

AUSTRALIAN SOCIETY
OF VITICULTURE AND
OENOLOGY

ASVO 



Fermentation

Converting research to reality

ASVO 2018 Oenology Seminar:
September 27th

Sponsors



AWRI
COMMERCIAL SERVICES
SO MUCH MORE THAN A GREAT LAB



Improving food & health



LAFFORT

l'œnologie par nature

Australia



Innovative
Ferment
Technology



[w] winetitles media
WINE INDUSTRY SOLUTIONS



PATRICK ISLAND
WINE PROMOTIONS



**WILEY-
BLACKWELL**

Wine
Australia
for
Australian
Wine



Winemakers'
Federation of
Australia



Australian
Vignerons



THE UNIVERSITY
of ADELAIDE

Forward

On behalf of the planning committee, it gives me great pleasure to welcome you to the 2018 Fermentation: Converting Research to Reality seminar

ASVO seminars are always considered to be an inspirational gathering that industry professionals look forward to, to enhance their knowledge and I am confident that this seminar will again provide wide opportunities to address current challenges about topics including microbial ecology in wild ferments, the use of non-Saccharomyces yeast, microbial contribution to regional wines, using oxygen to enhance fermentation performance, controlling colour and tannin extraction, and managing problematic fermentations.



Assoc. Prof. Paul Grbin
Program Chair

Thanks to all the members of the planning committee, Dr Eveline Bartowsky (Lallemand), Matt Holdstock (AWRI), Dr Anthony Robinson (TWE), Dr Simon Schmidt (AWRI), Dr Alana Seabrook (Laffort), Dr Alison Soden (TWE), Dr Paul Smith (Wine Australia), and David Wollan (Memstar). These people all took time out of their busy schedules to plan, organize and oversee this event.

Thanks also to our regional hosts David Wollan (Melbourne), Kristy Bartrop (Griffith), Hugh McCullough (Launceston), Jarrah Prior (Margaret River), and Mike Hayes (Stanthorpe).

A handwritten signature in black ink, appearing to read 'Paul Grbin'.

Associate Professor Paul Grbin
ASVO Seminar Chair

Social media

Follow the conversation on social media during the seminar. We'll be live tweeting @ASVOtweet using #ASVOseminar and will be posting to Facebook as @ASVO

Judge register

Are you on the ASVO judge register? If you are not currently on register you should create your online profile today and if you already are, it is important to ensure that your profile is up to date.

This is a free service to the Australian Wine Industry and is open to anyone who has judged or is aspiring to become a judge. There is no requirement to be an ASVO member, so encourage your fellow judges to register their details.

Find out more at <https://www.asvo.com.au>

ASVO membership

Join our network of members and get the professional edge. The ASVO is your unrivalled source of timely, accurate expert advice on the issues that matter to you.

Discover for yourself how becoming a member of your Professional Society will allow you to enjoy access to valuable information resources and forums, network with a community of like-minded individuals and provide opportunities for professional development.

Being an ASVO member allows you to publicly identify with high standards and professionalism. It provides extra reassurance to clients, colleagues and community members that they are working with a committed professional with strong credentials.

Find out more at <https://www.asvo.com.au/membership/>

Program

9:00 **Welcome**

Assoc. Prof. Paul Grbin University of Adelaide

9:05 **Opening Address**

Mr Brian Walsh Wine Australia

Session 1: Microbiology

9:15 **Wild wine: metagenomic analysis of microbial communities during wine fermentation**

Dr Alison Soden Treasury Wine Estates

Dr Anthony Borneman AWRI

9:30 **Wild fermentation in practice**

Sam Wigan Yalumba Family Winemakers

9:45 **New MLB strains for difficult environments**

Dr Eveline Bartowsky Lallemand

10:00 **Managing problematic MLF**

Geoff Cowey AWRI

Session 2: Fermentation

11:00 **Fermentation nutrition**

Dr Paul Smith Wine Australia

Dr Gemma Beltran University Rovira i Virgili, placed in Tarragona

11:15 **Modern Winemaking or: “How I Learned to Stop Worrying and Love Oxygen”**

Dr Martin Day AWRI

11:30 **Modelling of tannin and colour extraction**

Prof. David Block University of California

11:45 **Chemistry of fermentation**

Ass. Prof David Jeffery University of Adelaide

Session 3: New Horizons

13:00 **Characterisation and development of non-Sacch yeast for tailored fermentation**

Dr Alana Seabrook Laffort

Dr Ana Hranilovic University of Bordeaux

13:15 **Spoilt for choice; Towards a comprehensive understanding of yeast traits to facilitate strain selection**

Dr Simon Schmidt AWRI

13:30 **Past, present and future of non-Saccharomyces yeasts**

Dr Warren Albertin University of Bordeaux

13:45 **Anything but Saccharomyces**

Prof. Vlad Jiranek University of Adelaide

Session 4: Understanding when to do nothing

14:45 **Setting the Scene**

Sue Bell Bellwether Wines

15:00 **This highly regarded panel led by Sue Bell will answer your tough questions about the technical, commercial & philosophical considerations winemakers face when deciding whether to intervene or not.**

Max Allen Columnist

Steve Clarkson VA Filtration

Dr Anthony Borneman AWRI

Dr Irina Santiago-Brown Inkwell wines

Dr Paul Henschke AWRI | Adelaide Uni | Greenhill Wines

Sam Wigan Yalumba Family Winemakers

16:45 **Summary**

Abstracts

9:05 **Opening Address**

Brian Walsh, Wine Australia

Brian's early working life included 20 years in McLaren Vale, (Reynella, Ryecroft, Wynns and Hardy's) in various winemaking and management roles before going to Yalumba as Chief Winemaker in 1988. Over the ensuing 24 years, Brian's role expanded to Director of Production, then Director of Strategy & Business Development, before his move to self-employment in late 2012.



Session 1: Microbiology

Chair Dr Alison Soden, Treasury Wine Estates

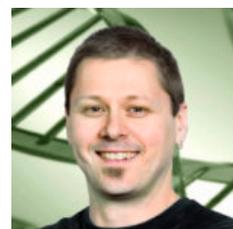
Alison is a graduate of the University of Adelaide, (B.Sc. and PhD), majoring in the area of microbiology. Alison's experience in the wine industry includes vintage work and five years in research and applied positions at E & J Gallo Winery in California. Alison is currently employed as the Group Microbiologist at Treasury Wine Estates



9:15 **Wild wine: metagenomic analysis of microbial communities during wine fermentation**

Dr Anthony Borneman, The Australian Wine Research Institute

Wine is a complex beverage, comprising thousands of metabolites that are produced by yeasts and bacteria acting on grape must. To ensure a robust and reliable fermentation, most wines are produced by inoculating grapes with specific commercial strains of the wine yeast *Saccharomyces cerevisiae*. However, there is a growing trend back to the historical practice of performing uninoculated or 'wild' fermentations, in which only those yeasts and bacteria that are naturally associated with the grapes or winery are used. Wild ferments show a far more complex progression of microbial species than inoculated wines and, accordingly, a more complex taste and aroma profile. As such, differences in these resident microflora between vineyards and wineries are therefore thought to have a key role in defining regional expression of wine characteristics. In order to map the microflora of spontaneous fermentation, DNA sequencing (metagenomic) techniques are being used to monitor the progression of microbial species in large numbers of wild fermentations from across the major winemaking areas of Australia. Notable differences between regions, vineyards and wineries were apparent and these can be broadly defined by the resulting microbial composition of the wild ferments.



9:30 **Wild fermentation in practice**

Sam Wigan, Yalumba Family Winemakers

'Natural' or 'wild' fermentation is the utilisation of the indigenous yeast found on the grapes from the vineyard to perform the fermentation in the winery. There is a skill to making sure you have success with wild fermentation. This includes understanding your vineyards and associated practices. Not adding sulfur dioxide to the grapes or juice and to encourage the passive oxidation of white/rosé juice prior to fermentation. I will cover a brief history of why we at Yalumba started working with wild fermentation. I will outline the benefits of using wild fermentation in your winery. There are not only organoleptic benefits for the resulting wine, but also savings associated with purchasing of yeast, lowering the use of sulfur, enzyme and DAP additions in your winery. I will then take you through four



different techniques we use at Yalumba for successful wild fermentation. Three of these processes relate to white and rosé production and will cover semi-clarified and full solid fermentation in tank as well as full solids fermentation in oak barrels. The final technique will be for wild fermentation in red wine.

9:45 **New MLB strains for different environments**

Dr Eveline Bartowsky, Lallemand, Australia

Wine bacteria are metabolically diverse and can offer a range of qualities to wine, that is, in addition to the conversion of malic acid to lactic acid, the basis of malolactic fermentation (MLF). Wine-associated lactic acid bacteria (LAB) include several genera and numerous species all capable of MLF, however, *Oenococcus oeni* is the most commonly used for MLF across all wine styles.

Grape juice and wine can often be challenging for bacteria, especially when confronted with low pH, low nutrients, and high ethanol content. It is *O. oeni*'s excellent ability to overcome and adapt to these challenging wine conditions and propensity not to produce spoilage sensory-impacting compounds that has seen it to be the species of choice in winemaking.

Lactobacillus spp have shown that they can survive winemaking conditions and possess an extensive suite of enzymes, including glycosidases, proteases, and esterases, which have the potential to synthesize desirable sensory-impacting secondary metabolites. Wine pH is particularly selective for wine LAB, where *O. oeni* can survive below pH 3.5, while above 3.5 there are some *Lactobacillus* spp which have shown good ability to conduct MLF. Additionally, *Lactobacillus plantarum* has facultatively heterofermentative properties, meaning it does not produce acetic acid from consumption of sugar in high pH conditions. Thus, when used under specific vinification conditions, *Lactobacillus plantarum* is part of the next generation of MLF starter cultures.

Enhancing the regionality of wine is an effective means to have a point of difference for a wine brand. Many well-known 'old world' premium wines are strongly associated with the region they come from. Moreover, there is mounting evidence that the local indigenous bacterial microflora contributes to a wine's terroir. The characterisation of a robust regional Australian strain will be presented.

Different wine environments might present new challenges for the winemaker, however wine LAB continually offer new approaches to meet these challenges.

10:00 **Managing problematic MLF**

Geoff Cowey, Australian Wine Research Institute

It's good to learn from your mistakes, but it's smarter to learn from the mistakes of others. The AWRI helpdesk sees the outcomes from common problems and/or mistakes experienced by Australian winemakers with malolactic fermentation. MLFs that are too fast, too slow or just not quite right are all encountered. This presentation shares real-life examples of problematic MLFs investigated by the helpdesk. What were the tell-tale early warning signs, how was the issue resolved and, most importantly, how it could have been prevented? This presentation shows how winemakers can apply learnings from research and these real-life case studies to avoid these issues happening to you.

10:15 Questions

10:30 Morning Tea



Session 2: Fermentation

Chair Dr Paul Smith, Wine Australia

Dr Smith is Senior R&D Program Manager at Wine Australia, with responsibility for co-investment of Industry and Commonwealth funding to benefit the grape and wine community in Australia. Paul received his PhD in Organic Chemistry from Flinders University (2000), followed by post-doctoral research at CSIRO Molecular Science and then the Department of Clinical Pharmacology at Flinders University (2001-2003) before managing teams of scientists (2003-2017) in grape & wine science at The Australian Wine Research Institute (AWRI) then joining the Wine Australia team. He has secured and managed \$15 million of research grants which mainly focused on understanding structure-function relationships, analytical chemistry and translation of this knowledge into practical solutions that make an impact for Industry. Paul has diverse networks and a breadth of experience across research management, and communication of both scientific and industry-focused knowledge.



11:00 **Yeast nitrogen consumption and preferences during pure and mixed fermentations**

Dr Gemma Beltran, University Rovira i Virgili, Tarragona

Nitrogen composition of grape must highly affects yeast growth, fermentation kinetics, as well as the production of several aromatic compounds, such as higher alcohols or hydrogen sulfide. Indeed, nitrogen deficiencies are one of the main causes for sluggish or stuck fermentations. Yeast cells are able to use a wide variety of nitrogenous compounds for growing, but not all of them provide the same efficiency. In *S. cerevisiae*, nitrogen transport, anabolism and catabolism are subject to tight regulation depending on the nitrogen content present in the medium, by a system called Nitrogen Catabolite Repression (NCR). This system is effective during wine fermentation, and thus responsible for the sequential uptake of the different nitrogen compounds from the media. Nitrogen demand is also dependent on yeast strain, sugar content and fermentation conditions. However, during part of alcoholic fermentation *S. cerevisiae* lives with non-*Saccharomyces* yeast species, and in the last two decades, the interest in using non-*Saccharomyces* yeasts as adjuncts to *S. cerevisiae* with the aim to exploit their flavor complexing properties has been growing. In mixed fermentations, different yeast species compete for the nutrients present in the media. Thus, the analysis of nitrogen consumption and preferences of those non-*Saccharomyces* species, in pure and mixed cultures with *Saccharomyces cerevisiae*, during wine fermentations is very important for improving their performance and avoiding fermentative problems due to the depletion of nitrogen by the non-*Saccharomyces* species. Several studies have shown that non-*Saccharomyces* yeast have specific amino-acid consumption profiles, and their presence on mixed fermentation seems to stimulate nutrient consumption in *S. cerevisiae*.



11:15 **Modern Winemaking or: “How I Learned to Stop Worrying and Love Oxygen”**

Dr Martin Day, Australian Wine Research Institute

Although considered detrimental by many who exclude oxygen throughout winemaking, a beneficial influence can be achieved on style and prevention of undesirable sensory outcomes in both white and red winemaking. Subtle modulation in sensory properties can be induced by controlling passive oxygenation at berry rupture rather than with inert handling. Oxygenation during white fermentation can improve efficiency and minimise sluggish completion without significant change to aroma and flavour. Maximum stylistic impact occurs in red winemaking with oxygenation during primary fermentation, preventing development of negative mercaptans, obviating N-supplementation and softening tannin.

The mechanics of oxygenation depend on fermenter scale and cap management but comprise in-tank spargers or in-line devices during pump-overs.



Gas choice is equally important, affected by workplace safety and product protection as much as efficiency. When, how-much, how-frequently and effect on simultaneous MLF remain key questions. Several early additions prove optimal for successful and efficient vinification with positive sensory outcomes.

11:30 **Developing a Practical, Predictive Tool for Optimization of Red Wine Phenolic Profiles in a Winery Setting**

Prof. David Block, University of California Davis



It is well known that the phenolic component of red wine is responsible for important elements of the flavour, mouth feel, and colour of the finished wine. While the origins, concentrations, and chemistries of the phenolics in a finished red wine are well known, the fundamental mechanisms and kinetics of extraction of these phenolics from grape skins and seeds during red wine fermentation are poorly understood and therefore difficult to predict, especially at commercial scale. We completed several years of replicated pilot-scale fermentations at the 120 L scale to illustrate the major impact of temperature and significantly lower impact of cap management practices on phenolic extraction. However, in order to apply these results generally at the commercial scale, it is necessary to understand the heterogeneous physical environment in red wine fermentors, as well as the fundamental chemical phenomena relevant to the extraction process itself. With this understanding, we have begun to develop a mathematical model to predict final wine phenolic profiles as a function of fermentor design, processing choices, and grape characteristics that can be used by winemakers to optimize the phenolic profile for their red wines. The model will have two parts, one to predict the spatial temperature and ethanol profiles throughout the fermentor at any time during fermentation and the other to predict net phenolic extraction from skins and seeds as a function of temperature and ethanol. Together, these two parts will form one model with great predictive value. Experimental results, as well as progress on this modelling and its practical use in a winery setting will be described.

11:45 **Chemistry of Fermentation: Water into Wine**

Dr David Jeffery, The University of Adelaide



Rising berry sugar levels due to warmer grape ripening periods and delayed harvests during compressed vintages can lead to wines with increased alcohol concentrations. This poses challenges for winemakers in warm viticultural regions, in terms of fermentation performance, wine quality and balance, consumer perceptions and health considerations, and greater taxes or duties on exports. Pre-empting recent changes to regulations, we explored the use of pre-fermentative addition of water to dilute initial must sugar concentrations, after proportional removal of juice to maintain the solid-to-liquid ratio of the must. Studies were conducted over several seasons using Cabernet Sauvignon and Shiraz harvested from McLaren Vale under differing vintage conditions. The water implementation approach was compared to substitution with “green harvest wine” and to an early harvest regime using fruit of different maturity levels. Wines underwent chemical and sensory analyses to evaluate the impacts of each approach. Importantly, large decreases in final wine alcohol content could be realised with relatively benign impacts on wine composition and sensory characters, although the outcomes depended on the vintage conditions. Attributes determined by grape maturity tended to be retained in the wines, such that in a hot, dry vintage with evident berry shrivel as experienced in 2015, treated wines were perceived as similar to the control in terms of hotness and dried fruit/jammy characters.

12:00 Questions

12:15 Lunch

Session 3: New Horizons

Chair Dr Alana Seabrook, Laffort

Alana graduated in Oenology and Viticulture from the University of Verona (Italy) before completing an honours and PhD in molecular biology in Oenology from the University of Adelaide. Currently working as the Australian Technical manager for Laffort, she has completed vintages around the world in cellar and winemaking roles, spent almost 7 years at Yalumba as Microbiologist/R&D manager and over 17 years in the wine industry.



13:00 **Characterisation and development of non-*Saccharomyces* yeast for tailored fermentation, *Lachancia thermotolerans*.**

Dr Ana Hranilovic, University of Bordeaux

Grapes from warm climates/vintages often contain excessive sugars but lack the acidity. *Lachancea (Kluyveromyces) thermotolerans* is the yeast of choice for such scenarios. During fermentation, *L. thermotolerans* can partially convert sugars to lactic acid. It can thereby induce acidification whilst decreasing ethanol content in wines. In pursuit of superior strain(s) to be used as starters in the industry, we acquired ~200 *L. thermotolerans* isolates from all over the world. We first developed molecular tools to study their relationships at the genetic level. Then, we performed an extensive oenological characterisation of 94 *L. thermotolerans* strains. The best performing strains were further tested in co-fermentations with *Saccharomyces cerevisiae*, required to complete the fermentation. The observed modulations in ethanol content and acidity further highlighted the oenological potential of this remarkable yeast species for warm-climate winemaking.



13:15 **Spoilt for choice; Towards a comprehensive understanding of yeast traits to facilitate strain selection**

Dr Simon Schmidt, Australian Wine Research Institute

The complex interaction between yeasts and their environment is brought sharply into focus when wine fermentations fail to complete. Retrospective analyses of such failures are difficult or impossible because of the many combinations of factors that may lead to this undesirable outcome. These factors include choice of yeast strain, of which there are many, grape juice composition and winemaker intervention. The relationship between yeast strain genetics and wine yeast performance characteristics in response to grape juice compositional features is the focus of a number of projects at the Australian Wine Research Institute. Rather than focusing on small numbers of strains with specific characteristics we have taken a broader approach to understanding wine yeast diversity by assessing the genetic diversity of more than 200 commercial wine yeasts using whole genome sequencing and using that information to create a representative subset of 94 strains whose performance characteristics and contributions to stylistic attributes have been assessed. Taken together, this information provides a comprehensive evidence-based framework for understanding the behaviour and potential stylistic contributions of different wine yeast strains. As an example of the complexities underlying yeast strain fitness the genetic basis of copper and sulfite tolerance, and the physiological contradiction that this entails, will be discussed. An improved understanding of the advantages and limitations of different yeasts in concert with evolving methods for analysis of juice composition, means better informed yeast strain selection is definitely on the horizon.



13:30 **Past, present and future of non-*Saccharomyces* yeasts**
Dr Warren Albertin, University of Bordeaux

Winemakers are showing growing interest for the use of non-*Saccharomyces* starter cultures, available since 2004 on the market. The management of mixed cultures is still in its infancy, with several key factors involved. In particular, yeast-yeast interaction will be described, and possible future practices will be discussed, like saturating grape must with CO₂ or the use of long lag-phase *S. cerevisiae*. The impact of non-*Sacchs* on wine aroma and wine complexity will be also discussed



13:45 **Anything but pure culture *Saccharomyces***
Prof. Vladimir Jiranek, ARC Training Centre for Innovative Wine Production and Department of Wine and Food Science, the University of Adelaide

The winemaking world has gone full circle and beyond in terms of their use or encouragement of microorganisms for fermentation. Historically fermentations were uninoculated, relying on indigenous yeast and bacteria. But this practiced progressed to the use of a pied de cuve, winery-propagated pure strains, active dried *Saccharomyces* (single and mixed cultures), pure culture non-*Saccharomyces* strains, novel strains from novel environments, and now back to uninoculated fermentations. What has changed over these several decades are winemaking fashion, consumer tastes and the depth of understanding of the nature and impacts of these organisms and their interactions. Recent insights from the international research community will be highlighted along with the opportunities these may present.



14:00 Questions

14:15 Afternoon Tea

Awards for Excellence

Prestigious and highly sought after in the Australian wine industry, the ASVO Awards for Excellence program is one of the most respected and valued industry awards.

The program includes dinner and presentation ceremony that attracts a large and influential audience of development professionals along with dignitaries from research and industry. The evening will commence with a drinks reception, followed by dinner and the presentation of the ASVO Awards for Excellence.

Celebrate our Award winners and welcome new Fellows, catch up with friends and colleagues.

When: November 13th **Where:** National Wine Centre, Adelaide

Find out more: <https://www.asvo.com.au/asvo-awards-for-excellence>



Session 4:

Chair Sue Bell, Bellwether Wines

Sue will get the conversation moving, then you will be able to ask questions, probe deeper, make bridges between ideas, present opposing views, catch contradictions, test the unsaid, shift gears, create transitions and Sue will try to keep everyone on track.



What is your take on the following questions?

1. What is intervention?
2. When did intervention become an issue for you?
3. What do you do when things don't go to plan?
4. Which makes better wine? Intervention or non-intervention?

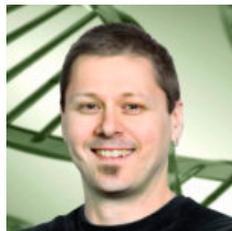
Participate in the discussion

We will give you the chance to have your say by microphone
or

Text [ASVO](https://www.asvo.com.au) to [+61 429 883 481](tel:+61429883481) anytime to join the session, then send your questions or comments to the panel.



Max Allen
Columnist, correspondent & wine expert



Dr Anthony Borneman
Australian Wine Research Institute



Dr Irina Santiago-Brown
Inkwell Wines



Steve Clarkson
VA Filtration



Dr Paul Henschke
AWRI | Adelaide Uni | Greenhill Wines



Sam Wigan
Yalumba Family Winemakers

AUSTRALIAN SOCIETY
OF VITICULTURE AND
OENOLOGY

