the future

If an organisation's most valuable resource is its people, then the WRI has performed a valuable service for the University's Waite contingent, investing in the leadership training and mentoring of the School of AFW's early to mid-career researchers since 2011.

## 4.1 Targeted Support of Early to Mid-Career Researchers

In 2015, a fourth cohort of 10 early to mid-career Waite researchers undertook the WRI's acclaimed Research Leadership Development Program. This program was developed by the WRI in conjunction with executive coach Karilyn Fazio of the Impetus Team and tailored especially for the Waite's needs and research scientists working in a University environment. It consists of a two-day workshop and follow up small group coaching to help participants develop a research/career vision, change the work paradigm, harness ambition and communicate with different audiences.

Past graduates of the WRI's Research Leadership Development Program are now prominently and regularly featuring in promotion rounds, grant successes, high-impact publication results, media and industry engagement activities and awards.

The School of AFW and the Waite more broadly are reaping the rewards of investment in this younger generation of researchers.

As well featuring among significant award recipients (see section 2.2), graduates of the RLDP also achieved the following career developments and highlights in 2015:

- > **Kerry Wilkinson, Cassandra Collins, David Jeffery** and **Paul Grbin**, developed the highly successful MOOC (Massive Online Course), *Wine101x: World of Wine – from Grape to Glass*. This was honoured with both the SA Interactive Media Excellence Award and the Australian Wine Communicators (Education) Award during 2015. The course has now been undertaken by more than 50,000 people worldwide and run three times due to popular demand.
- > **Vladimir Jiraneck**, Director of the ARC Industrial Transformation Training Centre for Innovative Wine Production, led proceedings at the Centre's official launch in May 2015, with the Federal Minister for Higher Education, Hon Christopher Pyne MP, and other dignitaries in attendance to mark the occasion.
- > **Matt Gilliham**, currently an ARC Future Fellow supported by the WRI, was part of a team which won an International Wheat Yield Partnership/GRDC project grant worth AUD\$4m over three years. He also presented at high-profile plant science international conferences in 2015, including the Society of Experimental Botany Annual Meeting, the International Congress on Plant Molecular Biology and a Global Plant Council Plant Stress Forum, and had a prestigious *Nature Communications* paper published.

- > **Beverly Mühlhäusler** commenced a four-year NH&MRC Career Development Fellowship worth \$455,452 on breaking the intergenerational cycle of obesity through nutritional interventions.
- > **Matt Tucker**, an ARC Future Fellow, had a paper published in *New Phytologist*, the second highest-impact research journal in plant science, and was a joint investigator in successful grant applications worth more than \$2.6m.
- > **Rachel Burton** was promoted to Professor in 2015, acknowledging her dedication, leadership and expertise across a range of roles and responsibilities.
- > **Stuart Roy** at the ACPFG is leading an Australian team on another International Wheat Yield Partnership (IWYP) collaborative project worth US\$2m over three years to enhance the yield of bread wheat under optimal growth conditions. The Australian component of the project, which commenced in early 2016, will receive AUD\$1.4m funding from the GRDC.

## 4.2 Joint training opportunities

In conjunction with SARDI, the WRI supported an on-site workshop in November 2015 for 20 AFW and SARDI researchers run by the Institute of Public Administration Australia (SA Division) on how to construct a business case. Using their own initiatives and projects as case studies, researchers worked together in small teams to develop and structure their ideas for presentation to potential industry partners, government departments and funding bodies.

As well as professional development through exposure to an increasingly important skill for researchers and academics, the full-day workshop provided an excellent networking opportunity between staff from the two organisations.

**Picture: Associate Professor Matt Gilliham**



# WRI and the Waite partnerships

The Waite Research Institute keeps alive the vision of Peter Waite by supporting the collective interests of the Waite Campus organisations. We do this by facilitating collaborative activity and communications, sponsoring and organising campus-community building exercises like Peter Waite Day and supporting collaborative initiatives such as conferences and workshops that bring the Waite organisations together or bring other scientists from the national and international arena to the Waite.

The Waite partnerships are an integral and valuable part of the Campus and its collegiate culture.

The WRI facilitates strategic partnerships on the Waite Campus.

## University partners

The WRI's primary partner on the Waite Campus is The University of Adelaide's School of Agriculture, Food and Wine.



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 70 academic and research 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 is involved in a number of specialist research centres and entities:**

## FOODplus

RESEARCH CENTRE

FOODplus Research Centre

[www.adelaide.edu.au/foodplus](http://www.adelaide.edu.au/foodplus)

LOCATION: Waite Main Building, Waite Road, Waite Campus, Urrbrae



The FOODplus Research Centre, a unit within the School of Agriculture, Food and Wine, is a joint venture between the University of Adelaide and the South Australian Health and Medical Research Institute (SAHMRI), and has research programs in human health food and nutrition with a particular focus on young families. FOODplus aims to enhance the nutritional value of food plants and animals through agronomic means and works with food manufacturers to develop these into new food products and prove the clinical value of foods through large scale, high-quality, randomised, controlled trials.



Australian Centre for Plant Functional Genomics (ACPFPG)

[www.acpfg.com.au](http://www.acpfg.com.au)

LOCATION: Plant Genomics Centre, Hartley Grove, Waite Campus, Urrbrae



The Australian Centre for Plant Functional Genomics Pty Ltd (ACPFPG) is one of the largest cereal crop genomics facilities in the southern hemisphere, employing more than 70 research scientists and staff. ACPFG works on delivering yield and yield stability to Australian breeders and growers in wheat and barley with a focus on yield loss due to environmental stresses. The company has a number of research projects including a longstanding research collaboration with DuPont Pioneer. The Centre also hosts the University of Adelaide's ARC Transformational Hub on Wheat in a Hot and Dry Climate which is jointly funded by ARC and GRDC with strong industry participation by Australian breeding companies. ACPFG is currently funded by the Grains Research and Development Corporation, South Australian Government and The University of Adelaide.

## Plant Cell Walls

ARC Centre of Excellence



ARC Centre of Excellence in Plant Cell Walls (PCW)

<http://www.plantcellwalls.org.au>

LOCATION: Level 4, WIC Building, cnr Paratoo Road and Hartley Grove, Waite Campus, Urrbrae

The ARC Centre of Excellence in Plant Cell Walls, established in 2011, is a seven-year collaboration between the Universities of Adelaide, Melbourne and Queensland in partnership with numerous domestic and

international institutions. The Centre is hosted by the University of Adelaide at its Waite Campus and has nodes at both Melbourne and Queensland Universities.

The Centre's mission is to advance the fundamental scientific understanding of plant cell wall biology with particular focus on grasses and cereals. The overarching aim of the Centre is to understand how plants regulate the synthesis, assembly, re-modelling and degradation of their cell walls during normal development and in response to the environment. This fundamental knowledge, considered a 'holy grail' in Plant Sciences, is linked with socially, environmentally and commercially important applications in areas such as food security, human health, and biomass utilisation for renewable energy production.

The Centre activities are integrated in three interconnected programs underpinned by state-of-the-art platform technologies, implemented and made available across all three geographic nodes to maximise synergistic interactions and outputs not be possible through individual 'traditional' research groups.

In early 2015, Professor Vincent Bulone from KTH University, Sweden, commenced as Centre Director to replace Geoff Fincher who retired in late 2014. Professor Bulone is building on existing collaborations and capacities to further enhance the Waite's international reputation.



Australian Plant Phenomics Facility

Australian Plant Phenomics Facility (APPF) - The Plant Accelerator

[www.plantphenomics.org.au](http://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; factors including the genetic make-up of the plants, the soil conditions, chemical and nutrient treatments, and environmental stresses. This facilitates an acceleration of crops 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.



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

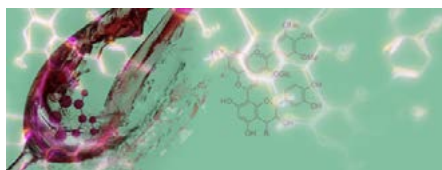
[www.plantenergy.edu.au](http://www.plantenergy.edu.au)

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 Associate Professor Matthew Gilliham as Chief Investigators

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 to fund the Centre 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.

Research highlights from 2015 included the discovery that GABA (a known animal neurotransmitter) could regulate the activity of ion channels from the aluminium activated malate transporter (ALMT) family, leading to altered plant growth. This work culminated in a publication in Nature Communications. Research on the role of cation-chloride cotransporters in ion homeostasis and salt tolerance in grapevines was published in Plant Physiology.



### ARC Industrial Transformation Training Centre in Innovative Wine Production

<http://www.adelaide.edu.au/tc-iwp/>

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

Based at The University of Adelaide's Waite Campus, the ITTC for Innovative Wine Production has been made possible by \$2.4 million from the Australian Research Council - Industrial Transformation Research Program, additional support from Wine Australia and \$1.2 million in cash and in-kind support from the project partners. The Training Centre will provide new knowledge, methods and technologies as well as highly skilled PhD and postdoctoral researchers to tackle the main challenges for the Australian wine industry – climate warming, water restrictions, changing consumer preferences and rising wine alcohol content – leaving the industry better placed to make the wines that the market and consumers want.

Incorporating 12 partners (including all of the WIC members – see below), the Centre represents a unique and exciting training opportunity for 14 PhD and 4 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

[www.wineinnovationcluster.com](http://www.wineinnovationcluster.com)

*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. 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; a 2012 audit showed 62 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. Since it was established in 2008, the WIC partners have worked on more than 35 collaborative projects that have attracted more than \$27m external funding; strong industry partnerships on many of them attest to their relevance.



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

<http://www.wheatHub.com.au/>

*LOCATION: Plant Genomics Centre, Hartley Grove, Waite Campus, Urrbrae*

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 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.

It is funded by the Australian Government through the Australian Research Council's Industrial Transformation Research Hubs scheme and the Grains Research and Development Corporation. Partners include breeding companies Australian Grain Technologies, LongReach Plant Breeders and Intergrain, the Universities of Adelaide, Sydney, South Australia and the Australian Centre for Plant Functional Genomics.

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 knowhow to breeding programs
- > Elucidating mechanisms and molecular markers for combined heat and drought tolerance by exploring genetic diversity in wheat
- > 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

## Co-location partners

The Waite Campus of The University of Adelaide 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 a recent example of the latter but there are also numerous bilateral links. The co-location model that epitomises the Waite Campus is universally admired and has helped maintain the reputation of the campus, and therefore the University, as the leading academic agricultural research precinct in Australia.



### Commonwealth Scientific and Industrial Research Organisation (CSIRO)

[www.csiro.au](http://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 focussed 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 <http://www.thewaite.org/waite-partners/csiro/>



### South Australian Research and Development Institute (SARDI)

[www.sardi.sa.gov.au](http://www.sardi.sa.gov.au)

*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 focusses 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.

During 2015, SARDI and GRDC negotiated a five-year, multi-program bilateral funding agreement that is providing a \$50M commitment to grains research in SA and nationally. Other highlights from the year were the Australian Pastures Genebank's collection and consolidation of pastures germplasm from around Australia, and researchers at SARDI's Molecular Diagnostic Centre launching a newly developed DNA test for assessing the risk of soil-borne diseases in potato crops.



## The Australian Wine Research Institute

### Australian Wine Research Institute (AWRI)

[www.awri.com.au](http://www.awri.com.au)

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



The Australian Wine Research Institute (AWRI) is the Australian grape and wine industry's own 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 Wine Innovation Cluster located at the Waite Research Precinct in Adelaide. 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 conducting problem-solving investigations
- > Presenting roadshow workshops and seminars in Australian wine regions
- > Delivering technical information via the John Fornachon Memorial Library, the AWRI website and regular email bulletins
- > Producing publications including an Annual Report, AWRI Technical Review and the Agrochemicals 'Dog Book'

- > 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.



### Australian Grain Technologies Pty Ltd (AGT)

[www.ausgraintech.com](http://www.ausgraintech.com)

*LOCATION: Level 1, WIC Building, Paratoo Road East, Waite Campus, Urrbrae*

Development Corporation (GRDC), the South Australian Government (PIRSA/SARDI) and the University of Adelaide (UA).

The aim of AGT's inaugural shareholders initially was to ensure the long term future of wheat breeding in South Australia. Wheat breeding in South Australia was formerly undertaken at both the Roseworthy and Waite Campuses of the University of Adelaide. The Roseworthy Campus program is in fact the longest continually run wheat breeding program in Australia, running now for more than 130 years. Since then, these have been consolidated through a strategic program of licencing arrangements and mergers into one very large scale national program, thereby creating greater critical mass and economies of scale.

Currently, AGT has four major plant breeding stations, Northam (WA), Roseworthy (SA), Wagga Wagga (southern NSW) and Narrabri (northern NSW). Breeders and support staff based at each of these centres aim to address the needs of local growers through new and improved varieties. We also have a team of highly skilled regionally based marketing and seed production managers who are continuously seeking feedback from growers on how we can better meet their needs, while an in-house quality assessment laboratory ensures that growers using our varieties can meet the needs of domestic and international markets.



### Australian Genome Research Facility (AGRF)

[www.agrf.org.au](http://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.



### Arris Pty Ltd

[www.arris.com.au](http://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.



# The WRI and the Waite's Future



## Message from the Director

The Australian Government announced the new National Science and Innovation Agenda in late 2015. It places emphasis on alignment between scientific and educational investments on the one hand and the imperative to drive innovation, both economical and scientific, on the other. At the same time, the University of Adelaide was developing its new strategic plan, Research for Impact. The Waite Research Institute is already well aligned with both of these strategies, and hence is poised to play a key role in research that will bolster Australia's agriculture, food and wine industries in future.

In the next year we will seek broader engagement wherever appropriate. This will include working with other University research centres – the Robinson Research Institute, the Centre for Nanoscale Biophotonics, and the Centre for Global Food and Resources, to name a few. We will also continue to pursue closer collaboration with partners on the Waite Campus. The new Waite Precinct web site and related internal communications will enhance communications with our partners, thereby providing a foundation for broader collaboration. And we will continue to work together with international partners, particularly selected key partners universities – Shanghai Jiao Tong, Nottingham and North Carolina State. We will extend our research capability by working with partners that have complementary expertise and facilities, as well as linkages with industries throughout the world. Our broader aim will be to undertake multidisciplinary research that delivers effective solutions to the big problems of industry and society as they relate to our research on agriculture, food and wine.

**Professor Michael Keller**

**J.A.T. Mortlock Professor of Plant Protection**

A handwritten signature in black ink that reads "Michael G. Keller". The signature is written in a cursive style.







# Appendices

## Appendix 1

### WRI Members

(Active AFW researchers in 2015)

Able, Amanda	Cu, Suong	Grbin, Paul
Able, Jason	Culbert, Julie	Habili, Nuredin
Andelkovic, Ivan	Danner, Lukas	Haefele, Stephan
Asenstorfer, Robert	David, Rakesh	Hanold, Dagmar
Baldock, Jeffrey	Davidson, Jennifer Anne	Hayes, Julie
Bartowsky, Eveline	Davies, Kerrie	Henderson, Sam
Bastian, Susan	De Bei, Roberta	Henschke, Paul
Baumann, Ute	Degner, Sophia	Herderich, Markus
Berger, Bettina	Degryse, Fien	Hettiarachchi, Ganga
Betts, Natalie	Delaporte, Kate	Heuer, Sigrid
Bianco-Miotto, Tina	Denton, Matthew	Hogendoorn, Katja
Borysyuk, Nikolai	Dolman, Fleur	Hrmova, Maria
Bose, Jayakumar	Doolette, Ashlea	Hsieh, Yves
Boutsalis, Peter	Drew, Damien	Huang, Chunyuan
Breen, Jimmy	Dry, Peter	Islam, A
Brien, Chris	Dundas, Ian	Ismail, Ismail Ahmed
Buhl, Jerome	Eales, Kathryn	Jefferies, Stephen
Bulone, Vincent	Eglinton, Jason	Jeffery, David
Burton, Rachel	Facelli, Evelina	Jenner, Colin
Byrt, Caitlin	Fincher, Geoffrey	Jiranek, Vladimir
Cao, Shifeng	Fleet, Benjamin	Jones, Graham
Cargill, Margaret	Fleury, Delphine	Kaiser, Brent
Cavagnaro, Timothy	Ford, Caroline	Kalenahalli, Yogendra
Chalmers, Kenneth	Ford, Christopher	Kastner, Christine
Churchman, Gordon	Fox, Rebecca	Keller, Michael
Clarke, Stephen	Franco Garcia, Alex	Khoo, Kelvin
Coleman, Desmond	Garcia, Melissa	Kleemann, Samuel
Collins, Cassandra	Gardner, Jennifer	Koltunow, Anna
Collins, Helen	Garnett, Trevor	Kookana, Rai
Collins, Nicholas	Genc, Yusuf	Koopman, Darren
Coqui da Silva, Rodrigo	Gibson, Robert	Kovalchuk, Nataliya
Coventry, David	Gill, Gurjeet	Kravchuk, Olena
Coventry, Stewart	Gilliam, Matthew	Krishnan, Mahima
Cozzolino, Daniel	Glatz, Richard	Kuchel, Haydn
Croxford, Adam	Gogel, Beverley	Langridge, Peter
Crump, Anna Marie	Grant, Cameron	Langridge-Reimold, Ursula
		Leigh, Roger
		Li, Gang
		Li, Ruyi
		Li, Yongle
		Little, Alan

Long, Yu	Rengasamy, Pichu	Verbyla, Arunas
Longbottom, Mardi	Riggs, Karina	Walker, Michelle
Loveys, Beth	Ristic, Renata	Walker, Robert
Lyons, Graham	Rodriguez Lopez, Carlos	Wallwork, Hugh
Malone, Jenna	Roy, Stuart	Watson, Tommaso
March, Timothy	Sadras, Victor	Watson-Haigh, Nathan
Mares, Daryl	Saucier, Cedric	Wege, Stefanie
Marschner, Petra	Schilling, Rhiannon	White, Thomas
Mason, Sean	Schultz, Carolyn	Whitford, Ryan
Mather, Diane	Schwerdt, Julian	Wilkinson, Kerry
Mayo, Gwenda	Scott, Eileen	Wilkinson, Mike
McBeath, Therese	Shavrukov, Yuri	Wirthensohn, Michelle
McDonald, Glenn	Shelden, Megan	Wood, Katie
McLaren, Tim	Shi, Bu-jun	Xu, Bo
McLaughlin, Michael	Shirley, Neil	Zerner, Michael
McNeill, Ann	Singh, Rohan	Zhang, Dabing
Melino, Vanessa	Skouromounis, George	Zhou, Jo
Milligan, Andrew	Smernik, Ronald	Zhou, Yi
Mrva, Kolumbina	Smith, Andrew	Zhu, Ying
Muhlack, Richard	Smith, Sally	Zhu, Yongguan
Muhlhausler, Beverly	Sornaraj, Pradeep	Zwer, Pamela
Navarro, Divina	Sosnowski, Mark	
Niimi, Jun	Stockley, Creina	
Nuberg, Ian	Sucheki, Radoslaw	
Okada, Takashi	Sumby, Krista	
Okamoto, Mamoru	Sundstrom, Joanna	
Oldach, Klaus	Sutton, Timothy	
Ovchinnikova, Evgenia	Sznajder, Beata	
Pagay, Vinay	Tate, Max	
Paull, Jeffrey	Taylor, Dennis	
Pearson, Allison	Taylor, Julian	
Penfold, Chris	Tilbrook, Joanna	
Petrie, Paul Robert	Timmins, Andy	
Petrovic, Tijana	Topping, David	
Philp, Joshua	Tricker, Penny	
Plett, Darren	Tucker, Matthew	
Potumarthi, Ravichandra	Tyerman, Stephen	
Preston, Christopher	Unkovich, Murray	
Qiu, Jiaen	Vandeleur, Rebecca	
Ramesh, Sunita	Vassos, Elysia	
Randles, John		

## Appendix 2

### 2015 Financial Statements

Expenditure	
	2015 Actual
<b>WRI Areas of Activity</b>	<b>\$</b>
Growing the quality of Waite science	542,207
Enhancing the Waite's reputation	11,269
Enhancing Waite collaboration	20,000
Developing Waite people for the future	40,389
<b>Subtotal</b>	<b>613,865</b>
Staffing & Office Administration	115,371
<b>Total Spend in 2015</b>	<b>\$729,236</b>

Income (to members of WRI)	
	2015 Actual
	<b>\$</b>
Category 1	20,279,298
Category 2	2,405,514
Category 3	8,117,201
Category 4	-
<b>Total in 2015</b>	<b>30,802,014</b>



## Appendix 3

### 2015 Publications

To view or download the full list of AFW publications from the 2015 calendar year go to [http://www.adelaide.edu.au/wri/news/AFW\\_2015\\_publications.pdf](http://www.adelaide.edu.au/wri/news/AFW_2015_publications.pdf)



**Book Chapters**  
**11**



**Journal Articles**  
**342**



**Conference Proceedings** **23**



**Patent** **1**

## Appendix 4

### List of Relevant Acronyms

ACPMG	Australian Centre for Plant Functional Genomics	LIEF	Large Infrastructure & Equipment Funding	WIC	Wine Innovation Cluster
AFW	The University of Adelaide's School of Agriculture, Food & Wine	NCRIS	National Collaborative Research Infrastructure Strategy	WRI	Waite Research Institute
AGRF	Australian Genome Research Facility	NCSU	North Carolina State University		
AGT	Australian Grain Technologies	PCW	ARC Centre of Excellence in Plant Cell Walls		
AGWA	Australian Grape & Wine Authority	PEB	ARC Centre of Excellence in Plant Energy Biology		
ARC	Australian Research Council	PIRSA	Department of Primary Industries & Regions South Australia		
APPF	Australian Plant Phenomics Facility (The Plant Accelerator)	PISC	Primary Industries Standing Committee		
AWRI	Australian Wine Research Institute	RIRDC	Rural Industries Research and Development Corporation		
CSIRO	Commonwealth Scientific & Industrial Research Organisation	SAFIC	South Australian Food Innovation Centre		
DEWNR	Department of Environment, Water & Natural Resources	SARDI	South Australian Research & Development Institute		
EIF	Education Investment Fund	SJTU	Shanghai Jiao Tong University		
GRDC	Grains Research & Development Corporation	UA	The University of Adelaide		
HIA	Horticulture Innovation Australia				



## For further enquiries

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