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School of Agriculture, Food and Wine

ARC Training Centre for Innovative Wine Production Annual Report 2014

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THE ARC TC-IWP CENTRE



*All photos supplied by Duc-Truc Pham



Louis Pasteur

"A bottle of wine contains more philosophy than all the books in the world." – Louis Pasteur

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Director's report

I am very pleased to present this the first Annual Report for the Australian Research Council's Training Centre for Innovative Wine Production. The Training Centre has been made possible by \$2.4 million from the ARC's Industrial Transformation Research Programme, with additional support from the Australian Grape & Wine Authority (AGWA) and \$1.2 million in cash and in-kind support from project partners. It highlights the substantial support given to wine research not only from government but from our partner institutions and the Australian wine industry.

Our aims are to build knowledge and technologies that will help the wine industry face the challenges of climate warming, water limitations, changing consumer preferences and increasing production costs. The key objectives are to better manage flavour and alcohol content in Australia's wines despite these pressures.

We have a portfolio of 18 projects which together take a 'grape to glass', multi-faceted approach to tackling these key issues facing the industry. We aim to underpin and enable more profitable grape-growing and winemaking while achieving the desired flavour and alcohol balance that consumers want.

The Centre represents a unique and exciting training opportunity for strengthening links between research, industry and education to produce highly skilled PhD and postdoctoral researchers honed for working at the industry/research interface. The knowledge and technologies arising from the Centre will help the industry make the best wines that will be sought after domestically and internationally.



The process for recruiting students and postdocs began in late 2013 and by the end of 2014 all researchers were well established in their projects. The vintage of 2015 therefore represents the first vintage for which a fully integrated contingent of all researchers has been possible. In celebration of this, the Centre was officially launched at the Waite Campus on 20 May 2015 by the Hon Christopher Pyne, Minister for Education and Training. The launch showcased a number of activities and outcomes related to our project as well as a bottling of our first research wine. The launch and news of our plans and activities created much media attention both locally and internationally.

We look forward to the successes in research, development, training and outreach which will arise in the coming years.

Professor Vladimir Jiranek
Director

Overview

The Australian Research Council (ARC) Training Centre for Innovative Wine Production (TC-IWP) has been established at The University of Adelaide. The centre is one of only four Training Centres funded in the first round of the ARC's Industrial Transformation Research Program, which is designed to foster close partnerships between university-based researchers and the industry members who benefit from their research outcomes.

The TC-IWP has been formed with support from industry partners and the Australian Grape and Wine Authority (AGWA) and links the scientific and industrial expertise, contributions and facilities of the University of Adelaide, Charles Sturt University, the Australian Wine Research Institute, CSIRO, NSW Department of Primary Industries, SA Research and Development Institute, BioInnovation SA, Treasury Wine Estates Vintners Ltd, Laffort Oenologie Australia Pty Ltd, Lowe Wines Pty Ltd, Memstar Pty Ltd, Tarac Technologies Pty Ltd and Sainsbury's Supermarkets Ltd. The centre is directed by Professor Vladimir Jiranek (UA) with the help of the TC-IWP Advisory Committee.

Our mission

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, such as climate warming, water restrictions, changing consumer preferences and rising wine alcohol content. Earlier grape ripening and more frequent hot weather events tend to compress vintages and lead to over-ripening and high sugar accumulation in grape berries. Over-ripened grapes lose their fresh fruit sensory profiles producing wines that can be overly alcoholic, "hot" and unbalanced. The approach that the TC-IWP will take in order to reduce alcohol levels and enhance wine flavor profile will include interdisciplinary strategies with specific research aims in the areas of viticulture, microbiology, winemaking, wine processing and consumer studies.

The specific aims are:

1. Through the vineyard: curb sugar accumulation, accelerate the development of flavour compounds and minimise taint compounds in the grape.
2. At the winery: remove sugar prior to fermentation, divert sugar away from alcohol, improve the reliability and reduce the duration of high sugar fermentations, and enhance the sensory properties of wine.
3. Post fermentation: selectively remove alcohol and develop additives to adjust levels of sensory compounds in wines from under-ripened grapes or lost from wines of lower(ed) alcohol content.
4. Define current market and consumer perceptions and preferences for lowered-alcohol wine and use this knowledge to inform the production process.

These topics will be addressed through an integrated whole-of-production-chain approach that starts in the vineyard, integrates vinification and post-vinification, and finishes with wine consumers.

Facilities

The TC-IWP has established links and collaboration with all 12 partner organisations, whose contribution in expertise and facilities is essential for the TC-IWP research projects. The base for the Centre, the University of Adelaide's Waite Campus, is home to the Wine Innovation Cluster, which includes UA, AWRI, CSIRO and SARDI. It is one of the largest concentrations of grape and wine research facilities in the world.



The Wine Innovation Central Building is home to the ARC Training Centre and houses world-class research laboratories and other state of the art research facilities.

It is also home to AWRI with SARDI and CSIRO partners located in adjacent buildings, thereby enhancing collaboration and communication opportunities and the optimum use of specialist equipment.

The building, a joint \$30 million construction, was completed and opened in 2008. It has extensive facilities for vine physiology, biochemistry, molecular biology, microbiology and sensory studies as well as process testing laboratories.



The University of Adelaide's Hickinbotham Roseworthy Wine Science Laboratory at the Waite campus is a state-of-the-art winery and research facility doing valuable work for the wine industry, through education, research and service provision. Students, researchers, laboratory staff and wine industry professionals are all involved in the winemaking, in a collaboration aimed at furthering quality, knowledge, and sharing of information, not to mention turning out award-winning wines.

Wine production started in 1998 with less than 10 tonnes being processed, and now has a capacity of nearer 200 tonnes, although the annual average is currently closer to 120 tonnes. There are more than 1,000 tanks, around 100 of which hold over 200 litres. The lion's share is under 200 litres for small batches to accommodate the various requirements for teaching, research, and catering to industry.

Official Centre launch

On the 20th May 2015 the Hon Minister Christopher Pyne MP, Minister for Education and Training, officially launched the new ARC Training Centre for Innovative Wine Production, in the Hickinbotham Roseworthy Wine Science Laboratory (the Winery) at the University of Adelaide's Waite Campus.



From left: Prof Aidan Byrne, Minister Christopher Pyne MP, Prof Vladimir Jiranek, Prof Mike Keller.

Minister Pyne was met by Prof Warren Bebbington, Vice-Chancellor and President of the University of Adelaide, Prof Mike Keller, Dean of Waite and Prof Vladimir Jiranek, Director of the Centre. Professor Aidan Byrne, CEO of the Australian Research Council, The Hon David Ridgway MLC, Shadow Minister for Agriculture, Food & Fisheries and Dr Andrew Southcott, Federal Member for Boothby also attended the launch.

The Vice-Chancellor spoke about the central role of the University and the campus in the history of Australia's wine research and industry. The pivotal role of the campus into the future is underscored with initiatives such as this Centre. Prof Jiranek highlighted the research activities and key objectives of the new Centre and acknowledged the support of its industry partners.



From left: Minister Christopher Pyne MP, Prof Aidan Byrne and Vice-Chancellor Warren Bebbington. Minister Pyne officially launched the Centre by unveiling two bottles of wine from the Centre's first vintage.

The Centre will strengthen links between research, industry and education and produce highly skilled PhD and postdoctoral researchers.

"Obtaining wine industry integrated support, knowledge and advice is invaluable in ensuring the delivery of beneficial outcomes and the future success of the Training Centre," said Prof Jiranek.



Professor Jiranek also acknowledged the importance of the ARC's Industrial Transformation Research Program. "ARC funding has been absolutely critical not just from the dollars point of view allowing us to do the work, but the structure of the program is very important. It allows us to take on over a dozen students and post-docs, which then allows us to simultaneously undertake the multifaceted research projects we have. We're trying to optimise the whole production chain, from the vineyard through to consumers, and I'm not aware of any other scheme that allows us to do that in the way that this particular scheme does."

Minister Pyne and VIP guests were taken on a tour of the Winery facilities and then introduced to some of the Centre's PhD students who spoke in brief about their research with the aid of some interactive displays.

Minister Pyne and Prof Aidan Byrne both affirmed their support for the Centre and the future investment in wine related research activities.



PhD students showcased their projects to Minister Christopher Pyne and VIP guests.





*"Making good wine is a skill.
Fine wine is an art."*

Robert Mondavi



People

Professor Vladimir Jiranek (Director)	The University of Adelaide
Professor Stephen Tyerman	The University of Adelaide
Professor Dennis Taylor	The University of Adelaide
Professor Pascale Quester	The University of Adelaide
Associate Professor Kerry Wilkinson	The University of Adelaide
Associate Professor Paul Grbin	The University of Adelaide
Associate Professor Susan Bastian	The University of Adelaide
Associate Professor Rachael Burton	The University of Adelaide
Associate Professor Christopher Ford	The University of Adelaide
Dr David Jeffery	The University of Adelaide
Dr Roberta Crouch	The University of Adelaide
Professor Alain Deloire	Charles Sturt University
Dr Leigh Schimdtke	Charles Sturt University
Dr John Blackman	Charles Sturt University
Dr Peter Torley	Charles Sturt University
Associate Professor Suzy Rogiers	NSW Department of Primary Industries
Associate Professor Markus Herderich	AWRI
Dr Paul Smith	AWRI
Professor Rob Walker	CSIRO
Associate Professor Victor Sadras	SARDI
Dr Theunes Johannes van der Westhuizen	Laffort Oenologie Australia Pty Ltd
Dr Vanessa Stockdale	Treasury Wine Estates Vintners Ltd

Advisory Board 2014

Professor Vladimir Jiranek (Director)	The University of Adelaide
Professor Stephen Tyerman	The University of Adelaide
Professor Alain Deloire	Charles Sturt University
Associate Professor Markus Herderich	AWRI
Professor Rob Walker	CSIRO
Associate Professor Suzy Rogiers	NSW Department of Primary Industries
Associate Professor Victor Sadras	SARDI
Dr Theunes Johannes van der Westhuizen	Laffort Oenologie Australia Pty Ltd
David Lowe	Lowe Wines Pty Ltd
David Wollan	Memstar Pty Ltd
Dr Paul Petrie	Treasury Wine Estates Vintners Ltd
Mark Anderson	Tarac technologies Pty Ltd
Ryan Carter	Sainsbury's Supermarkets Ltd
Dr John Harvey	BioSA (observer)



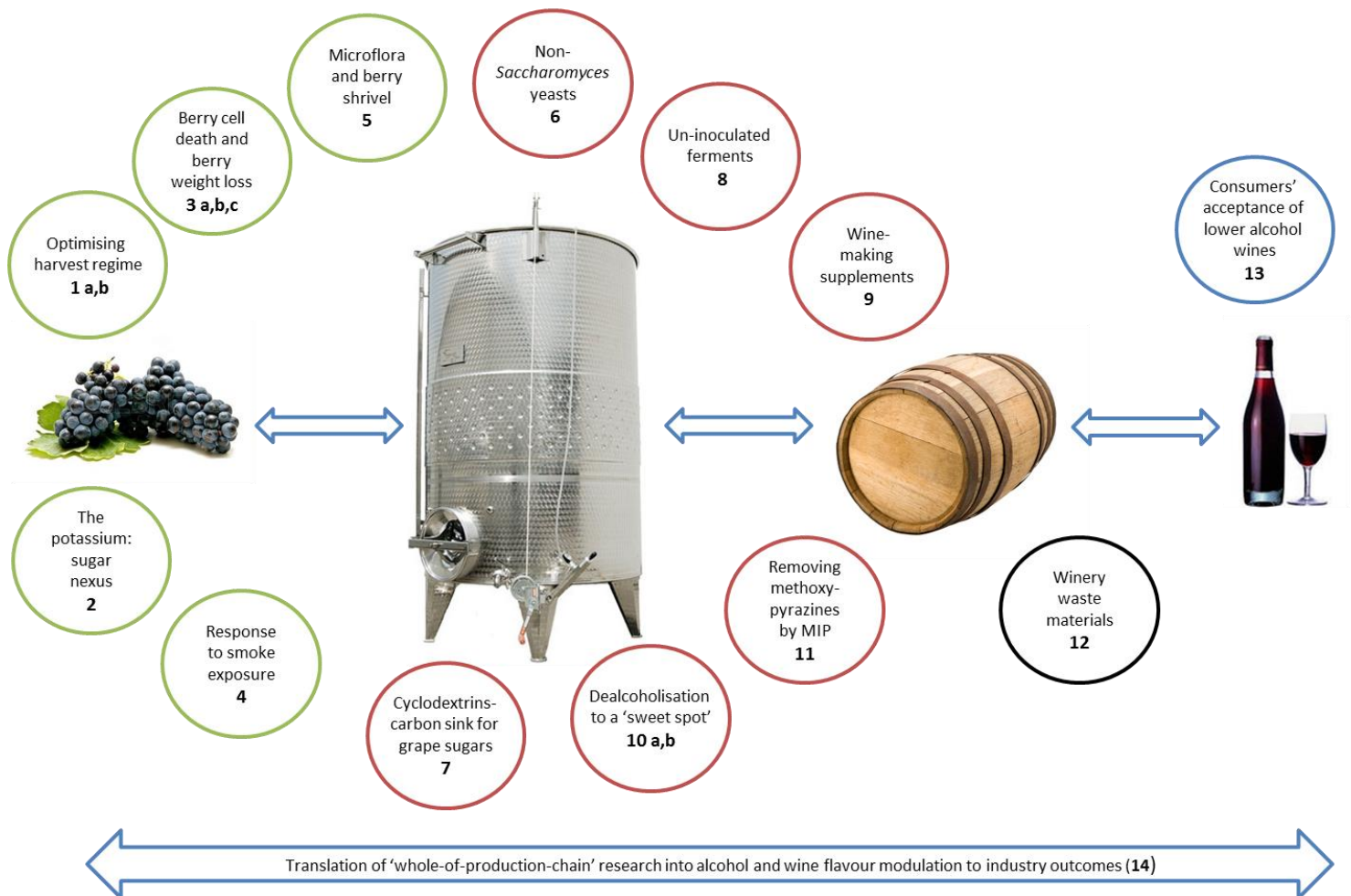


RESEARCH



Research projects

The ARC Training Centre for Innovative Wine Production



Project 1a: Optimisation of an early harvest regime – impact on grape and wine composition and quality

Researcher: **Olaf Schelezki**

Supervisors: Dr D. Jeffery, Professor A. Deloire, Dr P. Smith

One approach to reduce the alcohol level in wine involves several portions of the crop being harvested at an under-ripe stage and fermented to a lower alcohol blending material. Unlike water, this blending material can then legitimately be incorporated in any proportion into the wine produced from the remainder of the fully ripened crop to decrease the potential ethanol content (and pH) of the must. In this project, wines produced by sequential harvest will be chemically and sensorially compared with wines with similar alcohol levels made from grapes harvested at a specific °Baume. Treatments will be tested by descriptive analysis to examine limiting thresholds for ethanol reduction, and finally, to address whether it is better to reduce ethanol by blending or simply to pick the fruit earlier, and what is the potential of either treatment to reduce ethanol without compromising wine quality. Cultivar-specific quality attributes will be tracked back from the glass to the grapes, with consideration of both vintage effects and the influence of temporal variability of the berry population on grape and wine composition, to provide deeper insight into components related to quality other than sugar that can be targeted for more precise harvest decisions.



Olaf Schelezki began his career studying Viticulture and Oenology at the University of Geisenheim, Germany, followed by a Master's of Science in Viticulture and Oenology in France and Spain (VINIFERA). He put emphasis on the wine industry, where he gained winemaking experience during six vintages, among others, in Bordeaux and Madrid. After working as a vineyard manager in the German wine region Mosel, he joined the University of Adelaide in October 2014.

"This project gives me the opportunity to work closely with the wine industry and address their concerns directly in a scientific approach while respecting the applicability of the outcomes. Ultimately I hope to improve the ability of winemakers to target alcohol content yet maintain the quality of their wines by providing them with information about ethanol reduction through harvesting decisions."

Research highlights in 2014

Experimental plans were formulated and a partner organisation Treasury Wine Estates (TWE) commercial vineyard in McLaren Vale containing Cabernet Sauvignon was selected for the first vintage of the project. The Cabernet Sauvignon block used for this project is shared with another AGWA funded project conducted by Charles Sturt University that investigates the aroma evolution of berries during ripening, so cooperation regarding data collection and information sharing has been implemented.

Project 1b: Application of reverse osmosis/perstraction to wines made from grapes with different levels of maturity: chemical and sensory evaluation

Researcher: **Rocco Longo**

Supervisors: Dr L. Schmidtke, Dr J. Blackman, Dr P. Torley, Associate Professor S. Rogiers

This project will use a combined approach that involves a sequential harvest regime and blending of dealcoholised wines. Targeted grape harvests will be subjected to membrane separation technologies, such as reverse osmosis and evaporative perstraction, to achieve wines with a reduced level of alcohol. This research will investigate viticultural and wine production approaches that will enable the production of lower ethanol wines that retain the compositional components responsible for the enjoyment of wines that are naturally occurring at higher alcohol concentrations.



Research highlights in 2014

Rocco Longo spent 6 weeks in Mudgee assisting Lowe Family Wines in the production of low alcohol wines. Sugar accumulation and berry weight of Verdelho and Petit Verdot, from the Rylstone vineyards (NSW), were monitored during the ripening period. Petit Verdot and Verdelho double-harvest wines were made in triplicate aiming to evaluate an application of a sequential harvest approach using berry sugar accumulation profiles in order to produce lower alcohol wines. However, a minimal approach to the use of RO/EP was employed just in the pilot scale.

Rocco undertook his BSc and MSc degrees in viticulture and oenology at the University of Turin/Milan, Italy, where he developed a particular interest for a process of wine grape withering and its technology/chemistry aspects. In 2009, after working vintages in Barolo and Asti (Piedmont, Italy) Rocco moved to Australia in the Alpine Valleys (Victoria). Here, he worked for Gapsted Wines for over 5 years. In November 2014, Rocco joined the National Wine & Grape Industry Centre in Wagga Wagga (NSW) to start his PhD studies at the Charles Sturt University.

"I'll focus on strategies which could find an advantageous application in the wine industry. It will be a great opportunity to learn how international cultivars such as Verdelho and Petit Verdot physiologically respond to the Australian viticultural ecosystem."

Project 2: The sugar-potassium nexus within the grape berry

Researcher: **Zelmari Coetzee**

Supervisors: Associate Professor S. Rogiers,
Professor A. Deloire, Professor R. Walker, Dr S.
Clarke

Management practises targeted at lowering the sugar content of grapes include harvesting earlier at a lower Baumé, managing irrigation, or choosing varieties that do not accumulate high concentrations of sugar. Conversely, potassium (K^+) can be manipulated in the vineyard through the selection of rootstocks and potentially also by irrigation strategies, and depending on soil type and available K^+ concentrations, by modifying fertilisation regimes. The aim of the project is to investigate the apparent sugar-potassium nexus in ripening grape berries and to determine if it can be manipulated to optimise the berry sugar and K^+ concentration at harvest, without negatively impacting on other aspects, e.g. aromatic development, during ripening. If the sugar content of the grape berry can be lowered by reducing K^+ transport towards the grape berry, it may result in the production of lower alcohol wines due to the decreased sugar content in the grape juice at the time of harvest. In addition, by lowering the berry K^+ content at harvest, there would be a consequential reduction in grape juice pH and reduced requirement for costly tartaric acid adjustments.



Zelmari completed her undergraduate degree in Viticulture and Oenology at the Stellenbosch University in South Africa, after which she specialised in Viticulture during her postgraduate degrees. She completed her MScAgric in Viticulture (cum laude) part-time while working as a technical assistant for the Department of Viticulture and Oenology at Stellenbosch University. Her experience in industry includes two vintages as cellar assistant in a winery in South Africa, as well as three vintages in France at Les Vignerons du Pays d'Ensérune as coordinator for the harvest of Sauvignon Blanc and other white varieties. During her appointment as technical assistant, she regularly worked with industry, including overseeing a berry aromatic sequence project conducted on a network of commercial vineyards and led by Prof Alain Deloire. Zelmari commenced her research project in March 2014.

Research highlights in 2015

A new method has been developed to electrochemically determine the potassium content within tissue samples with the use of an ion-selective electrode, specifically in the case of a low pH matrix after sample digestion for the costly practise of adjusting pH by the addition of tartaric acid.

"My goal is to ultimately be able to advise the industry on manipulating the final sugar content in the vineyard, whether through canopy manipulation or the choice in planting material, to minimise the manipulation of the must and/or wine in the winery."

Project 3a: Cell death in the berry and berry weight loss

Researcher: **Dr Simon J. Clarke**

Supervisors: Associate Professor S. Rogiers, Professor S. Tyerman, Professor A. Deloire

Mesocarp cell death in some grapevine varieties could influence flavour and aroma development, extractability of the juice, berry water relations, sugar concentration, and ultimate wine quality. Cell death is potentially important to the production of lower alcohol wines because vital grape berry cells are thought to be necessary for maintaining a high water content in the fruit. Vital berry cells promote water inflow from the parent plant, compensating for water lost to the atmosphere through the berry surface. In the absence of vascular inflows, the fruit water content will decrease and the concentration of solutes will increase. The concentrated sugars resulting from these processes are anticipated to increase the alcohol content of wine.

The general aim of this research is to provide fundamental information on the processes responsible for inducing grape berry cell death. The aim of this particular research is to identify viticultural practices with the potential to delay or enhance grape berry cell death. This research will proceed by assessing whether processes extrinsic to the grape berry (such as canopy manipulations) have an effect on berry cell death. The research will then turn to assess the role of intrinsic berry characteristics (such as developmental stage) on berry cell death. These paired experimental themes will be used to identify where scope exists for manipulating berry cell death in the vineyard.



Simon Clarke obtained his PhD in 2005 from the School of Earth and Environmental Sciences, University of Wollongong, Australia. The doctoral research examined the amino acid and isotope chemistry of fossil eggshells in collaboration with colleagues at INSTAAR (University of Colorado) and the Carnegie Institution of Washington Geophysical Laboratory. Simon began post-doctoral research in viticulture at the National Wine & Grape Industry Centre (Charles Sturt University, Wagga Wagga) investigating plant water use and vascular transport in the grapevine, followed by investigating the effect of soil temperature on grapevine nutrition, carbohydrate status and reproductive development. Simon's written work spans both fossil biogeochemistry and grapevine physiology and includes 16 peer-reviewed publications. His background in isotope science continues to drive an interest in the application of stable and radioactive isotopes to the study of physiological processes in the grapevine.

"I will be satisfied with a series of experiments that rigorously examine factors extrinsic and intrinsic to the grape berry with the potential to influence the onset and subsequent rate of grape berry cell death. I would like to see the results of these experiments combined with previous research and the findings of the TC doctoral candidates working on this topic to devise practical means of influencing cell death in a vineyard."

Research highlights in 2014

Field observations from the 2014 season confirm that a decline in grape berry mesocarp cell vitality should be expected at commercial harvest. However, if fruit is not harvested, residual cell vitality is maintained for many months. The physiology of these post-harvest berries constrains ideas on the processes that maintain cell vitality during the ripening period.

Project 3b: Investigation of the physiological cause of grape berry cell death

Researcher: **Zeyu Xiao**

Supervisors: Professor S. Tyerman, Associate Professor V. Sadras, Associate Professor S. Rogiers

Cell death in grape berries is linked to berry shrivel for some varieties late in ripening. This event is hypothesised to affect quality, fermentable sugar content due to shrivel, and juice extractability of the berries. Oxygen depletion is one of the key determinants influencing plant physiological processes, especially in non-photosynthesising organs. Pericarp cells may be under hypoxic/anoxic stress during the late ripening stages, due to reduced gas exchange across the exocarp and respiratory consumption of oxygen. The resultant oxygen shortage restricts aerobic respiration causing a rapid change in the intracellular energy status, which could impact on cell metabolism, ultimately with effects on biochemical reactions and solute partitioning, and tissue vitality. Grape berry internal oxygen status, as well as changes in berry metabolism during ripening will be examined using cutting-edge oxygen microelectrode techniques. This project also aims to establish the potential links between berry cell death and wine quality.



Zeyu attained a Bachelor's Degree in Viticulture and Oenology with First Class Honours at the University of Adelaide. The program introduced him to the fascinating grape and wine world and he really enjoyed the studies. Zeyu's Honours project investigated new methods of measuring grape berry cell death using electrical impedance. The experience was great and it led Zeyu to stay in the research field continuously searching for the truth about the death of the grape berry cells. Zeyu commenced his PhD studies in April 2014.

Research highlights in 2014

A field experiment with heated and drought stressed vines was carried out in 2013-2014. Results indicated that cell death in the berry was more advanced under water stress compared to heat stress. An assay was developed that can be used to localize DNA fragmentation, an early phenomenon of programme cell death. Drought stress can promote the onset of cell death in the berry, compounding the effects of heatwaves. Oxygen sensing equipment was established for the 2014-2015 season to determine the role of oxygen in cell death in the berry.

"I look forward to this learning journey and make further discoveries that could help us understand the grapes better."

Project 3c: Molecular events underlying death in grape berry

Researcher: **Siyang Liao**

Supervisors: Professor S. Tyerman, Associate
Professor S. Rogiers

Cell death is characterised by a breakdown of cell membrane integrity. In order to assess the broader impact of cell death on berry quality it is important to gain a better understanding of the mechanisms underlying cell death. It is still not clear if cell death in the berry is apoptosis-like (programmed) or necrosis. Reactive oxygen species are versatile signalling molecules playing an essential part in regulating plant apoptosis-like cell death, of which the loss of cell membrane competence is one of several hallmarks. In this project, mesocarp cell death in the grape berry will be examined to determine if it is an apoptosis-like cell death. The potential role of reactive oxygen species in cooperation with other cell death specific signalling molecules and gene signalling pathways will be investigated.



Originally from China, Siyang came to Australia to study the Bachelor of Biotechnology at the University of Newcastle in 2009. Inspired by internship in plant research, she completed an Honours degree, focused on the role of calcium, calcium/calmodulin-dependent protein kinase (CCaMK) and reactive oxygen species in cell division in legumes. As a result of this work, it was found that reactive oxygen species play an important role in signal transduction pathways during the early stages of cell division. Siyang decided to pursue a PhD in Australia and joined Prof. Stephen Tyerman's group at the University of Adelaide in May 2014 to carry out a fascinating project about molecular events underlying cell death in grape berry.

Research highlights in 2014

A field site was established in conjunction with another project examining heat and drought stress. Detection methods for reactive oxygen species were trialled for use in the first season.

"I look forward to learning more about grapes and wine at the molecular and genetic level. I am trying to gain more understanding of the grape berry that could help the winemaking industry."

Project 4: The biochemical response of grapevines to smoke exposure

Researcher: **Lieke van der Hulst**

Supervisors: Associate Professor K. Wilkinson,
Associate Professor C. Ford, Associate Professor R.
Burton, Dr P Boss

Global warming is increasing the frequency of heatwaves and the incidence of bushfires. In some instances, fires are occurring in close proximity to wine regions, resulting in vineyard exposure to smoke. Grapes from smoke-exposed vines can be tainted and so, too, can the resulting wines, making them unsaleable and a significant challenge to grapegrower and winemaker viability in fire-prone areas. Previous research has demonstrated that smoke-derived volatile compounds accumulate in grapes in glycoconjugate forms, i.e., with one or more sugar moieties attached. This complicates both the detection of smoke taint in fruit and the amelioration of smoke taint from wine, and is also thought to be the reason that smoke taint intensifies in wines with bottle age. This project, therefore, aims to investigate the biochemical response of grapevines to smoke exposure; in particular, the enzymes responsible for glycosylation of smoke-derived volatiles in grapevine fruit and leaves following exposure to smoke. The outcomes of this research will aid development of practical solutions for eliminating smoke taint in wine.



Lieke obtained her BSc and MSc degrees in biotechnology and genetics at the University of Delft in the Netherlands. After finishing her studies with elective courses at the University of Adelaide Lieke moved to Australia for a gap year. Being completely captivated by the wine industry in South Australia she decided to gain experience in winemaking and worked for Wirra Wirra, Alpha Box & Dice and Primo Estate Winery in McLaren Vale over the last couple of years before starting her PhD position at the University of Adelaide in April 2014.

Research highlights in 2014

Field trials were established in vineyards located at the University of Adelaide's Waite campus, involving grapevine exposure to smoke. Potted vines have been propagated in the greenhouse in preparation for trials involving vine exposure to smoke and smoke-derived volatile compounds. Preliminary trials involving tomato plants (as a model/reference system) have also been completed.

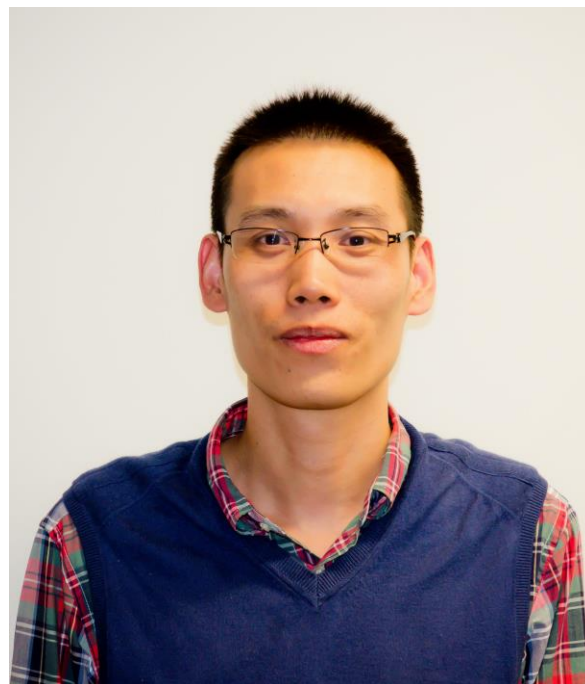
"During my time as a cellar hand for several wineries in South Australia I have experienced first-hand how weather conditions influence grape quality and wine flavour. This experience has made me extremely dedicated to my project addressing climate change, one of the biggest challenges for the Australian wine industry. I wish to work closely with grape growers and winemakers to find ways to produce wine from smoke affected fruit without quality loss."

Project 5: Exploiting communication between yeast and grapevine

Researcher: **Dr Shifeng Cao**

Supervisors: Professor V. Jiranek, Professor S. Tyerman

Grapevine surfaces provide a physical environment suitable for the growth of microbial communities that depend on the grapevine for nutrients, water and protection. Yeast populations are spatially distributed over the grapevines and are dynamic during the course of grape development. The community dynamics are also influenced by external factors such as geographical location, climatic conditions, grape cultivar, vine canopy and the use of agrichemicals. It has been clearly established that phytopathogenic fungi, bacteria, and viruses exert biotic stresses on plants. Much less is known, however, about the interactions between oenological species of yeast and their host plants. Although evidence exists that *S. cerevisiae* is a potential pathogen towards grapevine, to date there have been no reports that indicate that the association of the yeast with plants changes physiological conditions leading to restricted entry of pathogens through stomata or cell wall. To test this assumption, we will examine the importance of stomata and fruit cell wall in the phytopathogenicity of yeast towards grapevines and reveal previously unknown feature of grapevine behaviour in response to yeast attack. The mechanisms observed here may be of significant ecological importance and may help to explain the long periods of yeast survival found to occur in vineyards.



Over the past years, Dr Cao has been engaged continuously in full-time research, first as a PhD candidate at Nanjing Agricultural University, and a researcher in Nanjing Research Institute for Agricultural Mechanization, and then as an UQ postdoctoral research fellow at University of Queensland. Shifeng joined the University of Adelaide in September 2014.

Research highlights in 2014

The yeast distribution on the berry surface during fruit ripening was investigated with Scanning Electron Microscopy. Microbes from the berry surface during fruit ripening were collected for DNA sequencing. The pathogenicity of several yeast towards grapevine leaves was evaluated and the stomata behaviour after the yeast treatment monitored.

"I look forward to revealing the interaction between the yeast and grapevines at the molecular and genetic level and discovering more on the grapevines that could help the industry."

Project 6: Managing ethanol and sensory compounds by non-*Saccharomyces* yeasts

Researcher: **Ana Hranilovic**

Supervisors: Professor V. Jiranek, Associate Professor P. Grbin, Dr Theunes Johannes van der Westhuizen

This project intends to focus on exploring non-*Saccharomyces* biodiversity to select yeasts capable of diverting sugar from ethanol to other favourable or flavour-active end-products. The major objective is to define yeast strains and oenological practices leading to lower ethanol yield in high sugar must fermentations. Use of newly-selected and improved non-*Saccharomyces* strains will lead to the establishment and implementation of more efficient methods for ethanol reduction, alongside reduced risk of quality loss. This approach, permitted in the current legislative setting, is highly economically feasible and environmentally viable, as it does not generate additional capital investments and energy inputs associated with conventional methods for ethanol management. Outputs of this project are, therefore, expected to generate contributions relevant both for the research community and the wine industry.



Throughout Ana's undergraduate degree in Horticulture at the University in Zagreb, she has developed strong interest in grape growing and winemaking, and decided to enrol in a Master's degree in Viticulture and Oenology at the same University. During the Master's program, Ana spent one semester at the University of Hohenheim, Germany, focusing on food safety and quality chains in the context of global climate change. In addition, Ana has been involved in research related to viticulture and oenology at INRA, Montpellier France and at the Faculty of Agriculture, University in Zagreb, Croatia. She graduated on the genetic identification and parentage analysis of autochthonous Croatian grapevine cultivars and thereafter decided to broaden her experience in the wine industry working in a commercial winery in the south of France, facing all the problems and benefits of winemaking in a warm and arid region. Ana joined the University of Adelaide in June 2014.

Research highlights in 2014

Experimental design for high throughput identification and characterisation of non-*Saccharomyces* to select yeasts yielding lower ethanol during fermentation has been established, and methods have been tested and optimised. An in-house yeast collection has been complemented with strains acquired from microbial collections, as well as wild isolates. Collaboration with Treasury Wine Estate has been established in order to test all commercially available non-*Saccharomyces* active dry wine yeasts during vintage 2015 winemaking trials.

"I expect to become a better overall professional, capable of identifying links and translation opportunities from academia to the industry. It will comprise not only the use of state-of-the-art methods and equipment for research purposes, and collaboration with world class experts in the field, but also the involvement in an innovative and progressive Australian wine industry sector."

Project 7: Cyclodextrins – an inert carbon sink for grape sugars

Researcher: **Chao Dang**

Supervisors: Professor D. Taylor, Professor V. Jiranek

The project aims at exploring the utilisation of specific enzymes to convert fermentable grape sugars (especially glucose) in the must to non-fermentable cyclodextrins, ultimately producing wines with lower alcohol levels. Cyclodextrins are non-toxic, naturally occurring, cyclic oligosaccharides formed by the action of certain microorganisms on starch. The utilisation of Cyclodextrin forming enzyme (CGTase), fate of carbon from metabolised sugars, steps to remove the cyclodextrins and the oenological acceptability of the enzyme products will be explored and determined using suitable chromatographic and sensory techniques.

Research highlights in 2014

Too early to report



Chao finished his Bachelor's Degree in Horticulture at the Agriculture University of Hebei in 2010, and then was inspired by National Geographic's wine series "Explore the vine" to pursue a wine career. During his Master's at Lincoln University, New Zealand, he finished several special topics focusing on viticulture and oenology before conducting his research in physicochemical properties and mouthfeel in New Zealand Pinot Noir wines. After Master's, Chao balanced his academic experiences with a couple of years' industrial experiences in viticulture, oenology and wine business in New Zealand, USA and China. Chao commenced his PhD studies at the University of Adelaide in January 2015.

"I plan to push forward my goal of having quite balanced academia and industry experiences through this project. The challenges are exciting and obvious, which come not only from testing my limits in scientific performances to experiment this alternative carbon sink with potential of improving wine quality, but also from my responsibility to the industry and taking it into consideration in each step I take along the way."

Project 8: Impact of high sugar content on the efficiency and sensory outcomes of un-inoculated fermentations

Researcher: **Federico Tondini**

Supervisors: Professor V. Jiranek, Associate Professor M. Herderich, Dr Theunes Johannes van der Westhuizen

This project aims to uncover how wild yeast populations deal with the winemaking condition, particularly with the stressful environment created by high sugar concentrations. Different phenotypes will be identified together with the molecular rationale for their stress response and targets that can be used for the selection. This can ultimately provide a guide for selection of yeast strains with improved resistance to hyperosmotic stress and more desirable metabolic outcomes. Solutions for problematic fermentations and recommendations for the yeast strains, the type and condition of fermentation, and the prediction of the final fermentation bouquet would be evaluated.



Federico obtained BSc in Biotechnology at Milano Bicocca University in 2011, followed by MSc in Industrial Biotechnology at Milano Bicocca University in 2014. His Master's project focused on understanding how yeast physiology influences diacetyl production and diacetyl content in beer. Four industrial yeast strains were fermented under biological conditions resulting in different diacetyl content. Gene copy number, mRNA levels, enzymatic activity and metabolite levels were measured with a view to explaining the yeasts' phenotypic differences and to gain a better understanding of the regulatory pathways involved during beer fermentation. Federico commenced his PhD studies at the University of Adelaide in November 2014.

Research highlights in 2014

Too early to report

"My goal for the project is so to better understand the metabolic and regulatory changes inside the wild yeast cells, to generate a common protocol to solve the problems due to high sugar fermentation from different winemaking areas".

Project 9: Selective and deliberative use of winemaking supplements to modulate sensory properties of wines

Researcher: **Sijing Li**

Supervisors: Associate Professor K. Wilkinson,
Professor V. Jiranek, Associate Professor S. Bastian, Dr
K Bindon

Alcohol reduction can be achieved by several methods prior to, during or post vinification and this project will investigate two specific approaches: (i) an early harvest (12.5 Baumé) and (ii) a harvest at commercial maturity (~14.5 Baumé) with fermentation arrested at various residual sugar levels. The aim of the project is to evaluate the quality of red wines made from the above-described approaches through chemical analysis and sensory evaluation. Maceration enzymes and mannoprotein will be added individually and in combination to determine the optimal addition regime. Different combinations of residual sugar levels and lactisole concentrations will also be trialled to achieve the best sensory outcome. The results of this project will further wine researchers' and winemakers' understanding of the effect of maceration enzymes and mannoproteins on wine. The results will also help winemakers make informed decisions regarding the timing and dosage of these wine additives, should they choose to use them. The findings will also demonstrate the potential of lactisole as a sweetness repressor in wine; either to produce lower alcohol wines or to ameliorate excessive sweetness in stuck fermentations. Ultimately this project will provide winemakers with more tools to produce quality red wines with lower alcohol levels, which are increasingly in demand by consumers.



Sijing completed a Bachelor's degree in Viticulture and Oenology at the University of Adelaide in 2013. Through this program, she learned techniques in viticulture, winemaking and sensory evaluation of wine, as well as the fundamental sciences behind them. Sijing has been involved in several wine science projects on flavour chemistry and microbiology and her last research project was on reclaiming old oak barrels. Sijing commenced her PhD studies in May 2015.

Research highlights in 2014

A range of winemaking supplements (including enzymes, tannins and oak chips) have been sourced from our industry partner, together with access to Shiraz fruit, in preparation for small-lot winemaking trials to be undertaken in early 2015. Chemical and sensory based methods (involving quantification of wine volatiles and polysaccharides, and descriptive analysis of wines, respectively) have also been developed/devised.

"I hope to be able to produce red wines with low alcohol content without losing flavour and mouthfeel. Furthermore I hope to develop a deeper understanding of the winemaking process and of how winemakers can most effectively and positively affect wine characters through additives. The knowledge and experiences will aid me in my future career as either a winemaker or a researcher in wine science."

Project 10a: Getting alcohol content right: The compositional and sensory basic for an alcohol sweet spot

Researcher: **Dr Duc-Truc Pham**

Supervisors: Associate Professor K. Wilkinson, Dr D. Jeffery, Dr V. Stockdale

The wine alcohol 'sweet spot' refers to the observation that relatively small changes in a wine's alcohol content can have a substantial effect on its sensory properties. For dealcoholised wine, there often appears to be one or more alcohol concentrations at which the wine seems to exhibit greater flavour intensity and superior overall balance and, thus, is preferred over other concentrations. However, to date, the available scientific evidence does not support these observations. Current sensory research suggests that tasters cannot distinguish wines with less than a 0.5% (ABV) difference and raises questions as to whether the phenomenon exists or is of any commercial significance. This is an issue for all wines but particularly for reduced alcohol products. Indeed, many of those winemakers who have regularly practised alcohol reduction believe strongly in the idea of the sweet spot and actively target their alcohol reduction to these levels. If the prevailing research is correct, they are wasting their time and effort. If it is not correct, then winemakers who choose an arbitrary alcohol concentration could be missing an opportunity to optimise the quality of their wine. The aim of this project is to investigate more appropriate sensory evaluation techniques to test the sweet spot phenomenon on a range of wines. Presuming this can be demonstrated, more detailed chemical and sensory analyses will attempt to characterise and explain the changes in marginally reduced alcohol wine.



Truc is an experienced research fellow with significant expertise in organic and analytical chemistry, but a strong desire to change fields to pursue (i) an interest in wine and (ii) applied research of wine industry.

Research highlights in 2014

Reduced alcohol wine samples have been sourced from industry partners and preliminary chemical and sensory analyses performed to determine the impact of dealcoholisation on wine volatiles and sensory properties. Industry-based sensory trials to be undertaken post-vintage have also been devised. Furthermore, experiments investigating the loss of alcohol from covered and uncovered wine glasses have also been completed and are currently being prepared for publication.

"My personal goal in these 3 years study are to scientifically validate the alcohol sweet spot phenomenon to provide winemakers tool to find optimum ethanol level for reduced alcohol wines, and to gain experience in chemical and sensory analyses in wine science and in wine industry."

Project 10b: The alcohol sweet spot phenomenon

Researcher: **David Wollan**

Supervisor: Associate Professor K. Wilkinson
and Professor V. Jiranek

Reverse osmosis and evaporative perstraction is alcohol reduction equipment which is now widely used around Australia and the rest of the winemaking world when winemakers believe that alcohol levels are excessive. This could be driven by concern that consumers will reject wines which are labelled with higher alcohol contents than in the past. It could be driven by taxation penalties in certain jurisdictions or it could be driven by a genuine desire to achieve a certain style or balance.

The wine industry practises 'alcohol sweet spot' tastings where winemakers were presented with a range of samples of the same wine with varying concentrations of alcohol. Although the incremental alcohol concentration differences were small, clear favourites seemed to emerge. Surprisingly, these sweet spots exhibited better flavour and balance as well as stylistic differences such that the same wine at selected alcohol concentrations appeared to be preferred. If there are certain sweet spots that are demonstrably favoured by tasters, whether opinion leaders or consumers more widely, then these should be the obvious targets for alcohol reduction.

Unfortunately, current research does not provide any sensory or analytical explanation to support that sweet spots exist. This project will undertake a more focused investigation with the aim of validating the concept and providing practical but scientifically robust tools for identifying sweet spots for a given wine. Presuming the phenomenon is real and economically justified, the project will seek some explanation – chemical, physiological or neurological. If this project is successful, it will provide winemakers with the tools to adjust wine alcohol and target the best possible result with confidence.

Research highlights in 2014

Although the project is in its early stages, David has already prepared samples and developed a new tasting approach that he has tested with a couple of informal panels. So far, the results have been supportive but not conclusive. The aim now is to collect a range of samples of different but representative wine styles. These will need to be in sufficient volume to allow a full range of statistically significant sensory assessments to be made.



David Wollan is consulting oenologist and R&D leader with Industry Partner, Memstar Pty Ltd (now a subsidiary of VA Filtration). Besides his advisory role for the training centre, he is also personally conducting a research project in his own right and in conjunction with colleague, Duc-Truc Pham. He brings to these roles many decades of wine industry experience, as a winemaker, software system developer, consultant and technological innovator. In this last capacity, over ten years ago he invented a process for wine alcohol reduction using a novel, two stage membrane process including reverse osmosis and evaporative perstraction. This was patented and commercialised by his company, Memstar.

Project 11: Controlling unripe characters using molecularly imprinted polymers or specific microbes to eliminate methoxypyrazines from wine

Researcher: **Chen Liang**

Supervisors: Professor D. Taylor, Professor V. Jiranek, Dr D. Jeffery

Methoxypyrazines (MPs) are primarily responsible for the green characters in wine, displaying green bell pepper, grass, green bean, asparagus and herbal notes. Low concentrations can add varietal flavour, however, high concentrations are deemed undesirable and overpowering of the natural fruit berry characters by wine consumers. MPs are produced early in the development of most grape varieties and are largely unaffected by winemaking practices. Recent research has developed novel approaches to reduce methoxypyrazines in wine, such as molecularly imprinted polymers (MIPs). MIPs are a matrix that possesses structurally complementary cavities for target molecules. The functional polymer is first templated with the target compound to provide recognition sites that will selectively bind and remove MPs from juice or wine. Using this approach, unripe characters within wine caused by using early harvested grapes can be remediated, which will aid in the beneficial development of lower alcohol wines. The use of magnetic molecularly imprinted polymers will be an innovation and add convenience to practical industrial operations, since they can be removed from a wine by simply applying an external magnetic field. Though some microbes will transform methoxypyrazines into other forms, currently no wine yeasts have been found to have such ability, thus we are also on the hunt to find such new strains to use in combination with the MIPs.



Chen obtained a Bachelor of Science in Engineering Viticulture and Enology at China Agricultural University, Beijing. Her past research experience focused on anti-oxidation ability of polyphenols in blueberry and mulberry wines and lead to several publications and a hard working undergraduate. Chen commenced her PhD studies at the University of Adelaide in September 2014.

Research highlights in 2014

The inclusion of a magnetically based approach for recovery of molecularly imprinted polymers is quite innovative. We are now in the process of conducting the experimental work on new magnetic molecularly imprinted polymers and will test them shortly.

"I want to graduate from the University of Adelaide with a number of top scientific publications. I want to learn many new research and experimental skills and become an excellent researcher who will be able to contribute to the Australian wine industry and throughout the world. Finally, I plan to travel the world and help those who are not as fortunate as myself."

Project 12: Large scale processing of early-harvest or diseased grapes, or vine biomass for ethanol and dealcoholised ‘grape water’: alternate product streams and blending material for managing wine alcohol

Researcher: **Dr Ravichandra Potumarthi**

Supervisor: Dr D. Jeffery

During the 2012 vintage alone, several hundred thousand tonnes of grape marc required a suitable disposal method, with that responsibility resting with the respective wineries. One way for wineries to deal with marc is to make use of services that facilitate marc disposal through adding value, in the form of recovered alcohol through marc processing and distillation. An opportunity exists to improve the efficiency of alcohol recovery during marc processing by adopting alternate fermentation methods, process optimisations and pre-treatment techniques. This project aims to address process improvement of marc fermentation and its integration with existing distillation processes by undertaking a cost-benefit analysis, characterising marc samples, improving fermentation efficiency, and increasing alcohol yield and quality. Enhancing grape marc processing capabilities will enable greater utilisation of this industry waste stream, thereby addressing environmental sustainability concerns of industry stakeholders.



Ravi has a PhD in Bioprocess/Chemical Engineering with more than 13 years of industry and R&D experience in the area of industrial and environmental biotechnology for process development. His expertise is translational research to bridge the gap of life sciences and engineering. Specific skills include bioreactor design, operation, control and analysis; industrial enzymes production; wastewater treatment by aerobic and anaerobic cultures; process optimisation by experimental and theoretical methods. He has published more than 50 journal articles and book chapters. Ravi joined the University of Adelaide in July 2014.

Research highlights in 2014

Vintage trials have been designed through significant consultation with an industry partner and grape marc has been identified as the priority test material for increased production of ethanol. A detailed theoretical analysis of the process was carried out to identify bottlenecks in the process and obtain preliminary data for a cost:benefit analysis of recovering ethanol from waste streams. Several parameters which may influence ethanol production in a solid state marc fermentation environment have been identified and they will be tested in industry and laboratory situations.

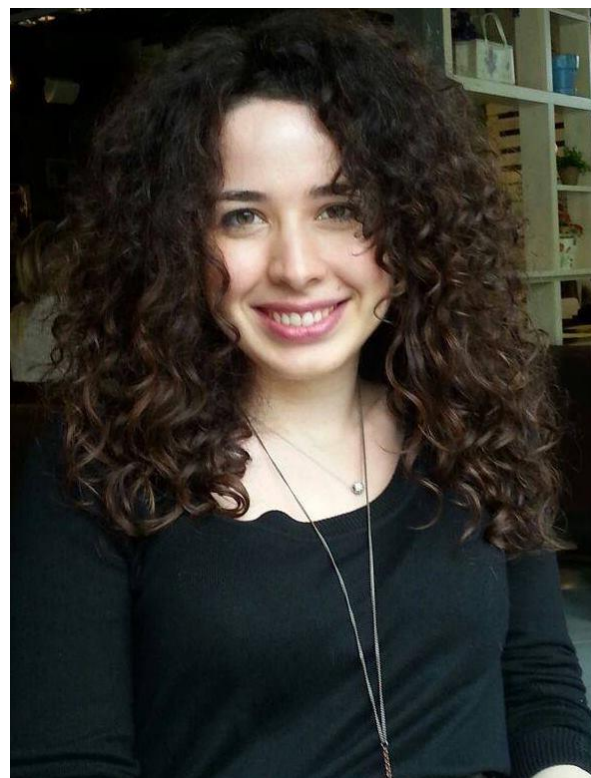
“I aim to develop techno-economically viable processes to utilise vineyard and winery waste to produce alcohol using advanced bioprocess technologies, which helps the wine industry to generate more revenue whilst addressing the environmental issue. This helps me in establishing myself as researcher, capable of addressing real time industrial problems through scientific innovative approaches in the area of industrial and environmental biotechnology.”

Project 13: Because you are worth it: Self-sacrifice vs. product authenticity (The case of wine)

Researcher: **Bora Qesja**

Supervisors: Dr R. Crouch, Professor P. Quester

The aim of this study is to investigate the effect of a substantial innovation of a product with a strong traditional and historical heritage, on perceived authenticity and congruence. Consequently, the trade-off between the innovated product's perceived loss of functional benefit and authenticity (if any) will be analysed with flow-on effects to purchase intentions (word of mouth and willingness to recommend) and, ultimately, quantity purchased. The innovation is the manipulation (lowering) of the alcohol level across a number of varieties and styles to be tested. In addition to determining the effect of the innovation on the level of authenticity and congruence, the percentage of alcohol together with the type/colour of wine (red, white, rose, sparkling) and the varieties/styles will be used as variables with the purpose of determining the optimum new product (as perceived by consumers). Consumer-oriented variables, relating to product category usage, involvement, etc, will be explored to determine any moderating effect on consumers' perceptions and expectations of the product and, ultimately, on its desirability. The study will not only be a contribution to the e-literature on authenticity, congruence and low/partially dealcoholised wines, but will have managerial implications as it will show how consumers deal with innovations of traditional products. Moreover, it will also be a contribution to the wine industry by providing an insight as to how consumers perceive the innovation as well as what is the 'optimum' innovated product when it comes to low/partially reduced alcohol wine. This would, in turn, help towards the bigger cause of lowering the alcohol consumption per capita.



Bora has a BSc in Bioinformatics & Computational Biology obtained from Jacobs University, Bremen, Germany. With the purpose of enriching her technical background with business knowledge, Bora pursued a MSc in Luxury Goods & Services in the International University of Monaco, followed by a six month internship in the marketing department of L'Oreal, Italy (for the brand Kérastase). What lead Bora towards pursuing a PhD in marketing, other than a desire to work in academia, was her very positive experience as a Lecturer at the Canadian Institute for Technology, Albania. Bora commenced her PhD studies at the University of Adelaide in May 2014.

Research highlights in 2014

The industry partner organisation has been contacted in regards to research conducted on partially reduced/lower alcohol wine. Experimental design has been finalised and overseas contacts and venues for focus groups examining low-alcohol wines identified.

"My goal is to contribute to the alcohol industry by providing an insight as to how consumers perceive low alcohol/partially dealcoholized wine as well as what is the 'optimum' innovated wine product in terms of alcohol level, varietal, styles etc."

Project 14. Translation of ‘whole of production chain’ wine science research to industry outcomes

Researcher: **Dr Renata Ristic**

Supervisors: Professor V. Jiranek, Professor A. Deloire

Dr Ristic will coordinate research between Charles Sturt University, the University of Adelaide and remaining industry partners and translate research outputs from all TC projects into industry-ready applications. The main aim is to assemble the outcomes from a range of flavour and alcohol modulation techniques into an integrated strategy that can be easily implemented in the wine industry. This project is funded by AGWA.



Research highlights in 2014

Too early to report

“I believe many issues will continue to challenge the wine industry; therefore it is very important to establish good communication and productive and efficient partnerships between industry, wine scientists and wine consumers. My career is dedicated to achieving excellence in research and building strong links between people, science and industry.”

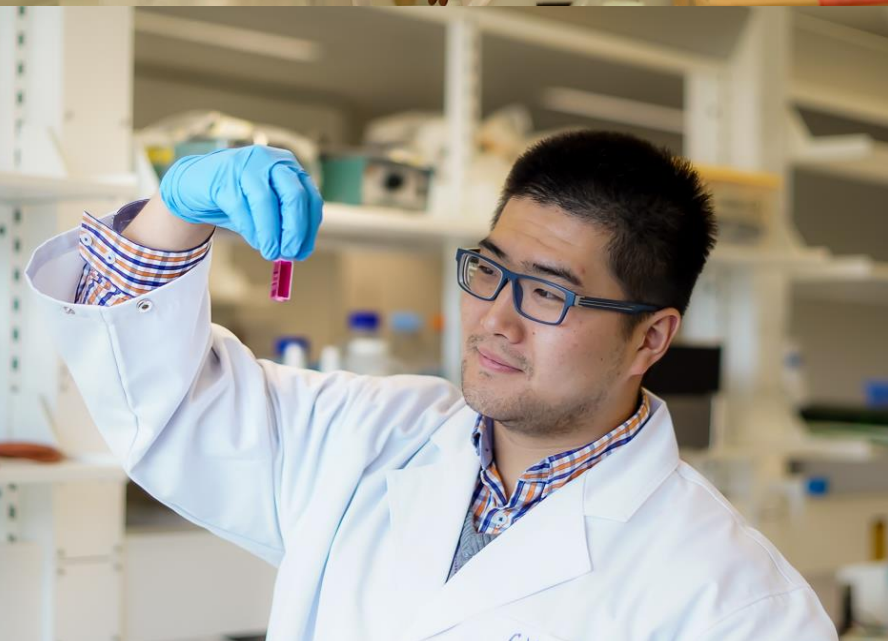
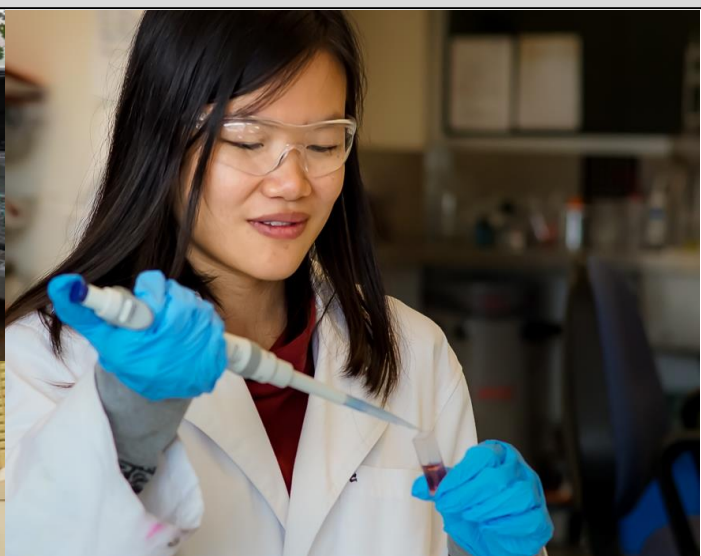
Renata graduated from the University of Belgrade, specialising in Viticulture and Horticulture. She attained her PhD in Viticulture and Oenology at the University of Adelaide in 2004. Since then she has been involved in many research projects and gained expertise in applied viticulture, winemaking, wine chemistry, sensory science and consumer studies. One of her previous research projects focused on the effect of bush fire smoke on vine physiology, grape and wine quality and wine sensory properties, while her last project, in the area of consumer studies, investigated the effect of context and wine composition on wine consumers' emotions, perception of quality, hedonic liking and purchase intentions. As a senior postdoctoral research fellow, Renata will coordinate research and collaboration between CSU, UA and ARC TC-IWP and translate research outputs from all TC-IWP projects into industry-ready applications. Renata joined the ARC TC-IWP in February 2015.

*"Wine is sunlight held
together by water."*

Galileo Galilei



TRAINING AND COMMUNICATION



Performance measures

1. Research training and professional education

Our international advertisement for postgraduate students and postdoctoral fellows generated much interest from researchers around the world. We have also been successful in attracting additional support to complement the project in the form of an AGWA grant (~\$500,000 over 3 years) to attract a senior PDF to assist with translation of project outputs to industry-usable outcomes. Finally, there are 14 postgraduate students (13 PhDs and one MSc) and four postdoctoral fellows (PDF) working across 18 research projects. Of these, 15 receive direct scholarships and operating support from Centre funds, while one PhD student and one PDF are fully supported by the Australian Grape and Wine Authority (AGWA), and one MSc student is self-funded. During 2014, 16 researchers commenced their projects and another 2 in early 2015.

Professional and personal training that the Centre promotes provide staff and students with capabilities and tools so they can become versatile and independent researchers. Training was undertaken by 10 postgraduate students and 2 postdoctoral research fellows who attended a total of 56 short courses and/or workshops. Those included courses in basic and advanced statistical methods, various writing workshops, as well as specific training on such topics as the introductory training/workshop on the use of X-ray fluorescence microscopy. As one-day professional development workshop and networking session sponsored by AGWA was attended by most students and run in conjunction with the first TC-IWP annual meeting (Sept 2014) and formed a lead-up to 'Crush 2014 the Grape and Wine Research Symposium' (Adelaide). As well as attending 'Crush 2014', many TC participants presented at the symposium, an activity that represented an excellent development and networking opportunity. One postdoctoral fellow attended a supervisor training workshop. Furthermore, the staff and students were actively involved in their respective Open Day and Research Day organised by The University of Adelaide and Charles Sturt University.

The TC-IWP offers unique training opportunities by enabling researchers to undertake extended industry placements to acquire workplace skills and knowledge, in addition to their scientific training. Two postgraduate students and two postdoctoral fellows seized the opportunity to spend considerable time working in their partner organisations.

2. International, national and regional links and networks

The number of visitors to the ARC TC-IWP exceeded targeted KPI of 3. The Centre was visited by six international scientists: Prof. Dr. Ulrich Fischer, Dienstleistungszentrum Ländlicher Raum, Rheinpfalz, Germany; Prof Thomas Henick-Kling, Washington State University, USA; Dr Bruno Fedrizzi, University of Auckland, New Zealand; Ms Huba Boshoff, Stellenbosch University, South Africa; Prof Javier Tardáguila, Universidad de La Rioja and Dr Guiseppe Lopriore, University of Foggia, Italy.

The director, Prof Vladimir Jiranek and Prof Alain Deloire made several visits to overseas universities, laboratories and facilities including Laffort Oenology, Bordeaux, France; Sainsbury's, London, UK; Bordeaux University, France; University of California, Davis CA, USA; University of British Columbia, Okanagan, Canada; Shanghai Jiao Tong University; University of Rioja, Spain; University of Stellenbosch, Institute for Wine Biotechnology and Department of Viticulture and Oenology, South Africa; Departamento de Investigação e Desenvolvimento, Sogrape Vinhos, S.A., Avintes, Portugal and ARC Infruitec, Nietvoorbij, South Africa.

Links and networks	Target	Actual
Number of international visitors and visiting fellows	3	6
Number of national and international workshops held/organised by the Centre	1	1
Number of visits to overseas laboratories and facilities by Centre staff/students	1	10
End-user links		
Number of government, industry and business community briefings	1	4
Number of industry visitors to Centre	10	8
Number of talks given by Centre staff open to the public	2	4

The ARC TC-IWP annual workshop was held in Adelaide on 23rd September 2014.



3. End user links

In 2014 the Centre has communicated their research to a range of government, industry and business groups. The researchers have undertaken a range of activities, including talks and presentations, to different professional and public groups, exceeding target KPI's for end user links in almost all areas. Special emphasis was given to communication with the wine industry in order to initiate further collaborations. The Centre hosted 8 industry visitors that spent considerable time discussing the research projects, their current and potential involvement. Major focus was given to the development of current projects as envisaged in the ARC grant application.

Number of government, industry and business community briefings

The director, Prof Vladimir Jiranek presented talks at the Treasury Wine Estates Technical Conference, Adelaide 2013 and at the Blackwood Winemakers and Brewers Club. Prof Alain Deloire, Dr Suzy Rogiers and Dr Leigh Schmidtke presented their research findings at the Royal Australian Chemical Institute, Natural Products Group, Wagga Wagga and at Wollongbar Research Station, NSW Department of Primary Industries, Wollongbar, NSW.

Number of Industry visitors to Centre

- ❖ Ryan Carter, Sainsbury's, UK, Jun 2013
- ❖ Richard Maltby, Sainsbury's, UK, Jun 2013
- ❖ Mark Anderson, Tarac Technologies, Dec 2013
- ❖ Jeremy Blanks, Tarac Technologies, Dec 2013
- ❖ Sam Brook, TWE, Apr 2014
- ❖ Alana Capaldo, Yalumba, Sep 2014
- ❖ Alison Soden, TWE, Sep 2014
- ❖ Dr Guiseppe Lopriore University of Foggia, Italy, Sep 2014

Number of talks given by Centre staff open to the public

- ❖ L Schmidtke. Wine metabolomics: combining sensory and instrumental measures in the multi-block framework. CRUSH 2014, Adelaide, 24-26 Sep 2014
- ❖ S Rogiers. Grapevine vegetative and reproductive development respond to root zone temperature. CRUSH 2014, Adelaide, 24-26 Sep 2014
- ❖ S Clarke. Berry growth, cell vitality and respiration in a warm climate vineyard. CRUSH 2014, Adelaide, 24-26 Sep 2014
- ❖ L Schmidtke. Wine metabolomics: combining sensory and instrumental measures in the multiblock framework - A case of Chardonnay. Macrowine, Stellenbosch, 7-10 Sep 2014

4. Future initiatives

Opportunities for additional researchers and collaborations are available. Interested parties should contact the Centre's director by email at vladimir.jiranek@adelaide.edu.au



Publications and media activities

1. Publications

- ❖ Bruwer, J., Jiranek, V., Halstead, L. and Saliba, A. (2014) Lower alcohol wines in the UK market: Some baseline consumer behaviour metrics. *British Food Journal* 116:1143-1161.
- ❖ Wilkinson, K. and Jiranek V. (2013) Consumer demand vs industry willingness and ability to deliver. *Proceedings of the 1st International Symposium on Alcohol Reduction in Wine, Bordeaux* pp 98-104.

2. Number of industry reports and publications

- ❖ <http://research.agwa.net.au/research-development/current-projects/10046/>

3. Number of invited talks/papers/keynote addresses

- ❖ V. Jiranek presented “Should the industry bother to manage flavour and alcohol?” at the Winery Engineering Association Conference “WineEng 2013” McLaren Vale, Adelaide, 5-6 June 2013
- ❖ K. Wilkinson presented “Low alcohol wine: Consumer demand vs industry willingness and ability to deliver.” At the 1st International Symposium on Alcohol Level Reduction in Wine. Bordeaux, 6 Sept 2013
- ❖ V. Jiranek presented “Innovative Wine Production: responding to climate, water, market and economic challenges” at the AIFST Food Science Summer School, Brisbane, 5 Feb 2014
- ❖ V. Jiranek presented “New opportunities for the wine industry arising from research in wine microbiology” at the Blackwood Winemakers and Brewers Club. 18 June 2014
- ❖ V. Jiranek presented “How the ecology and genetics of microbes affects wine flavour?” at the Romeo Bragato Conference, Blenheim, New Zealand, 27-29 Aug 2014
- ❖ V. Jiranek presented “New opportunities for the wine industry arising from research in wine microbiology” at the Shanghai Jiao Tong University, 3 Sept 2014
- ❖ L. Schmidtke presented “Wine metabolomics: combining sensory and instrumental measures in the multiblock framework- A case of Chardonnay” at the Macrowine Symposium, Stellenbosch, 7-10 September 2014
- ❖ V. Jiranek presented “New opportunities for the wine industry arising from research in wine microbiology” to the South African winemakers, 13-16 Oct 2014
- ❖ V. Jiranek presented “New opportunities for the wine industry arising from research in wine microbiology” at the Stellenbosch University, Institute for Wine Biotechnology, Stellenbosch, South Africa, 17 Oct 2014

4. Media releases

- ❖ www.adelaide.edu.au/news/news60921.html. “2.4m to help make the wine consumers want” 1 May 2013
- ❖ <http://archive.industry.gov.au/ministerarchive2013/donfarrell/mediareleases/pages/24mforadelaideuniwin.aspx.htm> 1 May 2013
- ❖ <http://news.csu.edu.au/latest-news/agricultural-science/grape-and-wine-science/new-funds-to-support-research-from-vine-to-wine/> 4 Feb 2014

5. Articles

- ❖ <http://www.dailytelegraph.com.au/wine-research-gets-24m-boost/story-e6freuz0-1226633326877/> 1 May 2013
- ❖ The Advertiser “Centre will research wine trends” 2 May 2013
- ❖ <http://www.adelaidenow.com.au/business/sa-business-journal/university-of-adelaides-waite-institute-based-new-wine-sector-training-centre-to-boost-research/story-e6fredel-1226633631395/> 2 May 2013
- ❖ <http://www.decanter.com/news/wine-news/583854/adelaide-university-announces-new-2-4m-wine-training-centre/> 7 May 2013
- ❖ <http://www.borderwatch.com.au/story/1483373/wine-industry-gets-a-24-million-boost/> 7 May 2013
- ❖ <http://www.murrayvalleystandard.com.au/story/1483373/wine-industry-gets-a-24-million-boost/> 7 May 2013
- ❖ <http://www.opencolleges.edu.au/informed/news/new-training-centers-for-australias-next-generation-of-food-scientists-4903/> 9 Aug 2013
- ❖ <http://www.mudgeeguardian.com.au/story/2715752/winery-teams-with-university-to-research-low-alcohol-wine-methods/> 21 Nov 2014
- ❖ Downloads/China%20SA%20Wine%20Story%2024pp%20doc_visual%2015%208.pdf
- ❖ WIC-e-Links: ARC Industrial Transformation Training Centre update, issue 6, Nov/Dec 2014

6. Radio/TV interviews

- ❖ <https://radio.adelaide.edu.au/developing-a-taste-for-wine/> Interview with V Jiranek, 9 Jun 2013
- ❖ ABC Radio 89.1 Afternoons with Sonja Feldhoff: Interview with Kerry Wilkinson - Effects of smoke on grape/wine due to Eden Valley fires, 20 Jan 2014
- ❖ <https://radio.adelaide.edu.au/talking-research-smoke-taint-in-wine/> interview with K. Wilkinson and L. Van Der Hulst, 27 Aug 2014



"There's something about being able to literally consume a work of art – then to divide all that pleasure of it – because it's a memory. A great wine for me is a memory, it's an extraordinary experience." – Robert Parker

