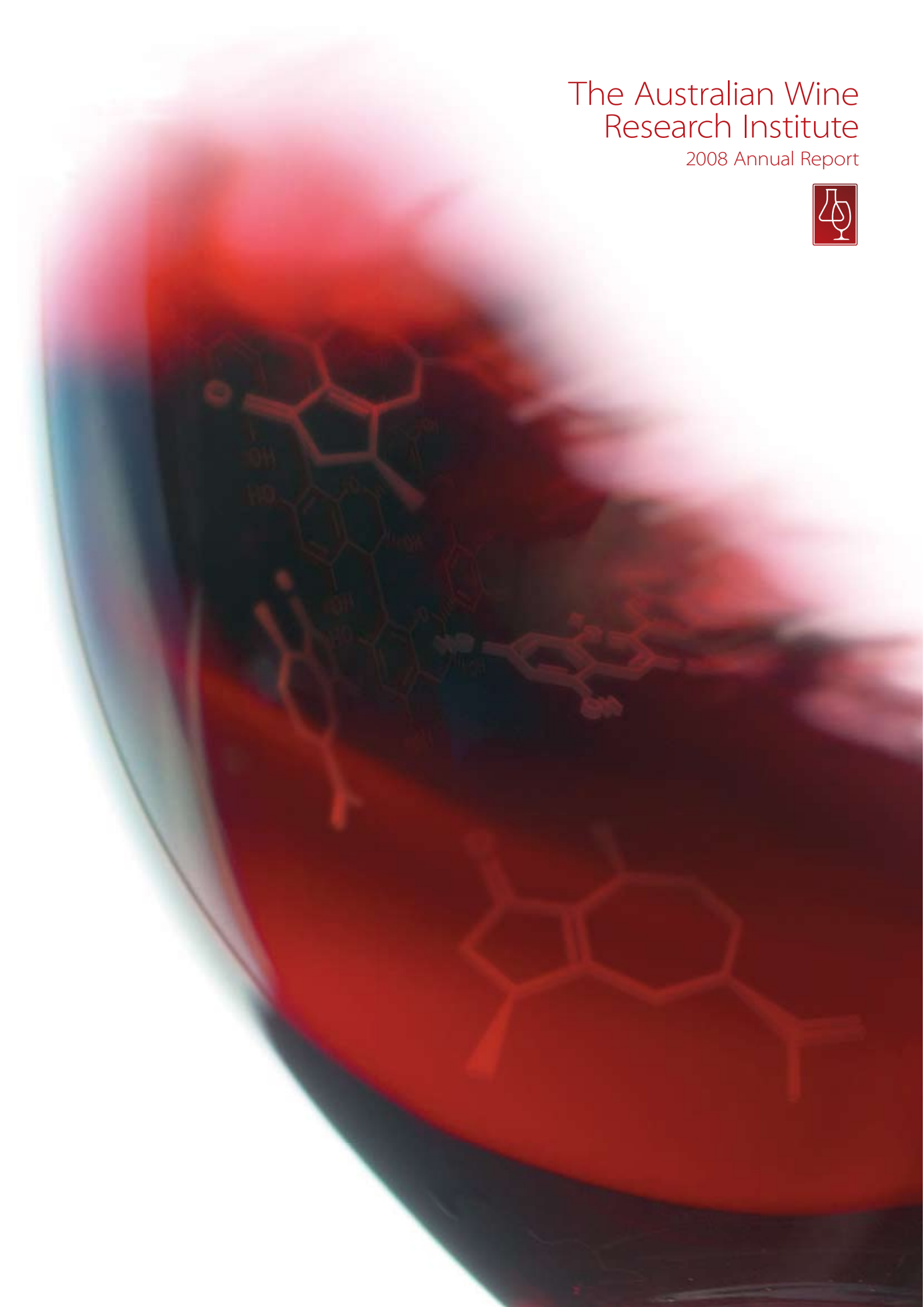
The Australian Wine Research Institute

2008 Annual Report



Board Members

Mr R.E. Day, BAgSc, BAppSc(Wine Science)
Chairman–Elected a member under Clause 25.2(d) of the Constitution

Mr J.F. Brayne, BAppSc(Wine Science)
Elected a member under Clause 25.2(d) of the Constitution (until 12 November 2007)

Mr P.D. Conroy, LLB(Hons), BCom
Elected a member under Clause 25.2(c) of the Constitution

Mr P.J. Dawson, BSc, BAppSc(Wine Science)
Elected a member under Clause 25.2(d) of the Constitution

Mr T.W.B. James, AssDip(Wine Prod)
Elected a member under Clause 25.2(d) of the Constitution

Mr G.R. Linton, BAppSc(AppChem), GradDip(SysAnal)
Elected a member under Clause 25.2(d) of the Constitution

Mr B.M. McKinnon, BAgSc (Oenology) (Hons)
Elected a member under Clause 25.2(d) of the Constitution (from 1 January 2008)

Mr S.B. Millar, CPA, DipMgmt
Elected a member under Clause 25.2(d) of the Constitution (until 1 November 2007)

Ms J.S. O'Connor, BEd (P.E.)
Elected a member under Clause 25.2 (c) of the Constitution

Professor I.S. Pretorius, BSc(Hons), MSc, PhD
Ex officio under Clause 25.2(b) of the Constitution as Managing Director of the AWRI

Mr M.R. Watson, BEc, MBA
Elected a member under Clause 25.2 (c) of the Constitution (from 24 June 2008)

Mr S.J. Webber, BAppSc(Wine Science)
Elected a member under Clauses 25.2 (d) and 27.1 of the Constitution (from 6 May 2008)

The Company

The Australian Wine Research Institute Ltd was incorporated on 27 April 1955. It is a company limited by guarantee that does not have a share capital.

The Constitution of The Australian Wine Research Institute Ltd (AWRI) sets out in broad terms the aims of the AWRI. In 2006, the AWRI implemented its ten-year business plan *Towards 2015,* and stated its purpose, vision, mission and values:

Purpose
To contribute substantially in a measurable way to the ongoing success of the Australian grape and wine sector

Vision
To deliver high value to the Australian grape and wine sector through world-class research and integrated solutions and to provide thought leadership to the research activities of the Australian wine sector

Mission
To underpin our world-class research and integrated solutions with:

- a tenacious pursuit of understanding;
- the development of a unique, extensive and usable knowledge base; and
- a focus on contributing substantially to stakeholders achieving their needs

AWRI's values provide guidance in how it will deliver on its mission. These *values* are:

- scientific integrity and excellence;
- a culture of delivering results;
- internally and externally collaborative;
- accountability and transparency; and
- focused on the Australian wine sector and industry driven

The AWRI's laboratories and offices are located within an internationally renowned research cluster on the Waite Precinct at Urrbrae in the Adelaide foothills, on land leased from The University of Adelaide. Construction is well underway for AWRI's new home (to be completed in October 2008) within the Wine Innovation Cluster (WIC) central building, which will also be based on the Waite Precinct. In this new building, AWRI will be collocated with The University of Adelaide and the South Australian Research and Development Institute. The Wine Innovation Cluster includes three buildings which houses the other members of the WIC concept: CSIRO Plant Industry and Provisor Pty Ltd.

Along with the WIC parties mentioned, the AWRI is clustered with the following research and teaching organisations: Australian Centre for Plant Functional Genomics (APFG), Australian Genome Research Facility (AGFR), Australian Grain Technologies (AGT), Australian Wheat Management, BiometricsSA, three divisions of CSIRO, Department of Water, Land and Biodiversity Conservation, Primary Industries and Resources South Australia (PIRSA), and The University of Adelaide's *School of Science* (which includes the Schools of Agriculture and Wine, and Earth and Environmental Sciences).

Registered office

Waite Road, Urrbrae, SA 5064

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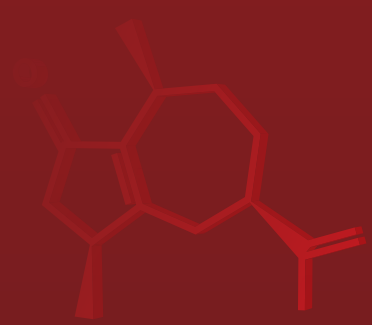
54th ANNUAL REPORT – 30 JUNE 2008



Presented to the Australian grape and wine sector

Chairman's Report

By the time this report is published, two of the year's most important events are likely to have unfolded. The AWRI anticipates occupying its new home in the Wine Innovation Cluster in October 2008 with the official opening of the building scheduled for 19 November 2008. During the past year, a great deal of preparatory work has been done in anticipation of a shift with as little disruption to the AWRI's outputs as possible. Mark Braybrook has shouldered much of the load in smoothing out the details, whilst CEO, Professor Sakkie Pretorius, has been instrumental in ensuring that the 'bang for our buck' in our new facilities are second to none. Our former CEO, Professor Peter Høj, should be recognised as the one who played the leading role in igniting the vision of the Government of South Australia to make a major investment in the concept of the cluster, and its manifestation into a state-of-the-art building.

The second major event is the publication of the sequencing of the genone of a wine yeast for the first time in the world. Beyond the brief front page news that this may generate lies the bigger story. The use of modern gene deletion technology, along with the sequencing now in train of a number of other yeast strains with well known performance characteristics, will step up the linking of genetic performance characteristics to enable new and better strains to be bred by conventional (non-GMO) methods.

The other key scientific highlights of the year are reported in detail at the beginning of this report. Leaving the obvious merit of some of these to one side, it is interesting to drill down into the detail of a few preliminary findings to probe their far reaching possibilities.

From preliminary findings, the revelation that relatively low levels of nitrogen in the vineyard reduce the chloride levels in grapes and resultant wine has wide reaching ramifications, as does the confirmation that tannin levels are augmented under low nitrogen regimes. The confirmation that nitrogen supplementation to red musts has implications for fruit characteristics and, therefore, style choice by winemakers is equally as fascinating. Preliminary early studies on changes to the composition of volatile thiols in white wines suggest that the rest of the iceberg remains to be uncovered.

During the year, a number of significant milestones were passed. The AWRI published its 1,000 staff paper and it held its 200th Board meeting in May.

Perhaps of more significance to the future of the AWRI was the revamping of the constitution to prepare for the next era. This was the culmination of a lengthy process involving careful and extensive deliberation by board members with the inputs of constitutional experts. The end result is a constitution which enhances the AWRI's ability to deliver outcomes for the whole Australian grape and wine sector. Key features of the re-written constitution are:

- instigation of a new category system for the election of Directors based on the small, medium and large category system adopted by WFA (for the purposes of AWRI's Constitution these categories have been defined as small [<2,000 tonnes], medium [2,000-50,000 tonnes] and large [>50,000 tonnes]);
- a broad skills profile expected in any levy-payer elected Director;
- removal of 'Representative Directors' in favour of 6 levy-payer elected Directors and up to four 'Special Qualification Directors' elected at the discretion of the Members of the AWRI;
- a requirement that no more than one Director can be appointed from any single entity under the levy-payer election process; and
- a new requirement that Directors must "… take into account the legitimate interests of both Wine Grapes Levy Payers, Grape Research Levy Payers and other key stakeholders…".

The AWRI continues to reach out both nationally and globally. National and international collaborations are continually being developed with a view to enhancing the scope and quality of the AWRI's outputs. This year, the first consumer preference study for Chinese consumers of Australian wine was conducted by our sensory team.

The recent downturn in levy revenue due to the recent short vintages has resulted in funding challenges for the AWRI. Despite the existence of a new long-term funding agreement, the tacit understanding that the GWRDC cannot allocate funds it does not have, has meant that the AWRI has had to become a frugal tailor and cut its cloth accordingly. This has meant some delays in staff appointments and some creative redeployment of existing staff. Our staff members continue to push up their outputs. Information requests responded to were 14% more than the previous year and staff members gaves 287 oral presentations, conducted 32 workshops and presented 31 lectures. These numbers reflect a general belief by the Board and the staff that the past extension activities of the AWRI were in need of augmentation to increase the reach and effectiveness of the work undertaken by the AWRI.

As I step down from the AWRI Board at the end of 2008, it is pleasing to reflect on the overwhelming support and assistance given by a very competent and balanced Board and the amazing energy and dedication shown by our two CEOs during my Chairmanship: Professor Peter Høj and our current CEO, Professor Sakkie Pretorius.

Finally, a sincere thank you to our staff, who make all the outputs happen. I was once forced to resort to comparing the AWRI to an Opera Trust in order to explain its financial characteristics. Inside this analogy, our staff perform their scientific arias with the pride and perfection of renowned artists. With the continued support from Australian grape and wine producers they are well placed to continue to deliver.

Robin Day
Chairman

Board Notes

Chairman
At the Board Meeting held on 26 February 2008, Mr R.E. Day was elected Chairman of the Board.

Members of the Nominations and Remunerations Committee
Mr R.E. Day
Professor I.S. Pretorius
Mr G.R. Linton
Mr P.J. Dawson

Deputy Members of the Board
Mr N.P. Blieschke
Mr L.P. Deans
Mr A. Kennett (until 12 November 2007)
Mr J. Northey
Mr A.N. Sas

Members of the Audit Committee
Mr P.D. Conroy
Mr P.J. Dawson
Mr M.R. Watson

Meetings
Ordinary General Meeting
The 53rd Ordinary (Annual) General Meeting was held on 20 November 2007.

Special General Meeting
Special General Meetings were held on 6 May 2008 and 24 June 2008 (via teleconference).

Board
The Board of the AWRI met on the following dates: 28 August 2007, 20 November 2007, 26 February 2008, 20 March 2008 (via teleconference) 6 May 2008, 24 June 2008 (via teleconference).

Funding
The Board of the AWRI acknowledges the continuing financial support of the Grape and Wine Research and Development Corporation. We also gratefully acknowledge the financial support from the Australian and State governments and our commercial partners.

Appreciation
The AWRI acknowledges the assistance and cooperation of the following organisations throughout the year:

Australian Society of Viticulture and Oenology Inc.

Australian Wine and Brandy Corporation

Australian Wine Industry Technical Conference Inc.

Charles Sturt University / National Grape and Wine Industry Centre

Commonwealth Scientific and Industrial Research Organisation (CSIRO)

Cooperative Research Centre for Viticulture

Department of Agriculture, Fisheries and Forestry

NSW Wine Industry Association Inc.

Provisor Pty Ltd

Queensland Wine Industry Association

South Australian Wine Industry Association Inc.

State Departments of Agriculture

State Government of South Australia

The University of Adelaide

Victorian Wine Industry Association Inc.

Wine Grape Growers Australia

Wine Industry Association of Western Australia Inc.

Wine Industry Suppliers Australia

Wine Industry Tasmania Inc.

Winemaker's Federation of Australia Inc.

Managing Director's report

1. A CLIMATE FOR CHANGE: STEPPING UP TO CHALLENGES THROUGH A COLLABORATIVE CLUSTER

Galileo portrayed wine as 'sunlight held together by water'; however, the indifferent menace that climate change threatens to impose on the wine sector is the excess of one and scarcity of the other. It was undoubtedly a very difficult year for Australian grape and wine producers as they tackled the challenges of extreme weather patterns; unpredictability of crop size; the shifting sands of preferences in consumer tastes in world markets; the impact of inflationary pressures; changing exchange rates with the soaring Australian dollar hammering exports; all compounded by the availability, quality and cost of irrigation water in most growing regions.

So, how does the AWRI step into the harness to assist grape and wine producers? We believe that collaborative innovation is one of the key mechanisms for igniting the spark to invigorate the wine sector to ensure a sustainable future; the genie of innovation will have to be uncorked along the entire value chain. The AWRI sees its role as being at the leading edge of building and strengthening partnerships and the culture of collaboration, cooperation and innovation between the public and private sectors in a way that boosts international competitiveness and value for Australian grape and wine producers.

Our move into the *Wine Innovation Cluster's* WIC Central building, later in 2008 will accommodate us with the grape and wine scientists of The University of Adelaide and the South Australian Research and Development Institute (SARDI). Our clustering with these organisations and with our other WIC members: CSIRO Plant Industry and Provisor, delivers a chance for strength in diversity and alignment with similarity of spirit. The cluster partners have complementary assets and talents and the AWRI will continue to foster linkages with them and other national and international collaborators to the benefit of partners, stakeholders and the whole Australian wine sector enabling us separately and together to bag a greater number of goals for *Brand Australia*.

2. AWRI = R+D+E+C: INSPIRING VALUE-ADDING CHANGE THROUGH A UNIQUE INNOVATION MODEL

As the wine sector searches for ways to stabilise so many aspects of its business from grape supply to export value, the AWRI, embedded within its extensive collaboration networks, is well positioned as the sector's own 'engine room for technical innovation'. Our outputs seek creative routes towards achieving business-building – and business-sustaining – capabilities, such as giving grape and wine producers the tools and knowledge to produce strong brands that, for example, express regional and varietal character and deliver ultimate consumer satisfaction. We know that change is the motivation for our existence and we can look back on the past year with the knowledge that we have been delivering opportunities for change that added value to the Australian wine sector and that we have supported our grape-growers and winemakers to embrace that change.

We define innovation as change that adds value. The basic premise is that an organisation obtains tangible benefits by introducing a new product or service, through additional or different features to existing products or by implementing processes to either lower cost or create a greater package of benefits. Our work is directed towards the development of grape and wine production strategies that, for example, could potentially be used to enhance the expression of the varietal character and regionality of wine, while improving the reliability and cost-effectiveness of production systems and lightening our footprint. This proposition is how the AWRI supports our sector's *aim*s of fostering and strengthening our *Brand Champions* while helping wine consumers to also develop an appreciation and enjoyment of *Generation Next* that will ultimately move their tastes on to *Regional Heroes* and thus to *Landmark Australia*.

Delivering benefit through collaboration and innovation is the *aim* of the AWRI and, if tomorrow's traditions are today's innovations, the AWRI is working for tomorrow. The AWRI's innovation model, which could be viewed as a three-dimensional 'pyramid' with four apexes: *Research* **(R)**, *Development* **(D)**, *Extension* **(E)** and *Commercial* **(C)** services, offers the grit that delivers the pearl for producers and consumers alike.

Research:

The AWRI's research is the backbone of our R&D&E&C innovation model. Striving for scientific excellence and industry relevance is at the heart of what we do. Our scientists often hit the headlines with a breakthrough and, over a period of more than 50 years, there are many examples of how the AWRI's discoveries have changed the way the scientific community conducts their research and the way grape and wine producers practice their craft. For example, last year, the AWRI's chemists sniffed out the source of the 'black pepper' aroma in Shiraz: a unique trace compound from grapes called rotundone. The discovery of the mystery compound was welcomed as one of the most significant finds in red wine flavour and aroma in a generation.

- Close on the heels of last year's major breakthrough, this year provided another 'world first'. For the first time, the whole genome sequence of a wine yeast has been revealed and compared to the genetic blueprints of other, non-wine strains of *Saccharomyces cerevisiae*. This analysis will undoubtedly lead to fresh and exciting insights into what makes a wine yeast tick, and will provide a powerful resource for wine yeast strain development programs.

- A large consumer sensory study conducted in China evaluated preferences of people from Beijing, Shanghai and Guangzhou for Australian red wines. The results will provide Australian wine producers with direction regarding red wine sensory properties that drive liking for consumers in China, and give a foundation for increasing export sales to this expanding market.

- Our on-going trial *aim*ing to quantify the effects of nitrogen supplementation in the vineyard on vine and grape nitrogen status, and wine aroma and quality, has now been expanded to establish how the observed changes in salinity and tannins affect colour stability, mouth-feel and sensory properties of red wine.

- We have completed a comprehensive study into the influence of pruning treatments on berry composition, wine composition and wine quality. This study revealed that the smallest berries do not always produce the highest quality wines. The fact that smaller differences in berry size due to vintage differences caused larger differences in wine quality, while larger differences in berry size due to treatments caused only small differences in wine quality scores indicates that the relationship between berry size and berry composition and wine quality is neither simple nor direct. While the improvements to wine quality from changes to pruning treatments are likely to be small, they may still be very important in achieving a desired berry and wine style.

Development:

Bridging the gap between a research discovery and the development of value-adding technology, analytical methods or applications is always front-of-mind for AWRI. Recent examples include the development of a simple tannin assay and a method for in-bottle oxygen measure, which allows the calculation of not only the oxygen ingress rate but also the initial amount of oxygen in the headspace of a wine bottle and the amount of oxygen entrapped in the closure.

- The minty 'eucalypt' character sometimes found in Australian reds has now been traced to cineol, a volatile monoterpene that can originate from a number of sources including nearby eucalypt trees, and there have been significant steps taken forward to give Australian winemakers' inside information' on how to manage the level of 'eucalyptus' aroma and flavour in wine.

- In addition to enabling Australian producers to measure tannin, we can now also provide information on what that tannin number 'means' within Australia. We have developed a database that now allows investigation of tannin concentration variations between regions, vintages and varieties. Furthermore, using allocation grading data from sector partners we have shown consistent positive correlations between red wine quality and wine tannin concentration, which proves that wine tannin can be used as one of the objective measures of quality in red wine.

- Applications such as the analysis of total anthocyanins in grapes, using Vis-NIR spectroscopy, have been adopted by Australian wine producers. To complement the analysis of anthocyanins it is desirable to also analyse tannin, as the two combine in wine to form pigmented tannins, the stable form of wine colour. To this end, AWRI has succeeded in the development of rapid spectral methods to predict tannin in wine.

- The ongoing targeted survey of Cabernet Sauvignon wines made in five major wine regions of Australia highlights a major success of Australia's winemakers with regard to improved 'Brett' management. The likelihood of encountering a Cabernet Sauvignon wine with 4-ethylphenol concentration higher than the sensory threshold has decreased markedly over the past decade.

Extension and knowledge dissemination:
In a global marketplace and an era of cross-border ownership, Australia's continued success will be linked to its ability to adopt new technology rapidly; thus speed to market is a key consideration. By far the greatest value of technical information is realised when it is made available to practitioners and adopted by them. Generating the capacity for innovation is only half the story – to extend that to grapegrowers and wine producers, the AWRI's priority is to keep our grape and wine producers informed, up-to-date and ahead of international competition. Our extension activities and achievements for this reporting year include the following:

- The triennial the Australian Wine Industry Technical Conference (AWITC) has been our major extension activity since 1970 and a highly successful 13th event was held during this reporting period

- Through our informational 'roadshows', the AWRI's *aim* is to visit each grapegrowing and winemaking region around Australia at least once every three years and the larger regions more frequently. To strengthen this part of our extension program, the AWIRI has now begun to make some of our key topical 'roadshow' presentations available as on-line webcasts via the AWRI website.

- The AWRI responds to thousands of calls in its capacity as the sector's technical problem-solving centre and operates an informative website that provides access to technical information sourced from all over the world. This year, a new on-line search platform was developed and launched, called the 'AWRI Grape and Wine Search Portal' – providing increased search capacity across a range of grape and wine-related websites.

- With the conclusion of funding of the CRC-Viticulture, the AWRI assumed responsibility for the maintenance of the website and the continued development of the highly successful *Research to Practice*® model, which will be extended to include environmental sustainability and improved winemaking practices.

Commercialisation and commercial services:
The AWRI's Commercial services contribute substantially to our collective knowledge and to that of Australian grape and wine producers more broadly. It is one of the most dynamic – and traditionally misunderstood – roles of the AWRI. The premise is simple: by providing tailored solutions for growers, wineries and suppliers, the AWRI can assist many producers and suppliers to utilise and adopt new technologies and methods while obtaining the greatest leverage from its base of existing technical skills and knowledge. Because such services are designed to provide knowledge or competitive advantages to a single firm or a small group of firms (rather than the sector as a whole), the AWRI charges a fee for its efforts. Every effort is made to ensure our commercial activities are profitable and involve a net transfer of funds that we, as a not-for-profit organisation, can invest in additional R, D and E initiatives.

- Wine yeast strains that make less hydrogen sulfide have been commercialised. Non-GM strategies have been used during the past year to develop novel yeast strains with the ability to ferment robustly while producing minimal or undetectable quantities of hydrogen sulfide. Two of these strains have been commercialised under the names *Maurivin Distinction*® and *Maurivin Platinum*®, with the latter trialled in several wineries during the 2008 Australian vintage.

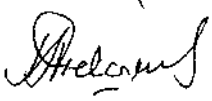
- Research into the benefits of co-inoculation strategies has contributed to development of commercialised blended yeast products: *Anchor Alchemy I*® and *Anchor Alchemy II*®. Trials conducted during the 2007 vintage confirmed that wines resulting from co-inoculation are different, in chemical composition and sensorial attributes, from wines generated using single yeast strains or wines produced by post-fermentation blending. Consumer trials demonstrated a preference for 2007 Sauvignon Blanc that was made using co-inoculation, compared to the single strains by themselves.

- The AWRI pioneered closure benchmarking assessments in 1999, with a large-scale study. The AWRI's commercial services have continued to support closure m*anu*facturers and wine producers through provision of competitively priced fee-for-service closure trials. The post-bottling 12 month assessment results were just reported for our white wine closure trial on 14 closure technologies. The AWRI has also successfully tendered to manage and conduct a commercial closure trial funded collaboratively by a number of Australian and international wineries and closure manufacturers.

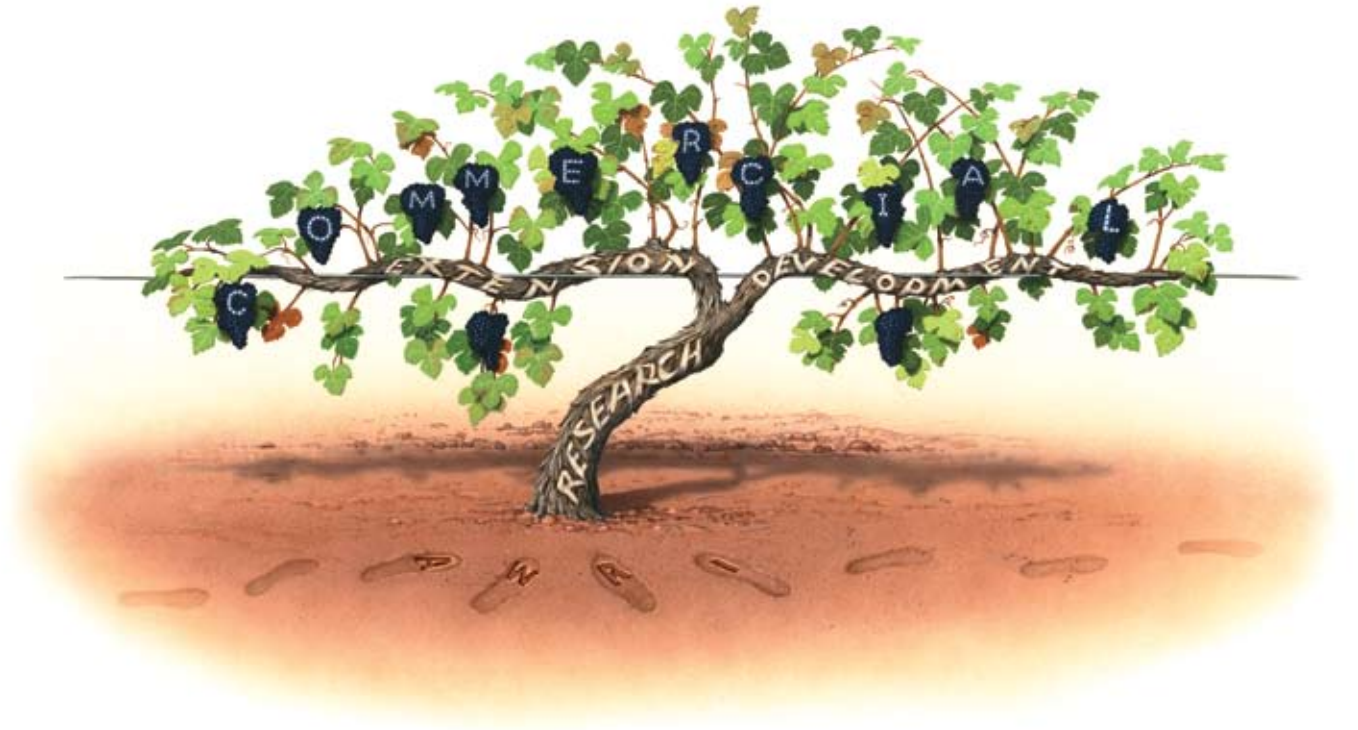
3. A COMMITTED TEAM: LEADING CHANGE AND INNOVATION FROM THE FRONT

I mentioned earlier that this was a period of change and one of the most significant to mark in this annual report is the imminent retirement of our Chairman, Robin Day. Having held the post since November 2001, Robin has been an inestimable support to both me and every member of the team, providing wise counsel, sound guidance and a depth of wine sector knowledge that has been invaluable to us all. I would also like to thank members of the Board for their vigorous and conscientious approach to their role. They have provided – and continue to provide – just the sort of overarching leadership an organisation such as the AWRI requires. Finally, I wish to pay tribute and say a big thank-you to the members of *Team AWRI* whose daily work and involvement is at the core of the AWRI's success. It is a profound privilege to lead such a committed team – an inventive team with an unending desire to discover, collaborate, deliver and care.

Team AWRI understands that continuous innovation is the life blood of the grape and wine sectors in the competitive and ever-changing markets both in Australia and overseas. Innovation will have to become even more ingrained in the grape and wine sectors, but it is an inherently unpredictable and risky pursuit where the unexpected must always be expected. While we might want to resist change, it is the only thing that is constant and the only thing that brings progress. Not changing when surrounded by a sea of change would endanger the long-term sustainability of the wine sector. As the sector's own R&D organisation, the AWRI's team is well equipped and prepared to confront the challenges with imagination and inspiration, embrace the necessary changes and continue to work enthusiastically with the Australian grape and wine sector to create a prosperous and sustainable future for all involved. If, as Churchill said, the price of greatness is responsibility, then we at the AWRI are ready to accept our share of that responsibility for making the Australian grape and wine sector even greater.



Sakkie Pretorius
Managing Director



AWRI = R+D+E+C: inspiring value-adding change through a unique innovation model

Staff

Office of the Managing Director

Isak Stephanus Pretorius, BSc (Ag) (Hons), MSc (Ag), PhD *Orange Free State*, Managing Director

Daniel Luke Johnson, BSc (Hons), PhD *Flinders*, GAICD, General Manager - Business Development

Raelene Joan Blair, CertAppMgt (Mkting) *AIM*, GAICD, Communication Manager

Shiralee Joy Dodd, BA, LLB (Hons) *UAdel*, Executive Officer

Roxanne Portolesi, BSc (Hons) *UniWA*, PhD *Flinders*, Business Development Officer

Kathryn Sarah Beames, Communications Assistant/AWITC Secretariat

Corporate Services

Hans Engelbert Muhlack, BEc *UAdel*, CPA, Group Manager - Corporate Services

Jeffrey Mark Eglinton, BSc (Hons) *UAdel*, IT Manager

Linda Joy Halse, BA, PostGradDip (Ind Rel) *UniNatal*, HR Manager

Catherine Louise Borneman, BBus (Acc) *RMIT*, CA, Accountant (commenced 7/1/2008)

Rachel Lee Edwards, Accountant (concluded 25/1/2008)

Mark Raymond Braybrook, Operations Coordinator

Andrew George Cregan, BSc *ANU*, Dip (OH&S) CIT, OH&S Coordinator (commenced 17/9/2007)

Susan Louise Rock, Help Desk Officer

Michelle Tania Carter, BCom (Acc) *UAdel*, HR Administrator (commenced 17/9/2007)

Pauline Jorgensen, Cert IV (Bus Admin) *TAFE SA*, Administration Support Officer

Rhonda Irene Milde, Finance Officer

Janice Margaret O'Donnell, Receptionist

Deborah Joy Thornton-Wakeford, Receptionist

June Robinson, Laboratory/Administration Support

Jeanette Fay Tooley, Laboratory/Administration Support

Research

Markus Johannes Herderich, staatlich geprüfter Lebensmittelchemiker (CertFoodChem), PhD *UniWürzburg*, Group Manager - Research

Paul Joseph Chambers, BSc (Hons), PhD *UniHertfordshire*, Research Manager

Ian Leigh Francis, BSc (Hons) *Monash*, PhD *UAdel*, Research Manager

Yoji Hayasaka, MPharmSc *Monash*, PhD *YamanashiUni*, Manager – Mass Spectrometry Facility

Paul Anthony Henschke, BSc (Hons), PhD *UAdel*, Principal Research Scientist

Mark Aiden Sefton, BSc (Hons), PhD *UniWA*, Principal Research Scientist

Elizabeth Joy Waters, BSc, PhD *UAdel*, Research Manager

Eveline Jutta Bartowsky, BSc (Hons), PhD *UAdel*, Senior Research Scientist

Anthony Richard Borneman, BSc (Hons), PhD *UMelb*, Senior Research Scientist

Paul Alexander Smith, BSc (Hons), PhD *Flinders*, Senior Research Scientist

Jan Hendrik Swiegers, MSc, PhD *StellenboschUni*, Senior Research Scientist (concluded 30/5/2008)

Peter James Costello, BSc (Hons), MSc *UniNSW*, PhD *UAdel*, Research Scientist

Gordon Elsey, BSc (Hons), PhD *Flinders*, Research Scientist

Richard Gawel, DipEd, BSc, GradDip (Oen) *UAdel*, Research Scientist

Helen Elizabeth Holt, BAgSc (Hons), PhD *LaTrobe*, Research Scientist

David William Jeffery, BTech (Forens&AnalytChem), BSc (Hons), PhD *Flinders*, Research Scientist

Alan Percy Pollnitz, BSc (Hons), PhD *UAdel*, Research Scientist (concluded 9/4/2008)

Simon Anthony Schmidt, BSc (Hons), PhD *Flinders*, Research Scientist

George Kyriakos Skouroumounis, BSc (Hons) *Flinders*, GradDip (Oen), PhD *UAdel*, Research Scientist (concluded 8/4/2008)

Maurizio Ugliano, BSc (Hons) *UniNaples*, PhD *UniFoggia*, Research Scientist

Cristian Andres Varela, BSc (Biochem), MSc (Biochem), PhD *CatholicUniChile*, Research Scientist

Antonio Felipe Garcia Cordente, BSc (Chem), BSc (Biochem), PhD *UniBarcelona*, Post Doctoral Research Fellow

Dimitra Liacopoulos Capone, AssDip (Chem), BAppSc *UniSA*, Senior Scientist

Kenneth Frank Pocock, BAppSc *UAdel*, GradDip (App Sc) *UniSA*, Senior Scientist

Tracey Ellen Siebert, ScTechCert (Chem) *SAIT*, BSc *UAdel*, Senior Scientist

Jennifer Rose Bellon, BSc (Biochem & Gen) *UAdel*, Scientist

Patrick August-Giesecke Dimanin, Cert (Enol & Vitic) *MichStateUni*, BSc (Vitic) *UAdel*, Scientist

Maria Jolanta Kwiatkowski, MSc (Chem Eng) *SilesianUniTech*, Scientist

Tangerine Parker, BSc (Chem) *Flinders*, Scientist (Maternity leave 23/2/2008)

Patricia Chaves Osidacz, BSc (Food Eng) *StateUniCampinas*, MSc (Food Sc) *Unilllinois*, Sensory Scientist

Brooke Travis, BAgSc (Oen) *UAdel*, Sensory Scientist

Gayle Ann Baldock, BSc (Hons) *UniGuelph*, Technical Officer

Belinda Ruth Bramley, ScTechCert (Biol) *SAIT*, Technical Officer

Angus Henderson Forgan, BSc (Hons) *Flinders*, Technical Officer

Robyn Louise Kievit, BSc *UniSA*, BSc (Hons) *UAdel*, Technical Officer

Jane Melissa McCarthy, Cert (Anim Hand), Cert (Vet Nurs) *TAFE SA*, AdvCert (Med Lab Sc) *UniSA*, Technical Officer

Kevin Herbert Pardon, AssDip (App Chem) *SAIT*, Technical Officer

Katryna Agatha Van Leeuwen, BSc (Hons) *Flinders*, Technical Officer

Caroline Elisabeth Abrahamse, BSc (Biotech) (Hons) *UAdel*, Laboratory Technician (commenced 22/1/2008)

Stella Kassara, BSc (Hons) *UAdel*, Laboratory Technician

Heather Margaret Donnell, Administrator

Samuel David Stranks, BA, BSc (Hons) *UAdel*, Casual (commenced 7/1/2008)


Alberto Antonini (Italy)

Microbial Metabolomics Facility

Meagan Diane Mercurio, BSc (Hons), BTech (Foren & Anal Chem) *Flinders*, Coordinator – Microbial Metabolomics Facility

Jeremy Crispin Hack, Technical Officer (commenced 6/7/2007)

Irina Rusinova, BSysEng(Hons) *MoscowEngPhysInst*, Technical Officer (commenced 29/1/2008)

Students

Rachel Christine Brown, BTech (Foren & Anal Chem), BSc (Hons) *Flinders*, PhD Student (concluded 18/4/2008)

Eric Dennis, BSc (Hons) *Flinders*, PhD Student

Joanne Giaccio, BTech (Foren & Anal Chem), BSc (Hons) *Flinders*, PhD Student

Josh Hixson, BTech (Foren & Anal Chem), BSc (Hons) *Flinders*, PhD Student

Ellena Sophia Anne King, BAgSc (Oen) *UAdel*, PhD Student

Dariusz Roman Kutyna, MSc *AgUniPoland*, PhD Student

Natoiya Dee Rayette Lloyd, BSc (Med Chem) (Hons) *Flinders*, PhD Student

Simon Nordestgaard, BE (Chem) (Hons) *UAdel*, PhD Student

Tina Thi My Tien Tran, BSc (Microbiol/Biotech), BSc (App Biol) *VicUni*, PhD Student

Steven van Sluyter, BA, BSc *UniNthCarolina-Wilmington*, PhD Student

Nicholas Ian Warnock, BBiotech (Hons) *Flinders*, PhD Student (commenced 16/6/2008)

Gal Winter, BSc (Biochem & Food Sc), MSc (Biochem & Food Sc) *HebUniJerusalem*, PhD Student (commenced 25/3/2008)

Bruno Fedrizzi, BSc (Chem), MSc (Chem) *UniPadova*, Visiting PhD Student (commenced 11/3/2008)

Fernando Salazar, BEng *UnibioBio*, DEAEng *UniRoviraVirgili*, Visiting Postgraduate Student (concluded 26/10/2007)

Casual Sensory Panel (all commenced 31/1/2008)

Lynn Alabaster, Peter Charles Baldwinson, Barbara Jane Binns, Jennifer De Livera, Kathrin Dressler, Andrea Louise Gamble, Russell Bond Gardiner, Gurinder Singh Khera, Karin Laila Marie Nagle, Jennifer Kay O'Mahony, Samantha Parletta, Lindy Taeuber, Kathryn Jean Tse, Christopher Howard Waters

Industry Development and Support

Con Arthur Simos, BAppSc (Oen) *UAdel*, Group Manager – Industry Development and Support

Sally Jean Bell, BSc (Ag), PhD *UniWA*, GradDip (Wine Bus) *UAdel*, Senior Viticulturist

Linda Maree Bevin, BBus (Info Mgt), GradDip (Lib & Info Stud) *QUT*, Information and Knowledge Manager (Maternity leave from 17/4/2008)

Adrian Dermott Coulter, BSc *Flinders*, GradDip (Oen) *UAdel*, Senior Oenologist

Leanne Michelle Curtin, BSc *Flinders*, Project Manager - Information and Knowledge Management (commenced 17/3/2008)

Creina Standish Stockley, BSc (Hons) *UAdel*, MSc *Flinders*, MBA *UniSA*, Health and Regulatory Information Manager

Staff

Sarah Louise Ballantine, BSc (Chem) (Hons) *UAdel*, Project Officer

Ingrid Betty-Maud Barratt, Dip (Lib & Info Stud) *TAFE SA*, Library Technician

Sean Mathew Boden, BA *UAdel*, GradDip (Info Stud) *UniSA*, Systems Librarian

Geoffrey David Cowey, BAppSc (Wine Sc) CSU, BSc (Hons) *UAdel*, Oenologist

Matthew Grant Holdstock, BSc *Flinders*, GradDip (Oen) *UAdel*, Oenologist

Marcel Essling, BBus *UniVic*, BSc (Ag) *UAdel*, Technical Officer

Leslie Joseph Janik, AssDip (Ind Chem), MAppSc *UniSA*, Technical Officer (concluded 28/9/2007)

Emma Louise Kennedy, BSc (CompMod) *Flinders*, Technical Officer

Oenone Jean Macintyre, BSc, BE (Chem) (Hons), PhD *UAdel*, Administrator (concluded 24/12/2007)

Narelle Elizabeth Cream, Administrator (concluded 30/8/2007)

Virginia Frances Phillips, Administrator (commenced 21/1/2008)

Claudia Rodriguez, MA (Comm Man) *UTS*, Administrator (concluded 24/1/2008)

Claire St George, Library Assistant

Fiona Mary Taylor, Library Assistant

Christopher Howard Waters, BEd (Hons) *UniSA*, Casual Library Assistant (concluded 30/9/2008)

Pauline Cecilia Thornton, Conference Assistant (concluded 3/8/2008)

Industry Applications

Peter William Godden, BAppSc (Wine Sc) *UAdel*, Group Manager - Industry Applications

Robert George Dambergs, BSc (Hons) *UAdel*, PhD *UniQLD*, Senior Research Scientist

Daniel Cozzolino, AgricEng *Uruguay*, PhD *UniAberdeen*, Senior Research Scientist

Christopher Daniel Curtin, BSc (Hons) *Flinders*, Senior Research Scientist

Wieslawa Cynkar, BSc, PhD *Wroclaw*, Research Scientist

Richard Anthony Muhlack, BE (Chem) (Hons), PhD *UAdel*, Process/Environmental Engineer (commenced 14/1/2008)

Ella Margaret Clare Robinson, BA, BSc (Hons) *UAdel*, Project Manager

Commercial (Analytical) Service

Vincent Thomas O'Brien, BE (Chem) (Hons) *UAdel*, PhD *UniQLD*, Group Manager - Analytical Service (commenced 3/9/2007)

Mai Nygaard, MSc *UniCopenhagen*, Group Manager - Analytical Service (concluded 17/4/2008)

Leanne Michele Craddock, BSc *UAdel*, Laboratory Supervisor

Randell Leith Taylor, BSc (Hons) *UAdel*, Laboratory Supervisor

Simon Paul Odell, BBiotech (Hons) *Flinders*, GradDip (Oen), PhD *UAdel*, Project Manager (commenced 27/8/2007)

Oliver David Lovat, BTech (Foren & Anal Chem) *Flinders*, Project Officer

Oenone Jean Macintyre, BSc, BE (Chem) (Hons) PhD *UAdel*, Project Officer (commenced 21/06/08)

Teegan Jean Waples, BAg *UAdel*, Customer Service and Marketing Manager

Suzanna Cottam, Customer Service Officer (from 16/7/2007 to 19/11/2007)

Jelena Jovanovic, Customer Service Officer

Melissa Renae Nutt, BTourHospMan *UniSA*, Customer Service Officer (concluded 14/3/2008)

Alana Williams, CertII (Hosp Op) *TAFE SA*, CertIV (Japanese Lang) VLLC, Customer Service Officer (commenced 26/3/2008)

David Rolfe Boehm, BSc *UAdel*, Scientist

Heather Mandy Brooks, BSc *UAdel*, Scientist

Slavko Matthew Bekavac, BAppSc (Chem & Chem Proc Tech) *UniSA*, Senior Laboratory Technician

Nevil Kamlesh Shah, BSc (Botany), MSc (Biotech) *UniQLD*, Senior Laboratory Technician

Andrew John Ferrell, BSc (Food Tech) *UniSA*, Laboratory Technician (concluded 15/2/2008)

Kate Marie Gerber, BSc (Vitic) *UniCalifornia*, Laboratory Technician (concluded 11/9/2007)

Danielle Kylie Leedham, Laboratory Technician (concluded 20/7/2007)

Yvonne Staeffler, DipMedSc (Pharm) *ProfMedStudium*, Laboratory Technician

Daniel Scott Tynan, DipAppSc (Chem Tech) *UniSA*, Laboratory Technician

Mark Roger Solomon, BSc (Chem) (Hons), BSc (Med Chem) *Flinders*, Casual Laboratory Technician (commenced 12/5/2008)

Pamela Stepancich, BTech (Foren & Anal Chem), BInnEnt (Sc & Tech) *Flinders*, Casual Laboratory Technician (commenced 14/4/2008)

See Appendix 3 for details of all students supervised by AWRI staff

Highlights of the year

The AWRI celebrated two particular milestones during 2007/2008:

1 The publication of the AWRI's 1,000 staff paper. Titled 'The prediction of total anthocyanin concentration in red-grape homogenates using visible-near-infrared spectroscopy and artificial neural networks' it is a reflection of how far grape and wine research has come in the past 53 years.

2 The AWRI held its 200th meeting of its Board of Directors on 6 May 2008. A function was held to celebrate this milestone.

Other highlights from the year include:

1 **In a world first, the genome sequence of a wine yeast has been determined** and compared to the genetic blueprints of other, non-wine, strains of *Saccharomyces cerevisiae*. This analysis is leading to fresh and exciting insights into what makes a wine yeast tick, and will provide a powerful resource for wine yeast strain development programs.

2 **A large consumer sensory study conducted in China** evaluated preferences of Beijing, Shanghai and Guangzhou consumers for Australian red wines. The results will provide the industry with direction regarding red wine sensory properties that drive liking for Chinese consumers, and give a foundation for increasing export sales to this expanding market.

3 **Commercialised wine yeast strains that make less hydrogen sulfide.** Non-GM strategies have been used during the past year to develop novel yeast strains with the ability to ferment robustly while producing minimal or undetectable quantities of hydrogen sulfide. Two of these strains have been commercialised under the names Maurivin Distinction® and Maurivin Platinum®, with the latter trialled in several wineries during the 2008 Australian vintage.

4 **Research into the benefits of co-inoculation strategies has contributed** to development of commercialised blended yeast products: Anchor Alchemy I® and Anchor Alchemy II®. Trials conducted during the 2007 vintage confirmed that wines resulting from co-inoculation are different, in chemical composition and sensorial attributes, from wines generated using single yeast strains or wines produced by post-fermentation blending. Consumer trials demonstrated a preference for 2007 Sauvignon Blanc that was made using co-inoculation, compared to the single strains by themselves.

5 **Significant funding for a three year program of research** on the role of oxygen in wine development was attracted from Nomacorc LLC. In addition to the financial benefit, the project also builds on and extends our international partnerships through being part of an international research program that includes UC Davis, Montpellier, Geisenheim and Universidad Católica de Chile.

6 **The Thirteenth Australian Wine Industry Technical Conference** was successfully held from 28 July to 2 August 2007. Many staff members contributed to all aspects of the conduct of this event. The Proceedings of the 13AWITC were edited, produced and distributed to delegates within six months of the event.

7 **The AWRI-Microbial Metabolomics facility was established.** The AWRI operates the South Australian node of Metabolomics Australia. Metabolomics Australia is a nation-wide, government-funded facility established to enable the development of, and access to, state-of-the-art metabolomic analysis.

8 **Diammonium phosphate (DAP) supplementation of low nitrogen red musts** is routinely used to improve fermentability but effects on wine composition are poorly known. Studies on 26 yeast volatiles in Shiraz wines have shown that acetate esters and medium chain fatty acids, and their ethyl esters, increase whereas branched chain fatty acids, and their ethyl esters, together with higher alcohols decrease. These changes are likely to lift the fruity aroma of red wines as previously observed in white wines.

9 **In addition to enabling Australian producers to measure tannin,** we can now also provide information on what that tannin number 'means' within Australia. We have completed a comprehensive Australian grape and wine tannin survey and developed a database that now allows investigation of tannin concentration variations between regions, vintages and varieties. Furthermore, using allocation grading data from industry partners we have shown consistent positive correlations between red wine quality and wine tannin concentration, which proves that wine tannin can be used as one of the objective measures of quality in red wine.

10 **Applications such as the analysis of total anthocyanins in grapes,** using Vis-NIR spectroscopy, have been adopted by Australian wine producers. To complement the analysis of anthocyanins it is desirable to also analyse tannin, as the two combine in wine to form pigmented tannins, the stable form of wine colour. To this end, AWRI has succeeded in the development of rapid spectral methods using spectroscopy to predict tannin in wine.

11 **Guaiacol glucoside was confirmed to be present** as a component of the juice of grapes naturally (through bushfire) and experimentally exposed to smoke, and was found in substantially greater amounts in the smoked grape juice than in the control juice from grapes with no exposure to smoke.

12 **We have shown that berry composition, wine composition and wine quality** can be influenced by pruning treatments in the vineyard and that the smallest berries do not always produce the highest quality wines. The results of this work indicate that the relationships between berry size and composition, wine composition, sensory properties and quality are complex and must be examined in the context of vintage variability.

13 **The ongoing targeted survey of Cabernet Sauvignon wines** made in five major wine regions of Australia highlights a major success of Australia's winemakers with regard to improved 'Brett' management. The likelihood of encountering a Cabernet Sauvignon wine with 4-ethylphenol concentration higher than the overall survey median value has decreased significantly over the past decade.

14 **A survey of flavonols in Australian wines was also completed.** As the first comprehensive study of this type it provided information on levels of flavonols in Australian wines but also highlighted several important aspects of flavonol analysis, including the fate of rutin in wine.

15 **A mathematical model describing the process of protein aggregation was developed** in collaboration with the School of Chemistry and Physics, Adelaide University. Having a greater knowledge of the process on a molecular level, such as the size and shape of the interacting protein aggregates, will help us to develop alternative solutions to the wine haze problem.

16 **More than 200 commercially labeled white wines were screened** for protein stability. Only one wine failed this test. These data confirm that the vast majority of Australian commercial white and rose wines are protein stable. The wines screened included a subset of wines from companies that use the 80ºC for 2 hour test. All these wines were stable. This thus also confirms our data that fining according to the rates determined by 80ºC for 2 hours would most likely prevent haze in the bottle in practice.

17 **The AWRI website was re-developed and new content added** (including calculators for winemakers). The new website has more valuable information included and is easier to use.

18 **A new on-line search platform was developed and launched,** called the 'AWRI Grape and Wine Search Portal' – providing increased search capacity across a range of grape and wine-related websites.

19 **Eight webcasts of AWRI presentations** were made available on-line via the AWRI website.

20 **Roadshow seminars and/or workshops,** were staged in 8 grapegrowing regions in three states.

21 **Communication and Information Services team members responded to** 3,860 requests for information during 2007/2008. The Information Services were presented to new and existing customers through a stand at WineTech – the Australian Wine Industry Trade Exhibition (as part of the 13AWITC).

Highlights (cont.)

22 **The Industry Services team responded to more than 1,450 calls** for technical advice and information. The Viticulture team responded to 363 enquiries.

23 **Eleven thousand copies of the AWRI annual publication,** *Agrochemicals registered for use in Australian viticulture 2007/2008* were produced and the booklet was made available from the AWRI website and distributed with the Annual Technical Issue of *Australian and New Zealand Grapegrower and Winemaker*. Six agrochemical updates were prepared for industry email subscribers.

24 **The Viticulture team developed an 'Online Search Facility for Agrochemicals'** which provides a searchable web-based format, delivering a more efficient way of retrieving agrochemical information currently available on the AWRI website.

25 **Use by Australian grape and wine producers of the AWRI's information** database increased by 34% compared to last year. Australian grape and wine producers can access 56,336 records of the John Fornachon Memorial Library 24 hours per day, 7 days per week.

26 **The print collection of the John Fornachon Memorial Library** was re-classified adopting a new and simplified classification reference system.

27 **Fourteen part-time sensory panellists have been recruited** and trained, resulting in greatly improved efficiency of collection of high quality sensory data.

28 **AWR staff members gave** 287 oral presentations and conducted 32 workshops and presented 103 posters.

29 **AWRI staff members presented** 31 lectures and coordinated the Grape Industry Practices, Policy and Communication six week subject to undergraduate students and the Aromaticity and pericyclic reactions course to Chemistry Honours students.

30 **AWRI staff members supervised/ co-supervised** 21 postgraduate students.

31 **AWRI staff members recorded** and responded to 5,900 requests for information during the 2007/2008 year, or to put the statistics into perspective, 24 people contacted AWRI seeking information on every working day of the year (a 14% increase over last year). This figure does not include the amount of problem samples investigated (1,042) or the number of Analytical Service analyses undertaken (> 100,000) during 2007/2008.

Readers are strongly encouraged to read the report in detail rather than relying on the brief details above for information.

Staff activities

Information on seminars, talks and poster papers given to outside organisations, academic lectures delivered, graduate students supervised, and the papers published is tabulated and can be found in Appendices 1–5 of the Annual Report. Activities in addition to those in the Appendices are described below.

Sakkie Pretorius is a member of the South Australian Wine Industry Council; the Wine Innovation Cluster Leadership Group; the Wine Industry Technical Advisory Committee (WFA); the Wine and Social Responsibility Committee (WFA); the Council of the Royal Agricultural and Horticultural Society of SA Inc.; the Wine Committee of the Royal Agricultural and Horticultural Society of SA Inc.; Editorial Board of the following journals: *American Journal of Enology and Viticulture*, *Annals of Microbiology*, *FEMS Yeast Research* and *Yeast*. He is the Chair

Tracy Siebert

of the Australian Wine Industry Technical Conference Inc. (AWITC). He is a member of the International Commission of Yeasts, the Scientific Board of L'Institut des Sciences de la Vinge et du Vin (ISVV), Bordeaux, France, and the Scientific Committee of Institut Català de Recerca en Enologia I Viticultura (ICREV) Tarragona, Spain. He is also a Professor Extraordinary of the University of Stellenbosch and an Affiliate Professor of The University of Adelaide.

Dan Johnson is a Director, the Public Officer and Secretary of the Australian Wine Industry Technical Conference Inc.

Markus Herderich is a Director of the Australian Wine Industry Technical Conference Inc., a member of Metabolomics Australia Executive Management Group, and Wine Innovation Cluster Research Group. He is also an Affiliate Associate Professor of The University of Adelaide and a member of the Advisory Board of the Journal of Agricultural and Food Chemistry.

Eveline Bartowsky serves on the Joint Editorial Board of the following journals: *Journal of Applied Microbiology*; and *Letters in Applied Microbiology* and serves on the Editorial Review Board of the *Journal International des Sciences de la Vigne et du Vin*. She is a member of The Waite Campus Health and Safety Forum, a member of the organising committees for the Australian Society of Microbiology Conference (Adelaide 2007) and the 11th International Symposium on the Genetics of Industrial Micro-organisms (Sydney 2010), Poster Coordinator for the 13th Australian Wine Industry Technical Conference, and is an Affiliate Lecturer at The University of Adelaide.

Paul Chambers is a member of the organising committees for the 11th International Symposium on the Genetics of Industrial Microorganisms Sydney 2010); and is coordinator of the Australian Yeast Group (through its home-page at http://www.australianyeastgroup.org/).

Leigh Francis is an Associate Editor of the *Australian Journal of Grape Wine Research*, a member of the Editorial Board of the *Journal of the Science of Food and Agriculture*, and is also an Affiliate Lecturer at The University of Adelaide.


Jane Robichaud (USA)

Jeremy Hack is a member of the Metabolomics Australia analytical, laboratory information management systems (LIMS) and Informatics working groups.

Paul Henschke serves as an Associate Editor of the *Australian Journal of Grape and Wine Research* and is a member of the Editorial Review Boards of *Food Microbiology* and *Mitteilungen Klosterneuburg*. He is a guest lecturer at The University of Adelaide and Flinders University.

David Jeffery reviewed the wine chemistry posters submitted for the Thirteenth Australian Wine Industry Technical Conference (28 July to 2 August 2008).

Meagan Mercurio is a member of the Metabolomics Australia analytical working group.

Simon Schmidt is a member and the ASBMB liaison officer on the Adelaide Protein Group (APG) organizing committee.

Mark Sefton is on the editorial review board of the *International Journal of Vine and Wine Sciences* and is an Affiliate Senior Lecturer with The University of Adelaide.

Hentie Sweigers is an Affiliate Lecturer, School of Agriculture and Wine, The University of Adelaide.

Elizabeth Waters is an Associate Editor for the *Journal of Agricultural and Food Chemistry*, an Affiliate Associate Professor, The University of Adelaide and an Adjunct Professor, National Grape and Wine Industry Centre, Charles Sturt University. She is a Director of Provisor Pty Ltd, a member of the Scientific Committee for Macrowine2008 (Montpellier, France, June 2008) and In Vino Analytica Scientia (Angers, France, July 2009), and an Expert member of Performance BIB.

Peter Godden was a member of the 13th AWITC Program sub-committee and the Workshop Coordinator of a program of 56 workshops held at the Thirteenth Australian Wine Industry Technical Conference. He is a committee member of the Australian Society of Viticulture and Oenology and was a member of the judging panel for the George Mackey Memorial Trophy (27 October 2007).

Ella Robinson, Sarah Kobelt, Teegan Waples, Jeremy Hack and Jean Macintyre assisted in the coordination of the conduct of the workshop program of the Thirteenth Australian Wine Industry Technical Conference (28 July to 2 August 2008).

Sally-Jean Bell reviewed and edited the viticulture posters submitted for the Thirteenth Australian Wine Industry Technical Conference (28 July to 2 August 2008).

Adrian Coulter is a member of The University of Adelaide's Wine Science Laboratory Management Committee.

Creina Stockley is an Affiliate Senior Lecturer, School of Agriculture and Wine, The University of Adelaide and is the Coordinator of the Wine Science Course entitled *Grape Industry Practice, Policy and Communication*. She is a member of the National Drug and Alcohol Research Centre's Young People and Alcohol Project Advisory Group on behalf of the Winemaker's Federation of Australia (WFA), and the WFA's Wine and Social Responsibility Committee. She is also the Department of Agriculture Fisheries and Food's nominated Australian delegate for Organisation International de la Vigne et du Vin (OIV) Health and Safety Commission (IV), and is the current President of the Food Safety Expert Group, and is on the WFA Wine Industry Technical Advisory Committee and the WFA Wine Industry National Environment Committee. She is also a member of the honorary editorial board of the *International Journal of Wine Research* and the Editorial Board of *Alcohol in Moderation*. She was a member of the Scientific Committee of the Third International Congress on Wine and Health (Bordeaux 20-22 September 2008).

Leanne Craddock is a member of the IWAG (Inter Winery Analysis Group) committee.

Roxanne Portolesi is a committee member of the Ausbiotech Student Association, Ausbiotech South Australian branch, and Nutrition Society of Australia, South Australian branch.

Acknowledgements
Compiled and edited by Rae Blair and Shiralee Dodd

Design by Geoffrey Reed Communications

Douglas Adams (USA)

Report on the 13th Australian Wine Industry Technical Conference

Contributing to the planning, management and conduct, and presenting content, at the Australian Wine Industry Technical Conference (AWITC) has been the AWRI's major extension activity since 1970. The AWITC Inc. is now jointly managed by the AWRI and by the Australian Society of Viticulture and Oenology. Held every three years, the 13th Australian Wine Industry Technical Conference was conducted from 28 July to 2 August 2007 at the Adelaide Convention Centre. This event comprised: eight 2-hour formal sessions; three colloquia; technical poster display; trade exhibition (WineTech – the Australian Wine Industry Trade Exhibition); workshops and a social program.

AWRI Staff holding formal positions:

Chair of Planning Committee
Professor Sakkie Pretorius

Conference Management
(Treasurer and Public Officer)
Rae Blair

Program Sub-Committee convenors
Dr Markus Herderich and Con Simos (along with Richard Hamilton from Foster's Wine Estates, and Russell Johnstone from Orlando Wines with support of the Program Sub-Committee)

Workshop convenors
Peter Godden
Ella Robinson, Sarah Kobelt, Teegan Waples, Jeremy Hack, Jean Macintyre

Poster coordination
Dr Eveline Bartowsky
Dr Sally-Jean Bell, Dr David Jeffery, Jeff Eglinton

Registration management
Kate Beames
Pauline Thornton

Conference Planning Committee:
Sakkie Pretorius (Chair) (AWRI), Rae Blair (AWRI), Kerry de Garis (Hardy Wine Company), Chris Dundon (FABAL), Richard Hamilton (Foster's Wine Estates), Markus Herderich (AWRI), Andrew Hood (Hood's Wines), Russell Johnstone (Orlando Wines), Steve Partridge (Agribusiness Research and Management), Philippa Pattison (ASVO), Maryanne Pidcock (Captain's Paddock), Louisa Rose (The Yalumba Wine Company), Con Simos (AWRI), Frank van de Loo (Mount Majura Wines)

Program Sub-Committee:
A group of 33 members from the grape and wine sector, government, and research and education institutions, from all states and the ACT, were responsible for the development of the conference program (details from the AWITC website).

From feedback received, the event achieved its objectives of delivering valuable information on new technical advances of benefit to the Australian grape and wine sector.

The Program Committee convenors worked particularly hard to develop the final program (with input from the members of the Program Sub-Committee) and assistance from the Conference Manager and Secretariat. During the months immediately before the conference, the convenors had to review the 285 poster abstracts to develop the program for Colloquium 3. A stimulating Colloquium was achieved. Dr Richard Smart and Russell Johnstone were heavily involved in the development of Colloquium 1, and Professor Sakkie Pretorius developed Colloquium 2. The formal program was presented by 36 Australian speakers and 15 international speakers. In addition to these international speakers, delegates attended the event from countries such as Argentina, Canada, Chile, Denmark, France, Germany, Italy, Japan, New Zealand, Portugal, South Africa, Spain, Sweden, US and the UK. This unique event presented Australian producers with an opportunity to mix informally with peers from other countries and to benefit from obtaining an international perspective on challenges and opportunities of grape and wine production, marketing and sales.

The details of the final program, workshops, posters and trade exhibition are available from the AWITC website.

A program of 56 workshops was staged over five days, with 2,065 workshop places being taken up by delegates. The most intensive time for the workshop coordinators was between 21:00 on Friday, 27 July and the end of the Sunday workshops at 12:30 on 29 July. At its peak on the Saturday afternoon, the coordination team rose to 49 people, which were almost exclusively AWRI staff, and their relatives and friends.

A valued aspect of the conference was the high quality and variety of the 285 posters. The record number of posters presented at the conference highlighted the value placed on this form of communication to the conference audience. Posters were managed for the first time via an on-line submission process. Also, for the first time, the posters were available for viewing by delegates via the AWITC website until the proceedings were published – so any posters missed at the event could be reviewed at leisure on-line. The posters covered a range of oenological and viticultural categories, and poster prizes were awarded to the following posters:

1 Chris Soar: A comparison of experimental systems for increasing grapevine canopy and bunch temperature (Viticulture prize)

2 Angela Smith: Effect of grapevine leaf physiology on development of fungi that cause powdery and downey mildew (Student Viticulture prize)

3 Eveline Bartowsky (AWRI): Wine bacterium *Oenococcus oeni* can liberate oak lactone from its glucoside precursor (Oenology prize)

4 Venetia Joscelyn: The consequences for wine colour of extended maceration during red winemaking (Student Oenology prize)

5 Angela Smith: Effect of grapevine leaf physiology on development of fungi that cause powdery and downey mildew (Pest and Disease prize)

The Australian Wine Industry Trade Exhibition – renamed WineTech 2007, is owned by AWITC Inc., but is managed by Reed Exhibitions under licence from AWITC Inc. This was the first event which was co-presented by AWITC Inc. along with Wine Industry Suppliers Australia (WISA). WineTech 2007 delivered a 12% increase in sold space over the previous exhibition held in Melbourne in 2004, with 203 exhibitors. Feedback from exhibitors and visitors has been extremely positive about the event.

Proceedings

The proceedings from this event were edited by Rae Blair, Pat Williams and Sakkie Pretorius. They have been produced in hard copy and on CD. Summaries of the posters are included in the hard copy of the proceedings, whilst the full posters (where available) are provided on the CD.

This type of event is impossible to conduct at the low registration fees charged, without the strong support of sponsors. Additionally, we believe it is important for students to attend the event, as they are the future of the industry. The student registration fee was heavily subsidised through sponsorship funds received. The following sponsors were valuable contributors to the event: Amcor, Thomas Walter Hardy Memorial Trust Fund, Maurivin, Stephen Hickinbotham Memorial Research Trust, Bayer CropSciences, Grape and Wine Research and Development Corporation, The Yalumba Wine Company, Yarrabank, Petaluma Australia, DeBortoli Wines, Madfish Wines, Bethany Wines, Mt Appallan Vineyards, Jacob's Creek, Winetitles, *Australian and New Zealand Grapegrower & Winemaker*, Provisor and Amorim. Cash and in-kind contributions were also provided by The Australian Wine Research Institute and the Australian Society of Viticulture and Oenology.

Team reports

Theme 1: Grape and wine composition

Defining and controlling important volatile compounds and their impact on wine aroma and flavour


Elizabeth Waters

Staff and students

Dr Mark Sefton, Dr Elizabeth Waters, Dr Alan Pollnitz, Dr Gordon Elsey, Dr Sally-Jean Bell, Dr David Jeffery (since June 2008), Dimitra Capone, Tracey Siebert, Katryna van Leeuwen, Marcel Essling, Kevin Pardon, Richard Gawel (AWRI staff); Rachel Brown, Natoiya Lloyd, Carolyn Puglisi, Anthea Fudge, Joanne Giaccio, Heather Heading, Josh Hixson (Flinders University), Bruno Fedrizzi (University of Padova) (Students)

Collaborators

Dr Michael Perkins (Flinders University); Professor Dennis Taylor, Dr Kerry Wilkinson (University of Adelaide); Dr Chris Soar, Dr Michael McCarthy (SARDI); A/Professor Duncan McGillivery, Dr Xavier Conlan (Deakin University); Dr Paul Boss (CSIRO); Nick Bruer (Orlando Wines); Audrey Lim, Paul Carpenter (The Hardy Wine Company); Nigel Blieschke, Louisa Rose (The Yalumba Wine Company)

An understanding of the relationship between wine composition and wine aroma and flavour is essential to being able to predict grape and wine quality. These aromas and flavours include many important varietal and bottle-age characters, and characters associated with oak, wine microorganisms, and oxidation, as well as taints, 'off-flavours', 'reduced', and 'green' characters. Our objectives are to determine the chemical nature of hitherto unrecognised important volatile wine components; to enhance our understanding of the relationship between wine composition and sensory properties; to develop analytical methods for important wine components and their precursors; and to determine the effect of viticultural and oenological techniques and wine storage conditions on the formation and fate of these compounds.

1,8-cineole (eucalyptol) in commercial Australian wines

A recent study in California has shown that eucalyptol (1,8-Cineole) could play an important role in the sensory perception of 'eucalyptus' character in some local wines. The characteristic aroma of eucalyptol was described as 'eucalyptus', 'fresh', 'cool', 'medicinal' and 'camphoraceous'. It was suggested that the eucalyptol in the wines might have been derived from nearby Eucalyptus trees. Subsequently, an Italian study showed that at least some of the eucalyptol in wine could also be derived by acid catalysed transformations of grape metabolites. To study the presence and relevance of eucalyptol in Australian wines, we synthesised a deuterium-labelled analogue, d_6-eucalyptol, and used this to develop a simple and rapid analytical method to determine the amount of eucalyptol present in a broad cross section of commercial Australian wines. We also investigated whether eucalyptol could be transferred to grapes in the vineyard from nearby Eucalyptus trees.

As part of this study, we analysed 146 commercially available red wines: Shiraz (43 samples), Cabernet Sauvignon (45 samples), Merlot (25 samples), Pinot Noir (17 samples), Cabernet Sauvignon and Merlot blends (10 samples) and Durif (6 samples). Of the commercial wines analysed, 40% contained eucalyptol above the reported aroma detection threshold of 1.1 µg/L and several contained relatively high amounts (between 5-20 µg/L). The highest level of eucalyptol found was 19.6 µg/L in a Shiraz wine. The vineyard that produced this wine had Eucalyptus trees in close proximity.

For the 44 white wines (12 Rieslings, 10 Sauvignon Blancs, 10 Semillons and 12 Chardonnays) analysed, eucalyptol was not detected above 0.8 µg/L. The low concentration of eucalyptol found in all white wines examined might be because this compound accumulates in the skins and is thus only extracted during maceration of skins.

We also investigated the possibility that Eucalyptus trees contribute to eucalyptol in red wine. We analysed red wine samples made from grapes from two different parts of Australia which were grown close to Eucalyptus trees. In the first case, the winemaker had made separate wines from different parts of the same Western Australian vineyard. The wine made from the rows closest to a stand of Eucalyptus trees contained the highest amount of eucalyptol, and the concentration of this compound in the other wines decreased with increasing distance of the vines from the trees. In the second case, two wines were made from a single Yarra Valley vineyard. The first wine, made from rows within 50 m of a stand of Eucalyptus trees, contained 15.5 µg/L of eucalyptol, while the concentration of ecualyptol in the second wine, made from vines ranging from 50 to 175 m from the trees was only 0.1 µg/L. These prelim-inary studies indicate that Eucalyptus trees were the source of the eucalyptol in the wines. Further studies are underway to confirm this hypothesis.

Sensory impact of γ-lactones in wine

γ-Lactones are important to the aroma of a wide variety of essences and fruit products. These compounds have also been observed as wine components in many instances and their importance to wine aroma and flavour has been suggested in recent reports by other groups. However, the distribution of the individual enantiomers of these compounds in wine and the aroma properties of these individual enantiomers have not been investigated. We, therefore, synthesised the eight enantiomers of γ-octalactone, γ-nonalactone, γ-decalactone and γ-dodecalactone and determined their sensory detection thresholds in a red wine. Furthermore, deuterated analogues of these lactones were synthesised and used to determine the concentrations of these compounds in commercial Australian red (N = 120) and white (N = 44) wines using the method described in the previous Annual Report. A modification of this method using chiral chromatography was developed to assess the enantiomer distribution in 34 commercial Australian red wines.

From this work, it was concluded that γ-nonalactone was the most abundant γ-lactone encountered, followed by γ-octalactone. While γ-decalactone was only observed in some red wine varieties, γ-dodecalactone was not found above the detection limit of the GC-MS method. Furthermore, in all cases for the wines analysed, the concentrations of the various γ-lactones were well below the threshold values determined for the individual lactone enantiomers. For instance, the highest concentration of γ-nonalactone was 40 µg/L in a red wine, and at least 10 times lower in the white wines, while the sensory threshold value for the most potent γ-nonalactone enantiomer was determined to be 91 µg/L.

Analysis of a precursor to oak lactone in oak extracts

We have synthesised a deuterium-labelled analogue of the glucoside of the open-chain form of the *cis*-isomer of 'oak lactone' — the most important of the known oak components that contribute to the aroma and flavour of wine matured in the presence of oak products. We had previously shown that this glucoside could release *cis*-oak lactone during oak coopering and also during malolactic fermentation. To date, however, no method has been reported for the quantification of this precursor in the wood itself. The deuterated analogue of the glucoside was thus used to develop an accurate and reproducible liquid chromatography-mass spectrometric method for determining the concentration of the glucoside in oak extracts. The method affords a tool for measuring the oak lactone potential in oak wood, and could be used to more accurately estimate the duration of oak contact or cooperage treatments required

to produce desired levels of oak flavour in wine. The work highlighted that in some extracts the oak lactone precursor glucoside was found in high enough amounts to release sensorially significant amounts of oak lactone.

Extraction and purification of white wine polysaccharides

It is believed that polysaccharides, phenolics and alcohol all contribute to the sensory attributes of wine. They contribute to the fullness and mouth-feel of a wine, and ultimate consumer satisfaction. The complexity of the interaction of these components is not well understood. It is our aim to unravel this mystery to enable Australian winemakers to more effectively deliver wines against consumer preferences.

Simple and efficient preparative-scale separation techniques have been developed for use in wine fullness studies, using food-grade reagents for extracting polysaccharides from white wine. Firstly, different methods of extracting crude polysaccharides from Riesling wines were evaluated. Compared to the standard method of single ethanolic extraction, double extraction produced higher purity material with reduced levels of phenolics. However, the organic acid content of the precipitate was not reduced following double precipitation. Following extraction of crude polysaccharides from wine using double precipitation, multilayer counter-current chromatography (MLCCC) has been found to effectively and efficiently purify polysaccharides from the wine matrix. Minor variations to the current MLCCC method are being trialled with the view to better separating the phenolics and organic acids from the polysaccharide fraction. Once achieved, a sensory trial will be conducted to investigate the sensory interactions between polysaccharides, phenolics and alcohol in white wine.

Effect of manipulation of nitrogen application in the vineyard

The main objective of this research is to develop a nitrogen strategy for the vineyard and winery to allow grapegrowers and winemakers to manipulate the secondary metabolite concentration and composition in red grapes and wine.

In the first season of this trial, the results confirmed that the site chosen was low in nitrogen and thus responded to the application of nitrogen. Initially, the shoots were visibly stunted with very short internodes and small leaves. The application of nitrogen increased the shoot length and the rate of shoot extension (vigour). As expected, the application of nitrogen increased the concentration of ammonia, total amino acids and yeast assimilable nitrogen (YAN) in the berry at each sample date. In contrast, the yeast non-assimilable nitrogen (YNAN) decreased in response to nitrogen application. While both proline and arginine increased in response to nitrogen, the proline to arginine ratio decreased as has been previously reported in the literature. Interestingly, the application of nitrogen increased the concentration of pathogenesis-related (PR) proteins in the berry at harvest and this included both the thaumatin-like and chitinase proteins. While this is not of great significance for Shiraz wines, being a red variety and one that accumulates relatively low levels of PR proteins, it might have significance for other varieties such as Sauvignon Blanc which accumulate high concentrations of PR proteins (often associated with haze formation in white wine). Nitrogen application had no effect on colour, brix, pH or titratable acidity, but did appear to reduce tannin levels in the berry. Nitrogen had no effect on yield or any of the yield components, which included berry weight. This trial has now been expanded to include small-scale winemaking, and clinical and sensory characterisation of Shiraz wine produced under a variety of vineyard nitrogen regimes is currently being undertaken.

Improving microbial performance, wine diversity and wine quality

Staff and students

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The ambit of wine biosciences research at the AWRI is the improvement of microbial performance, wine diversity and wine quality. Research in this broad arena encompasses physiology, genetics, molecular biology, biochemistry and systems biology of wine yeast and bacteria. The aims of the Wine Biosciences team include: identifying and generating novel yeasts with improved winemaking and sensory-imparting properties; improving fermentation outcomes by developing improved yeast nutrient supplementation regimes; improving robustness of wine yeasts and malalactic bacteria; improved understanding of the link between malolactic fermentation (MLF) and wine quality; and developing 'low-alcohol' yeasts. The following is an overview of some of the activities of this team (see also reports under Theme 2).

Flavour-enhancing yeast

Staff

Dr Chris Curtin, Dr Hentie Swiegers, Dr Toni Cordente, Robyn Kievit

Wine yeasts perform their primary role of turning grape sugar into alcohol admirably in all but the toughest of conditions, at the same time making a sizeable contribution to the array of compounds that give wine aroma and flavour. The flavour-active yeast research program is focused on understanding how the metabolism of yeast interacts with the wine production environment, and ultimately how this impacts upon wine sensory properties and consumer preferences.

A core aspect of our work is the characterisation of known and novel flavour-active yeast genes. Candidate genes identified by microarrays (reported in the 2007 Annual Report) were further studied through the use of deletion strains. Fermentations with these single gene deletion strains provided evidence for their role as flavour-active genes. Availability of characterised genes enables us to develop prototype flavour-enhancing wine yeasts such as the thiol-releasing strain described in the previous Annual Report. Non-GM strategies can then be applied to develop industry-relevant wine yeast strains with these 'benchmark' properties.

Non-GM strategies have been used during the past year to develop novel yeast strains with the ability to ferment robustly, while producing minimal or not-detectable quantities of hydrogen sulfide. Two have been commercialised under the names Maurivin Distinction® and Maurivin Platinum®, with the former trialed in several wineries during the 2008 Australian vintage.

Research into the benefits of co-inoculation strategies has also contributed to development of commercialised blended yeast products:

Anchor Alchemy I® and Anchor Alchemy II®. Trials conducted during the 2007 vintage confirmed results obtained in 2006, highlighting chemical and sensory differences in wines resulting from co-inoculation, as opposed to post-fermentation blending of single-strain wines. Consumer sensory trials demonstrated that consumers preferred the 2007 Sauvignon Blanc trial wine made using co-inoculation, compared to the single strains themselves.

Fermentation nutrient effects on red wine volatile composition

Staff

Dr Paul Henschke, Dr Maurizio Ugliano

It is well established in white winemaking that a balanced supply of nutrients lowers the risk of fermentation problems, including slow or incomplete fermentation of sugars and off-flavour formation, and promotes cleaner and fruitier wine styles. Yeast assimilable nitrogen (YAN) has been identified as a key nutrient that strongly affects yeast growth and metabolism. However, YAN is highly dependent on vintage, soil, and viticultural practices, and is commonly present at a sub-optimal concentration in grape must. The threshold concentration for sub-optimal YAN in moderately ripe grape juice is considered to be around 140 mg/L, however the threshold concentration for red wine fermentations with maceration on skins is not known. Nevertheless, recent survey data suggest that a significant proportion of red grapes harvested each vintage have YAN concentrations below this value; grape juice YAN from dry areas of South Australia were especially low in vintage 2008.

The most frequently used method to optimise must nitrogen composition is supplementation with ammonium ions, usually in the form of di-ammonium phosphate (DAP). Proprietary nutrients based on inactivated yeast also supply nitrogen but in a complex form. Despite the widespread nature of this winemaking practice, very little information is available on how DAP effects the aroma composition of red wine.

A series of trials has been carried out over the last two vintages to investigate the influence of DAP addition on Shiraz wine volatile composition. Grapes from different sources, but having low initial YAN (about 100 mg N/L), were selected for the study. In a typical experiment, the YAN content of these musts was increased by the addition of DAP to give a final concentration of either 250 mg N/L or 400 mg N/L. Triplicate 30 kg lots of these musts were fermented by commercial *S. cerevisiae* strains at 22°C. The cap was plunged three times per day with similar length of maceration for all of the treatments.

Results *(Figure 1)* highlight the complexity of flavour formation in relation to DAP supplementation. Biosynthesis of ethyl fatty acid and acetate esters, which, in red wines, are generally associated with sensory characters such as fruity, red fruits and dark fruits, greatly increased with nitrogen supplementation. Conversely, branched-chain ethyl esters, which are associated with descriptors such as strawberry, are decreased with increasing nitrogen. The behaviour of ethyl fatty acid esters and branched-chain esters clearly reflects the trends observed for their precursor compounds in the cell, namely medium-chain fatty acids and branched-chain fatty acids. Acetate ester content, including ethyl acetate, appears to be different, as these compounds increased with increasing nitrogen, although a decrease in their precursor, acetic acid, was observed. Acetate ester levels generally positively correlate with wine aroma quality, although overly high concentrations can result in loss of aroma quality and the appearance of nail-lacquer aromas. A response to nitrogen supplementation was also observed for higher alcohols across the whole range of experimental wines. However, this was much less than previously reported for white wine fermentations, probably due to the high level of grape solids present in red fermentations.

This series of experiments indicates that DAP supplementation is a powerful tool to modulate the aroma composition of red wine. Further work is in progress to understand better the relationship between these changes and the sensory properties of wine. Integrating the role of DAP in modulating non-volatile compounds, including anthocyanins and tannins, with aroma composition is also in progress.

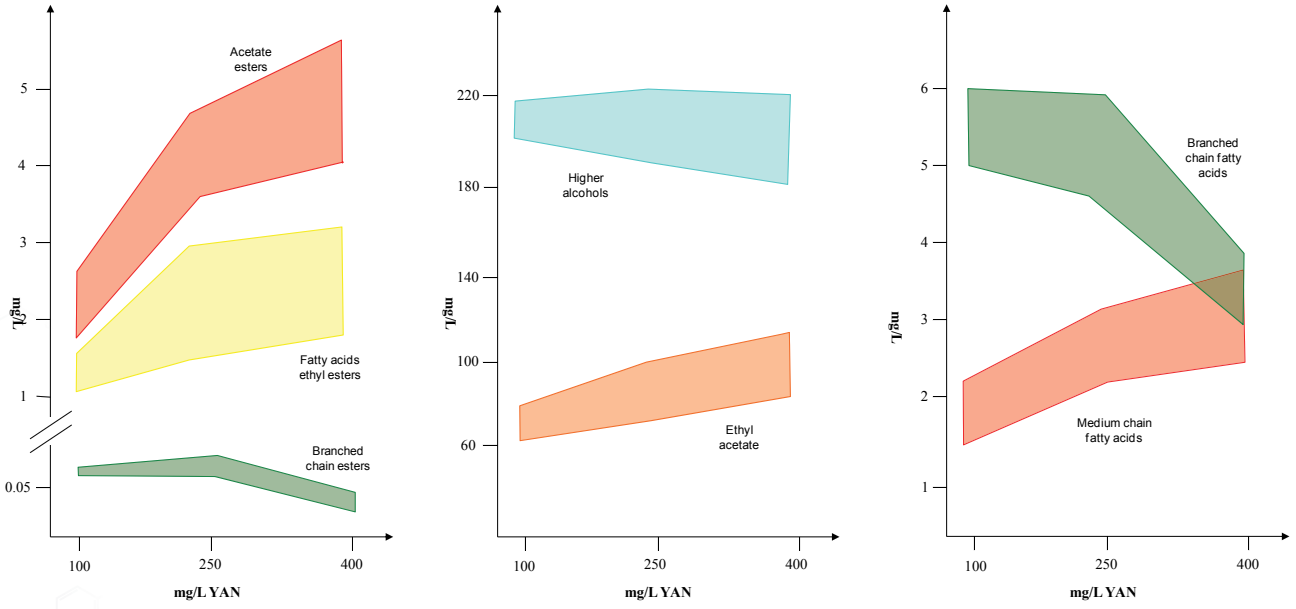

Figure 1. Fermentation-derived volatile compounds in Shiraz produced from low YAN (approx. 100 mg N/L) musts supplemented with different amounts of DAP. The coloured areas illustrate trends and the ranges of concentrations of volatiles measured in experimental wines made using different red wine yeasts and across two vintages

Wine yeast genomics: outlining the blueprint of wine yeast

Staff

Dr Paul Chambers, Dr Anthony Borneman, Angus Forgan

Every living cell, from those inside complex multi-cellular animals such as humans to single-celled bacteria, contains DNA and it is this material that is responsible for determining the inheritable traits of that cell. DNA is divided up into functional units called genes, each of which is responsible for controlling one or several functions of the cell, with the entire collection of genes in a cell termed the *genome*. Subtle differences in the structure of genes can produce differences between cells; in fact, it is variations present in DNA that are responsible for the many different types of plants, animals and other organisms that we see today. DNA is, therefore, considered to be the blueprint of life, and the emerging science of *genomics* seeks to understand the structure of genomes in order to understand how cells function.

Like inheritable differences between humans, such as eye or hair colour, differences in winemaking properties that are observed between wine microorganisms are ultimately attributable to variations in their DNA. Furthermore, all strain improvement programs rely on generating changes in DNA in order to isolate novel, genetically improved, strains. Understanding the genome of highly desirable wine yeasts or bacteria is the key to understanding DNA variation that is responsible for desirable properties. Once understood, genetic variation can be exploited by bringing together desired combinations of traits, to form 'super' wine yeasts that carry the desirable properties from a number of strains.

Until recently, genomic technologies were very costly and required large investments in infrastructure. The first (laboratory) yeast genome to be fully characterised (i.e. sequenced) was for a laboratory strain and the project, completed over 10 years ago, took around 70 different laboratories more than 10 years to complete, at a cost of millions of dollars. However, with advances in DNA sequencing technology, genomics has now become accessible to organisations such as the AWRI. Given its potential impact on the wine sector, we have actively pursued this powerful new technology, and have recently begun our genomics initiative with the aim of defining the global genomic blueprint of wine yeast. As a starting point, the genome of the wine yeast strain AWRI1631 has been determined. This yeast was chosen as it will be the model organism for systems biology studies at the AWRI, and is the host organism for the construction of a Wine Yeast Genome Deletion Library.

The genome of AWRI1631 was compared to that of a laboratory yeast strain (S288c) in order to map out variation that might be responsible for the significant differences in winemaking potential of laboratory and wine yeasts; the former do not efficiently ferment grape must, let alone make good wine. An enormous amount of variation was shown to exist between the two strains, indicating that there might be thousands of differences that contribute to the desirable winemaking properties of AWRI1631 compared to the laboratory strain. This first step in outlining the genetic blueprint of a wine yeast clearly points the way ahead for wine yeast strain development programs.


Eveline Bartowsky

AWRI Wine Microorganism Culture Collection

Staff

Dr Eveline Bartowsky, Jane McCarthy

A major role of the AWRI Wine Microorganism Culture Collection (AWMCC) is to maintain a world-class repository of diverse, wine-relevant strains of yeast and bacteria that can be readily accessed by Australian wine producers and for research purposes. The collection, containing over 1,800 strains, has been built over decades with inputs from Australian wineries, microbial strain development programs at AWRI, and by sourcing other culture collections for reference strains. This resource is of enormous value to Australian wine producers, and is mined by the AWRI to isolate yeast strains that have novel characteristics of importance to winemakers.

As an example of what is housed in the AWMCC, there are 11 experimental yeast strains that, over recent years, have been available to Australian winemakers to perform commercial-scale fermentation trials. Information received from these trials augments the AWRI knowledge base and helps to develop a detailed overview on the potential of these yeast strains for commercial release to the broader wine sector. Five of these experimental yeast strains are now commercially available through yeast supply companies.

Most yeast and bacterial strains in the collection can be provided to Australian wineries, research institutions in Australia and overseas, Australian teaching institutions and commercial companies. All strains are provided as live cultures on agar slopes. Provision of all cultures, except experimental strains, incurs a modest fee to cover costs of materials. Yeast and bacterial strains can also be deposited into the AWRI collection; and one large Australian winery has recently deposited their entire yeast and bacterial collections into the AWMCC.

Metabolomics: unravelling the biochemical complexity of wine microorganisms and the chemical complexity of wine

Staff

Dr Paul Chambers, Meagan Mercurio, Jeremy Hack, Irina Rusinova

The AWRI houses and operates the South Australian node of Metabolomics Australia. Metabolomics Australia is a nationwide, government-funded facility established to enable the development of, and access to, state-of-the-art metabolomic analysis. But what is metabolomics and why should a wine research institute be interested in microbial metabolomics?

Metabolomics is the comprehensive analysis (qualitative and quantitative) of the metabolome, which is the complete set of all low molecular weight metabolites that exist within an organism. The metabolome comprises of hundreds to thousands of compounds with widely varied chemical and physical properties; from low molecular weight polar volatiles such as ethanol, to high molecular weight polar glucosides and non-polar lipids. In this context, wine is a complex mixture of several interacting 'metabolomes': metabolites from grapes, yeast, bacteria, and oak all contribute to the chemical composition of wine, and shape its final characteristics. It is these metabolomes that are responsible for the quality and distinctive characteristics of a wine.

The analysis of metabolites is nothing new to wine scientists; however, due to the diversity of metabolites and the complexity of the networks in which they are produced or utilised, research has previously targeted either single or small


Paul Smith

groups of them. While these targeted approaches have delivered an enormous amount of information on, and understanding of, outputs of specific metabolic pathways, one of the downfalls lies in what they miss: unknown, biological processes are overlooked and therefore their importance remains undiscovered. Metabolomics offers a new approach that is unprejudiced by previous knowledge. This approach gives scientists the ability to look at things from a 'global' perspective—to see the bigger picture. Thus, where wine scientists previously looked at perhaps ten or twenty metabolites in a wine fermentation, we can now potentially analyse hundreds of grape or yeast-derived compounds with metabolomics approaches. Such an approach allows us to fully understand the impact of currently known compounds of interest and to also identify wine-relevant compounds that were previously unknown.

Metabolomics approaches in wine research will provide a much greater understanding of how variables, such as environmental conditions and genetic variation of vines, yeast and bacteria, shape the sensory attributes of wines. This will give us the chemical clues to distinguish the best vintages and winemaking practices from the 'also-rans'. Most importantly, greater knowledge will lead to greater control of product quality; winemakers will have more options when attempting to deliver the wine of their dreams.

Phenolics and their contribution to wine composition and sensory properties

Staff and students

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The Phenolics Research Team at the AWRI has the objective of evaluating the roles of phenolic compounds present in grapes and wines to deliver outcomes of benefit to the Australian wine sector. One critical aspect of this project includes developing the ability to measure phenolic grape and wine components relevant for wine colour, mouth-feel, astringency and taste on a molecular level. Focus is also directed towards the development of a more detailed insight into the winemaking-related transformations of phenolic compounds; particularly the consequences of these reactions for wine composition, quality or style, which relate to preserving and enhancing quality, consumer expectations and profitability. The project also develops knowledge of grape and wine phenolic attributes of relevance for consumer wine preferences and looks to improve grape harvesting and delivery processes. Finally, targeted optimisation of viticultural and winemaking practices, and the verification of potential and risks associated with novel practices and new technology are considered critical aspects to the project's success.

Structure and function of phenolic compounds in grapes and wine

One of the keys to driving applied phenolics research forward is to increase the fundamental knowledge of how the chemical 'structures' of grape and wine phenolics affect their 'function' in wine. Whether the function of interest is mouth-feel, colour or perhaps bitterness, it is crucial to understand the molecular structures of the phenolics responsible. David Jeffery leads this area with particular focus on characterisation of tannin structure, reactivity and function. As tannins in wine constitute a hugely diverse mixture, and reference substances are largely unavailable from commercial sources, separation, isolation and characterisation of compounds are a significant challenge. Progress in characterisation of red wine tannins requires new technologies for separating these complex polymers and the project has progressed significantly in this area in the last year.

A variety of new methods for characterisation of the physico-chemical properties of tannins has been developed. Partitioning of tannin between octanol and water and has been optimised, validated and used to characterise a range of wine tannin fractions. New analytical HPLC techniques using novel solid phases now allow characterisation of several tannin sub-fractions. A solid phase extraction (SPE) method, using a novel solid phase, has been finalised in our laboratory for rapidly isolating pure wine tannins with minimal handling, using just one cartridge. This allows total wine tannin to be isolated; which can be further separated into two wine tannin sub-fractions of significantly different polarity. Gaining access to these two tannin sub-fractions is a major step forward as the relationship of each of the two sub-fractions is now being investigated with respect to wine age, variety, sensory properties and other parameters. Furthermore, a series of experiments is being undertaken to assess the influence of oxidation on wine tannins.

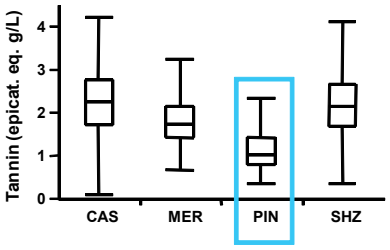
A survey of flavonols in Australian wines was also completed. As the first comprehensive study of this type it provided information on levels of flavonols in Australian wines, but also highlighted several important aspects of flavonol analysis, including the fate of rutin in wine. Rutin is rapidly degraded to the aglycone quercetin and does not exist to any measurable extent in bottled wine. Hence rutin is unlikely to contribute significantly to the mouth-feel properties of wine.

Yoji Hayasaka continues to contribute his significant skills to determining phenolic structures. A project undertaken to isolate anthocyanin oligomers using multilayer countercurrent chromatography has resulted in the discovery of a new compound similar to grape reaction product (GRP: the reaction product of glutathione with caftaric acid). This type of anthocyanin-related compound has not been reported before and further characterisation is in progress. In addition, a method for the characterisation of tannin subunits by acid-catalysed hydrolysis, in the presence of cysteamine, was optimised and evaluated using commercial seed and skin tannins as well as insoluble materials of red wine. This method is a more sensitive and user-friendly substitute for other mass spectrometric methods for the characterisation of sub-units of tannins. Mass spectrometry has proven to be valuable for the characterisation of red wine tannins and, together with the new SPE fractionation and partition methods, these methods now form essential parts of the 'tannin toolkit' available to the AWRI.

The PhD research of Eric Dennis on the organic synthesis of condensed tannins continues to make good progress through our collaboration with Michael Perkin's Natural Products Chemistry research group at Flinders University. The focal point of this research project continues to be the coupling of monomeric units together into larger, structurally-defined tannin polymers. Such defined tannin molecules are critical to understanding the influence structure has on function.

Grape phenolics and their contribution to wine composition and sensory properties

To improve our understanding of the relationships between viticultural practices, grape composition, red wine composition and sensory properties, Dr Helen Holt has continued her study into pruning and irrigation effects on berry size. Cabernet Sauvignon vines in a single



Variety	N	Low	Med	High	Mean
CAS	629	0.1 – 1.7 g/L	1.7 – 2.8 g/L	2.8 – 5.3 g/L	2.9 g/L
MER	188	0.3 - 1.4 g/L	1.4 – 2.2 g/L	2.2 – 3.3 g/L	1.8 g/L
PIN	112	0.4 – 0.8 g/L	0.8 – 1.4 g/L	1.4 – 3.5 g/L	1.2 g/L
SHZ	1107	0.4 – 1.7 g/L	1.7 – 2.7 g/L	2.7 – 4.9 g/L	2.2 g/L

Figure 2. Box plots showing Australian red wine tannin concentrations for Cabernet Sauvignon (CAS), Merlot (MER), Pinot Noir (PIN) and Shiraz (SHZ)

vineyard in the Clare Valley, South Australia were managed using three pruning treatments: machine, cane and spur. During three vintages (2003 to 2005) grape samples were collected from the vineyard at commercial harvest date to measure berry weight and to analyse berry phenolic composition. Fruit from each pruning type was harvested separately and triplicate 0.5 tonne lots of each was made into wine. Formal sensory analysis was performed on the wines approximately two months after bottling each year and wine compositional analysis was performed at the same time.

In this trial we have shown that berry composition, wine composition and wine quality can be influenced by pruning treatments in the vineyard and that the smallest berries do not always produce the highest quality wines. The results of this work indicate that the relationships between berry size and composition with wine composition, sensory properties and quality are complex and must be examined in the context of vintage variability as well. Berry weight was influenced by pruning treatments in all vintages. Berry composition also showed clear treatment effects with machine-pruned berries the lowest weights and the highest concentrations of anthocyanins, total phenolics and tannin in all vintages. Wines also showed compositional differences between treatments, but the trends were not as clear as those for berry composition. Higher anthocyanins, tannins and phenolics concentrations in berries did not always result in higher concentrations of wine anthocyanins, tannins or phenolics. Descriptive sensory analysis of the wines did not show clear differences among pruning treatments for individual descriptors. However, the overall quality rating was significantly lower for wines made with machine-pruned berries than for wines made with cane- and for spur-pruned berries in all vintages.

This information leads to two obvious avenues of investigation. First, it appears that it is necessary to investigate phenolic composition (classes of tannins) in addition to total tannin concentration in berries and wines in order to clarify the links between berry and wine composition, wine sensory properties and quality. Second, the complexity of the relationship between the composition of grapes and wine and wine sensory properties (overlaid with the significant vintage to vintage variability), warrants further examination of the key factors that determine regional identity and the production of wine for specific consumer markets.

In addition, our 2007 vintage experimental work focusing on the relative contributions of seed and skin tannin to wine tannin has been successfully completed. This work was conducted using seven parcels of Cabernet Sauvignon grapes from five regions and a wide range of berry tannin concentration. Over 9,000 berries were de-seeded or de-skinned in order to investigate the composition of the berries and the wines resulting from micro-fermentations (100 berry ferments). These data indicate that berries of different phenolic maturity can give highly variable skin tannin:seed tannin ratios in finished wines, with skin tannin dominating sometimes and seed tannin other times.

Method development and optimisation for measurement of white grape and wine phenolics has continued. Mango Parker remains responsible for the identification of the compositional basis for style and quality parameters associated with phenolics in white grapes and wines, and the positive and negative roles these compounds might play in defining taste and colour. This work has a strong collaborative focus through interaction with research groups at AWRI, The University of Adelaide and industry partners. A number of analytical techniques for phenolic profiling of white juice and wines are being developed and optimised.

Analysis of phenolic compounds – developing innovative phenolic analysis techniques

We have continued to provide Australian grape and wine producers with practical and informative material to help them measure the tannin concentration in their grapes and wines and to help them better understand the implications of tannin. Meagan Mercurio drove the development, adoption and application of new, industry applicable methods for tannin measurement in response to the wine sector's need for objective indicators of grape and wine quality. The AWRI standardised methodology for quantifying tannins in grape and wine samples has been developed based on precipitation of tannin with methyl cellulose. This assay, known as the methyl cellulose precipitable (MCP) tannin assay is now fully optimised, validated and available to wine producers and researchers alike in 1 mL, 10 mL and high throughput (HTP) formats. A web accessible standard operating protocol (SOP) is available for the MCP tannin assay (www.crcv.com.au/resources/).

To inform producers about the tools to more accurately understand the concentration of tannin in their grapes and wines, and for a greater understanding of the implications of tannin, publications have appeared in peer-reviewed journals, industry journals, websites (including 'standard operating procedures'). See Appendix 5 for more details on the publications. Development of rapid spectral grape and wine tannin measurement using the MCP tannin assay as reference method continued in collaboration with the Spectroscopy and Chemometrics team in the Industry Applications group. As a result, a very rapid UV-based predictive model for red wine tannin has also been developed. This allows prediction of tannin using simple, spectroscopic measurements.

In addition to assisting Australian producers with the measurement of tannin, we can now also provide information on what that tannin number 'means' within an Australian context. This significant opportunity stems from completion of our Australian grape and wine tannin survey and the development of a database that now allows investigation of significant tannin concentration variations between regions, vintages and varieties *(Figure 2)*. Furthermore, using allocation grading data from major industry partners, we have shown consistent positive correlations between red wine quality and tannin concentration. This proves that total wine tannin concentration can be used as one of the objective measures of quality in red wine *(Figure 3)*.

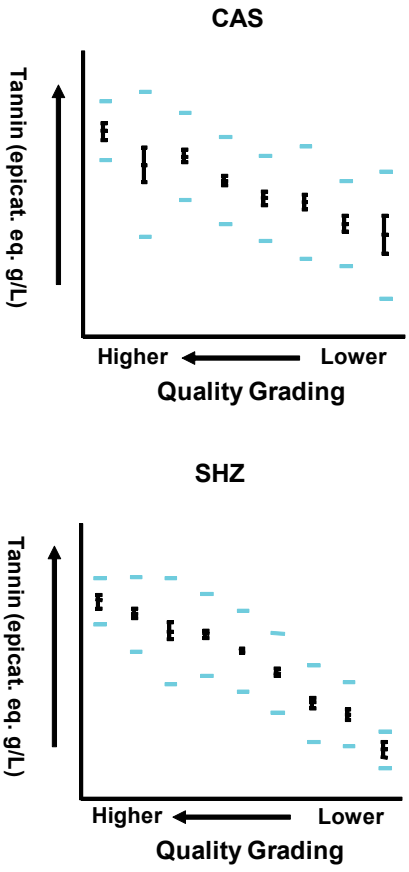


Figure 3. Wine tannin concentration vs red wine allocation grade as determined by a major Australian wine company over the 2004 to 2007 vintages (mean and SE)

A method comparison study was also completed that compared performance of the MCP tannin assay and the protein-based 'Adams-Harbertson' tannin assay. This showed that the two assays correlate very highly for 50% ethanol grape homogenate extracts (r_2=0.96); highly for red wines (r_2=0.80); and that the MCP tannin assay is significantly faster, simpler and cheaper to perform. A manuscript describing these comparisons has been published in the *Journal of Agricultural and Food Chemistry*. Interestingly, despite the correlation between the two assays, a 3-fold difference in actual tannin concentration was observed. Extensive studies into this apparent systematic difference in tannin quantification between the two assays have not revealed the reason for this difference.

Novel winemaking processes to stabilise and package wine and deliver it to the consumer in optimum condition whilst maintaining or improving quality, value and sustainability

Staff and students

Dr George Skouroumounis, Mariola Kwiatkowski, Ken Pocock, Patrick Dimanin, Sam Stranks (AWRI); Oenone (Jean) Macintyre, Simon Nordestgaard, (The University of Adelaide), Steven van Sluyter (University of Melbourne) (PhD students)

Collaborators

Dr Chris Colby, Dr Lorenz von Smekal, Dr Heath Ecroyd, Professor John Carver (The University of Adelaide), Chris Day (Provisor), Dr Ian Menz, Dr Peter Anderson (Flinders University), Nigel Krollig, Dr Vanessa Stockdale, Dr Eric Wilkes (Foster's Wine Estates), Audrey Lim (Constellation Wines), Leon Deans, Inca Pearce (Orlando Wines); Dr Filomena Pettolino, Professor Tony Bacic (University of Melbourne), Fernando Salazar (visiting PhD student, University of Roviri I Virgili, Spain), Stéphane Vidal, Olav Aagaard (Nomacorc PL, Belgium)

During the year, this research focused on two key winemaking processes: protein stabilisation and packaging.

Protein stabilisation

Preventing protein haze is a major white wine production issue. The current method of bentonite fining is effective, but has disadvantages associated with both efficiency and cost. The first suite of research projects in the AWRI's wine production stream addresses ways to improve bentonite efficiency, and the need to develop alternatives to bentonite fining through a thorough understanding of the phenomenon of haze formation.

We have continued to make good progress in understanding the mechanism of protein haze formation. The protein haze formation is likely to be a two-step process, with the first step being protein denaturation, aided by the sulfate anion and accelerated by heat. The denatured protein then aggregates. Whilst sulfate appears to be fundamental to haze formation, other wine components such as phenolic compounds remain as candidate haze modulators. One possibility is that white wine phenolic compounds affect the particle size of denatured aggregated proteins, possibly through crosslinking.

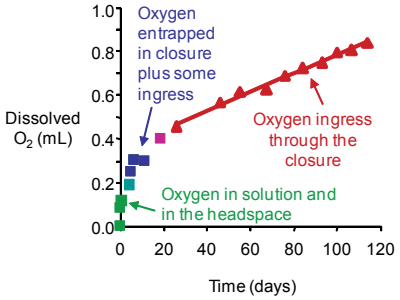


Figure 4. The ingress of oxygen into a 375 mL volume wine bottle sealed with a synthetic closure during storage at 18ºC. Oxygen content was determined, non destructively, from the loss of BPAA

One approach we have taken this year to further elucidate the mechanism of haze formation is to develop a mathematical model describing the process of protein aggregation. This model suggests that the protein aggregates are initially spherical and then develop more of an oblate deformation eventually leading to a more cylindrical shape. Being able to define particle size and shape is important because these parameter effects light scattering and thus the turbidity of solutions containing these particles. By having a greater knowledge of the process on a molecular level, such as the size and shape of the interacting protein aggregates, the more successful we will be in proposing alternative solutions to the wine haze problem.

We plan to extend this work further to see how other wine components affect the size and shape of the particles and to confirm that protein aggregation is not nucleation dependent. If haze formation is nucleation dependent then one alternative approach to preventing haze formation would be to prevent this initial nucleation event.

One approach to improving bentonite efficiency is to improve the way wineries determine the amount of bentonite required to prevent subsequent protein haze formation. We have examined the suitability of the current tests used by Australian winemakers to predict wine protein instability (80ºC for six hours, 80ºC for two hours and Bentotest) through long-term storage trials of wines that had been fined according to the test results. We challenged the wines to severe transport and storage conditions and held them under best practice cellar conditions. Under severe conditions, none of the wines became hazy. Under the best practice conditions some of the wines eventually became slightly hazy but only after more than two years of storage. Such slight hazes would probably be commercially acceptable. This means that fining according to the rates determined by all the tests examined by us would most likely prevent haze in the bottle, in practice. It was significant, however, that the tests gave different bentonite fining rates, hence, using some of the tests could lead to over fining with bentonite.

We have also screened more than 200 commercially labelled white wines for protein stability under simulated severe transport and storage conditions. Only one wine failed this test. This wine also failed the heat tests at 80ºC for two or six hours. These data confirm that the vast majority of Australian commercial white and rosé wines are protein stable. The wines screened included a subset of wines from companies that use the 80ºC for two hour test and all these wines were stable. This also confirms our data that bentonite fining according to the rates determined by testing at 80ºC for two hours would most likely prevent haze formation in the bottle in practice.

Packaging

In addition to protein haze formation after bottling, wines can also be placed at risk of oxidative spoilage and premature development through packaging, transport and storage decisions. At present, the wine sector has little in the way of tools to predict shelf life because the factors likely to impact on it are poorly understood or difficult to measure. The second suite of research projects in the AWRI's wine production stream aims to develop the tools and collect the data required to assess the relative importance of winemaking practices, packaging choices and transport and storage conditions on oxygen ingress into wines and to link this to wine development in bottles and oxidative spoilage.

This year we have undertaken studies to elucidate the relative roles of closure oxygen transmission rate, free SO_2 levels at bottling and copper fining before bottling on wine development in the bottle. Two Sauvignon Blanc wines with different levels of volatile thiol compounds were bottled in August 2007. The treatments imposed on the two wines were copper fining (presence or absence), SO_2 adjustment (30 and 60 mg/L free SO_2) and oxygen transmission rate (OTR) through closures (screw cap, Nomacorc Premium and Nomacorc Light, low to high OTR, respectively). The bottled wines are stored under best practice industry conditions of controlled temperature and humidity.

Several analyses were undertaken after six months of storage. There were only small differences between the treatments. Wine sealed under screw-caps have retained marginally more SO_2 and ascorbic acid than those under the Nomacorc closures. There was a trend for the wines sealed with Nomacorc Premiums to contain slightly more SO_2 and ascorbate than those under the Nomacorc Lights, as we would expect from knowledge of the OTR, but, data from further time points are needed to confirm this. There were no clear effects of the copper treatment at this stage.

White wine colour was assessed using CIELab. The Sauvignon Blanc wines were very lightly coloured and differences were probably not yet visually detectable. Wines sealed under Nomacorc Light tended to be less green and more yellow than those under Nomacorc Premium; wines under screw-caps were even less yellow than wines under Nomacorc closures. Wines with the higher SO_2 addition at bottling were greener and less yellow than those with the lower addition. Again, there were no clear effects of the copper treatment on wine colour at this stage. Informal tasting of the wines after six months of storage confirmed the results of informal tasting after three months; the wines were sound, but differences between the treatments were not clearly evident yet.

We have also developed a method which allows the calculation of not only the oxygen ingress rate through closures, but also the initial amount of oxygen in the headspace of a wine bottle and the amount of oxygen entrapped in the closure. This new assay uses methylene blue and light to convert dissolved oxygen into singlet oxygen, the reactive form of oxygen, and a water-soluble compound [(BPAA); bis-9, 10-anthracene-(4-trimethylphenylammonium) -dichloride] to trap singlet oxygen. The reaction product formed when BPAA reacts with singlet oxygen has a different absorption spectrum than BPAA. The change in absorbance after the reaction can then be related to the quantity of oxygen present. By using a modified spectrophotometer, these reactions can be undertaken in synthetic wine solutions and measured in a wine bottle sealed with closures inserted under normal commercial conditions. The determination of oxygen permeation rates is calculated from measurements made over an eight week period under controlled storage conditions.

We are now in a position to use the non-destructive BPAA method to more rapidly evaluate the route of oxygen ingress into bottled wines and validate the data we have already obtained. This information will add to a growing body of data that we plan to collect during the next few years in order to assess the relative importance of winemaking practices, packaging choices and transport and storage conditions on wine development and oxidative spoilage. Our ultimate aim is to be able to develop models to allow predictions of shelf life to be made at various stages of a bottled wine's 'life'.

Chris Curtin

Industry Applications

Staff

Peter Godden, Dr Daniel Cozzolino, Dr Bob Dambergs, Dr Wies Cynkar, Dr Richard Muhlack, Dr Chris Curtin, Ella Robinson, Emma Kennedy (part-time), Dr Paul Smith (part-time from April 2008), Les Janik (until October 2007), Vince O'Brien (Until April 2008)

The AWRI has formed a new group known as Industry Applications (IA), which will be led by Peter Godden. The group will work closely with other AWRI teams and with Australian producers to more effectively bridge 'gaps' that might exist between research and uptake by producers. The IA group will pro-actively assist wine producers to apply practical knowledge generated from both inside and outside the AWRI. Identifying the barriers to application of knowledge and research outputs is critical; for example determining whether there is a technical solution that is missing, or perhaps a requirement for more education and awareness around a topic. Demonstration of the financial and sustainability benefits that will come from knowledge application will also be crucial. In addition, the IA group will have a focus on the development of new products and technological solutions that arise from research programs. In a global R&D marketplace and an era of cross-border ownership, Australia's continued success will be linked to its ability to adopt new technology rapidly; speed to market is a key consideration.

External collaborators

Nigel Blieschke, Matthew Zadow, Louisa Rose (The Yalumba Wine Company), Michael McCarthy, Chris Soar (SARDI), Duncan McGillivery, Paul Cox, Xavier Conlan (Deakin University), Paul Boss (CSIRO Plant Industry), Kevin McCarthy, Dr Eric Wilkes (Foster's Group), Frédéric Blanck (Domaine Paul Blanck, Alsace, France), Inca Pearce, Jai O'Toole, Hylton McLean, Peter Policki, Leon Deans (Orlando Wines), Chris Colby, Brian O'Neill, Peter Ashman, Stephanie Dutton (University of Adelaide), Chris Bevin, Kerri Thompson, Warren Birchmore, Sue Bell, Jim Northey, Handoko Putra (Constellation Wines Australia), Bruce Kambouris (McGuigan Simeon Wines), Patricia Valente (Universidade Federal do Rio Grande do Sul Brazil), Mark Tamplin, Tom McMeekin, Tom Ross (University of Tasmania)

Investigations into the relationship between *Dekkera/Brettanomyces* yeast and red wines in Australia

Staff

Dr Chris Curtin, Adrian Coulter, Geoff Cowey, Matthew Holdstock, Emma Kennedy, Virginia Phillips, Peter Godden. Internal collaborators: Dr Leigh Francis, Belinda Bramley, Brooke Travis, Dr Yoji Hayasaka, Gayle Baldock

External collaborators

Patricia Valente (Universidade Federal do Rio Grande do Sul Brazil), Mark Tamplin, Tom McMeekin, Tom Ross (University of Tasmania)

'Brett' research at the AWRI is focused upon providing Australian wine producers with tools to guide their decisions regarding management and detection strategies. Broadly, through R&D we aim to deliver: the ability to benchmark against industry trends in 'Brett' spoilage; the ability to assess relative susceptibility of wines to 'Brett' spoilage; and the availability of knowledge linking wine composition and sensory data to individual thresholds and consumer preferences. The multi-disciplinary nature of this approach necessitates internal and external collaborations, and a strong practical focus through the AWRI's Industry Applications group.

Industry trends in 'Brett' spoilage

The ongoing targeted survey of Cabernet Sauvignon wines made in five major wine regions of Australia highlights a major success of Australia's winemakers with regard to improved 'Brett' management. The likelihood of encountering a Cabernet Sauvignon wine with 4-ethylphenol concentration above the sensory threshold has decreased significantly ($p<0.001$) over the past decade. Table 1 summarises these data, where it can be seen that the median 4-ethylphenol concentrations for the most recent representative vintage (2005) was only 33 µg/L. This concentration is well below perception thresholds even for highly sensitive individuals.

Table 1. Summary of five-region Cabernet Sauvignon 'Brett' survey

Vintage	Wines analysed	Median 4-ethylphenol concentration (µg/L)
1996	8*	942
1997	29*	1060
1998	46*	682
1999	59*	582
2000	104	713
2001	125	339
2002	147	227
2003	127	132
2004	92	52
2005	63	33
2006	14*	177

* Vintages with fewer than 60 wines analysed cannot be considered statistically representative

Assessing the relative susceptibility of wine to 'Brett' spoilage

A collaborative trial was undertaken with a South Australian winery to compare 'Brett' susceptibility of multiple wine parcels through multiple stages of wine processing. The aim of this work was to determine if, under controlled laboratory conditions, any differences in susceptibility could be related to compositional or processing variables. Such data would make it possible for a risk-matrix to be established.

Preliminary results suggested four of the ten wine parcels might be more susceptible to 'Brett' spoilage, based upon controlled challenge tests. Comparison with the winery's in-house monitoring data revealed that two of these wines had been identified as 'Brett'-affected through microbiological screening, sensory assessment, or chemical analysis.

Rapid analysis of grape and wine composition

Staff

Dr Vincent O'Brien (until April 2008), Dr Paul Smith (part-time from April 2008), Dr Daniel Cozzolino, Dr Robert Dambergs, Dr Wies Cynkar

The Rapid Analytical Methods team has demonstrated many analytical methods using spectroscopy and chemometrics and are considered to be the international leaders in this field. This team has published many review articles, presented information at national and international conferences and have conducted training workshops for Australian grape and wine producers.

Applications such as the analysis of total anthocyanins in grapes, using Vis-NIR spectroscopy, have been adopted by Australian wine producers. To complement the analysis of anthocyanins, it is desirable to also analyse tannin, as the two combine in wine to form pigmented tannins: the stable form of wine colour. To this end, the AWRI has developed a simplified wet chemistry method (the 'MCP tannin method') to measure tannin in grapes and wine, which replaces the need to use HPLC methods. This has been taken one step further in the development of rapid spectral methods using UV, Vis, NIR and MIR spectroscopy.

A survey of winery laboratories showed that only 15% currently measure tannin, but 82% of the remainder, wanted to measure tannin. Thirty-five per cent currently measure colour and of that group, 45% also currently measure tannin and 100% also wanted to measure tannin. Another important statistic from the survey was that the majority of respondents managed a grape crush of 1,000 to 20,000 tonnes. While many large wineries have enough sample through-put to justify relatively expensive NIR and MIR spectrophotometers, similar to research-grade instruments that are used for development work at the AWRI; for these smaller wineries a cost-effective solution is to use existing equipment. Survey respondents indicated that 85% had a UV-Vis spectrophotometer. To this end, a calibration for tannin originally developed on a high-end UV-Vis-MIR device was simplified for use on a standard UV-Vis spectrophotometer to enable technology transfer to winery laboratories. The MCP tannin method was used as the reference method to develop the spectral calibration and data from a validation set of samples are shown in *Figure 5*. Note that the standard error of the 'UV tannin method' was 0.19 g/L (or a CV of 9%), the same as the reference method that was used to develop the calibration. A test version of this method was trialled with six wine industry laboratories and the AWRI's Analytical Service. After adjustments for individual instrument performance, the results for all laboratories matched well. The big advantage of a spectral method is simplicity but the method is also more repeatable, for example when two laboratories were compared with the same validation set as used to compare the reference method with the spectral method, the standard error was only 0.05 g/L (or a CV of 2.4%, Figure 6).

While a method using a standard UV-Vis spectrophotometer might be advantageous for a smaller laboratory that does not have access to NIR or MIR devices, using the IR wavelength regions has the advantage that many other analyses can be performed simultaneously. For example, we have now demonstrated that with the same Vis-NIR scan, anthocyanins, tannins, total dry matter, water content, total soluble solids and pH can be rapidly measured in red grapes. As appropriate equipment and software becomes more affordable and more versatile, these methods will become main-stream for Australian wine producers.

We have also undertaken further work on developing existing simple spectral methods such as the Somers methods, first described by Chris Somers more than 25 years ago at the AWRI. The modifications that we have made to this method offer improvements in the results obtained and improvements in efficiency for routine use. In collaboration with the tannin team, the modifications to the Somers methods have allowed them to be adapted to a plate reading spectrophotometer for high through-put analysis, in combination with MCP tannin (AWRI publication #975).

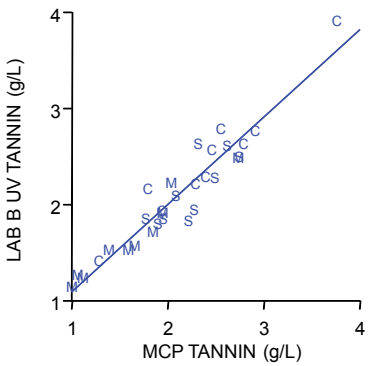


Figure 5. A plot of reference method values (MCP tannin) versus values predicted with a UV spectral calibration. R^2 = 0.91, standard error = 0.19 g/L, CV (standard error/mean)= 9.0%, C= Cabernet Sauvignon, M= Merlot, S= shiraz

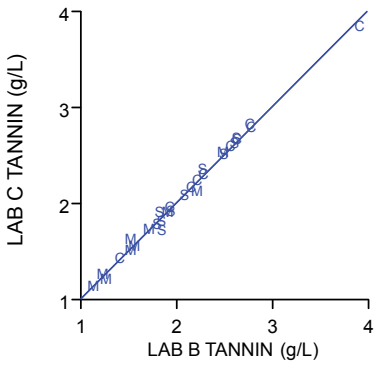


Figure 6. A plot of tannin values obtained by Lab B (AWRI Analytical Services) and Lab C (industry laboratory) using a UV spectral method on a set of commercial wines. R^2 = 0.99, standard error = 0.05 g/L, CV (standard error/mean)= 2.4%, C= Cabernet Sauvignon, M= Merlot, S= Shiraz

Process and environmental engineering

Staff

Dr Vincent O'Brien (until April 2008), Dr Paul Smith (part-time from April 2008), Dr Richard Muhlack

As the Australian grape and wine sector moves forward, the rapid and rigorous application of innovative science, particularly technologies that reduce cost and increase our control of grape and wine production processes, will become increasingly important. Indeed, the continued development and adoption of efficient production systems which produce the highest-possible quality wines at the lowest possible cost will be crucial if the sector is to maintain a competitive advantage in the increasingly competitive global market.


Yoji Hayasaka

The AWRI has long held the view that in many cases the 'missing link' which has prevented the uptake by the Australian grape and wine sector of many important research findings has been an engineering solution, and we are pleased to report that during the year the AWRI was able to appoint a process engineer to its staff for the first time.

Additionally, it is recognised that efficient processing is intimately linked to the sector's environmental impact and sustainability, and the AWRI views issues such as resource use and waste stream management as integral to its investigations into process efficiency.

Our newly-acquired engineering capability will work within the fledgling Industry Applications Group to build synergies with the Group's existing expertise, particularly in the development of rapid analytical methods for grape and wine analysis and process monitoring.

Pilot and feasibility studies were conducted during the 2008 vintage, further building on the Rapid Analytical Methods (RAMS) teams' previous application of rapid, particularly near infrared spectroscopy and multivariate modeling, to the winemaking process. One such application is in the simulation, monitoring and control of primary fermentation. The ability to reliably and accurately monitor and control fermentation in real-time, and to identify and predict problem fermentation behaviour is crucial to maximising wine quality. Fermentation management places significant demands on winery resources, which range from daily sample collection, laboratory analysis and winemaker tasting, to infrastructure constraints such as equipment availability, energy and water use, and refrigeration capacity. The occurrence of slow and stuck fermentation further impacts on process efficiency with significant quality downgrades, additional labour costs (reseeding, monitoring, pump-overs and transfers, and laboratory analysis) and reduced tank availability. Australian winemakers could potentially markedly reduce those resource demands through optimal engineering design and process control strategies. Quality parameters can be quantified and controlled more effectively through the use of inline monitoring, and problem fermentation behaviour could potentially be predicted through computer simulation, giving winemakers advanced warning on pending issues before they occur.

A scoping study conducted during the 2008 vintage sought to evaluate the utility of spectral analytical methods for the prediction of the juice yield from various grape batches, which could later be used to inform decisions on pressing conditions. This work fits with the Industry Applications Group's broader aims of assisting wine producers to improve their grape-receival and scheduling systems and management of related resources. Such work could lead to improvements in the separation and potentially the evaluation of the chemical composition of various juice fractions, and the subsequent streaming of similar-juices in order to optimise overall wine quality.

The availability of solid data on the true bio-economic cost of vineyard and winery operations is crucial if the potential efficiency gains of changes in processes are to be properly evaluated. To this end 'activities-based costing' analysis commenced during the 2008 vintage; the first phase examining grape receival and juice processing operations.

Process engineering opportunities to improve energy and water efficiency and other sustainability measures are also being evaluated as a key priority area. These investigations include options for water recycling such as capture and reuse of wash water and cleaning chemicals, and recycling of cooling tower blow-down water. Opportunities to improve the energy efficiency of existing processes and equipment such as compressed air systems, pumps, drives and refrigeration and heat exchange systems have all been identified, and strategies are currently under development to drive sector adoption of such improvements. Technology for renewable onsite power generation from waste streams such as grape marc and grape stalks is also being investigated in collaboration with external research partners. Improvements such as these could help to not only reduce winery operating costs but also reduce greenhouse gas emissions and carbon footprints. Such measures will further enhance the competitiveness of the Australian wine sector and will play an important part in its efforts to mitigate the harmful risks of climate change.


Michael Brajkovich (NZ)

Pepper aroma in Australian Shiraz

Staff

Peter Godden, Ella Robinson, Emma Kennedy

The Industry Applications group has the goal of learning more about the viticultural factors affecting rotundone concentration in grapes and wine. Following the AWRI's identification of rotundone as the black pepper aroma impact compound in Shiraz grapes and wines, the Industry Applications group is collaborating with the Flavour team. Ultimately, the aim is to provide Australian grape and wine producers with the tools to control the pepperiness of their wines, both in the vineyard and the winery.

In preliminary work commenced just before the 2008 vintage, we identified existing Shiraz viticultural trials underway in Australia, made contact with the relevant research organisations and gained access to grape and wine samples for rotundone analysis. Factors under investigation in these trials include clonal differences, irrigation practices, rootstocks and heat stress.

The very hot 2008 vintage conditions unfortunately appear to have had an impact, with many of the samples analysed to date found not to contain detectable levels of rotundone. Our focus is now on completing analysis of 2008 vintage samples and identifying trials for the 2009 vintage which are likely to offer the greatest potential insight into factors affecting rotundone concentration.

Team reports

Understanding Pinot Gris and Pinot Grigio wines

Staff
Peter Godden, Ella Robinson, Dr Daniel Cozzolino, Emma Kennedy

Pinot Gris is a white grape variety that is increasing in importance in the Australian wine sector. Between 2005/2006 and 2006/2007, the total area of Pinot Gris under vine increased by 83% from 1352 ha to 2469 ha; the largest percentage increase of any white variety. However, because this variety has two different names (Pinot Gris and Pinot Grigio), and has traditionally been used to make wines of very different styles, there is potential for considerable confusion amongst consumers. This confusion could impact on the variety's ultimate success in the marketplace.

Our work on this variety aims to gain a greater understanding of Australian styles of Pinot Gris/Grigio wines, in a global context. A combination of sensory analysis and rapid analytical techniques will be used, with the goal of developing objective measures of Pinot Gris/Grigio style. This, in turn, could provide wine producers with information which could assist communication with consumers, and potentially to label wines more consistently.

Our initial approach has been to start to build up a spectral dataset of a range of Pinot Gris/Grigio wines. We will investigate potential for discrimination among samples from different regions and/or based on whether they are labelled as 'Gris' or 'Grigio'. Preliminary indications are encouraging, and we are working to increase the number of samples in the dataset.

Additionally, a sensory panel of Australian producers and AWRI staff was convened to assess the sensory characteristics of a range of Pinot Gris and Grigio wines from France, Italy, Australia and New Zealand. During a one-day tasting, 14 panellists developed a list of attributes and then assessed duplicate samples of 23 wines against these attributes. Analysis of the sensory data combined with chemical and spectral data obtained on these wines is underway.

Applications of mass spectrometry to ensure the quality and integrity of Australian wine

Staff
Dr Yoji Hayasaka, Gayle Baldock

Members of the Mass Spectrometry team work collaboratively across teams within the AWRI and also with external researchers. Their collaborative activities are included elsewhere within this report, however, the highlights from the year are shown here.

Major potential oak lactone precursor measured in oak extracts for the first time

Collaborator
Dr Kerry Wilkinson (The University of Adelaide)

β-D-Glucopyranoside of 3-methyl-4-hydroxyoctanoic acid, the major potential oak lactone precursor, was measured in oak extracts for the first time. A method for the quantification of the oak lactone precursor in oak extracts was successfully developed. The method affords a tool for measuring the *potential* oak lactone *level* in oak wood, and could be used to more accurately estimate the duration of oak contact or cooperage treatments required to produce desired levels of oak flavor *from oak maturation.*

Guaiacol precursors in grape and wine as a consequence of exposure to smoke

Collaborators
Dr Kerry Wilkinson, Kerry Dungey (The University of Adelaide)

Guaiacol glucoside was confirmed to be present as a component of the juice of grapes naturally (bushfire) and experimentally exposed to smoke, and was found in substantially greater amounts in the smoked grape juice than in the control juice from grapes with no exposure to smoke.

In recent years, the negative impact of bushfire on grapes and their resulting wines is an increasing concern. The wines made from grapes exposed to smoke in vineyards are often characterised by objectionable 'smoky', 'dirty' and 'burnt' aromas and tastes. This can result in significant reductions in their market value or even make the wine unsaleable.


Greg Jones (USA)


Stephen Strachan

The concentrations of smoke-derived phenols, including guaiacol, are reported to increase during the winemaking processes as well as by hydrolysis with acid and enzyme. These observations indicate the existence of the precursors to smoke-derived phenols in grapes exposed to smoke.

The existence of guaiacol glucoside in smoked juice was investigated in collaboration with Dr Kerry Wilkinson's group at the University of Adelaide.

- Guaiacol glucoside was synthesised as a reference compound. Using the reference compound, LC-MS/MS conditions were optimised for the detection of guaiacol precursors in juice.
- The juice from grapes exposed to smoke by bushfire was analysed. As a result, guaiacol glucoside was confirmed to be present as a component of the smoke-affected grapes.
- For further confirmation of the formation of guaiacol glucoside as a result of exposure to smoke, the juice from grapes that were experimentally exposed to smoke and control grape juice (from grapes with no exposure to smoke) were analysed. Guaiacol glucoside was found to be present in greater amounts in the smoke-affected grape juice than in the control grape juice.

These results indicate that the formation of guaiacol glucoside increases as a consequence of exposure to smoke and free guaiacol could be released from the glucoside during winemaking processes and hydrolysis. The contribution of guaiacol glucoside to the smoke taint character of affected wine and the existence of other potential precursors are under investigation.

Technical problem solving

Staff

Adrian Coulter, Geoff Cowey, Matt Holdstock, Gayle Baldock, Emma Kennedy, Con Simos and Dr Yoji Hayasaka

In addition to its extension and information transfer activities, the Industry Services team provides a technical problem solving and analysis service to Australian wine producers, which represents a significant proportion of the team's workload. This service is provided according to strict Terms and Conditions, and client confidentiality is an important aspect of the provision of the services. This facilitates a frank exchange of information between the AWRI and its clients, which in turn allows the maximisation of the knowledge gained from the provision of these services. If a problem is thought to be of interest to the whole wine sector, findings of the investigation conducted may be published. However, under no circumstances are the names of the winery or company concerned, or any possible identifying references, ever published.

Full reports, containing technical information relating to the problems investigated, are prepared for clients when investigations are likely to result in litigation. Otherwise, clients are provided with summaries which seek to explain the underlying causes of the problems encountered, or are directed to relevant sections within the *Problem Solving Services* section of the AWRI's website. Advice on how to prevent the re-occurrence of such problems is provided to clients and technical references relating to the area of investigation are also often supplied.

A summary of the number and type of investigations conducted by the Industry Services team over the past three financial years is presented in Table 2.

reflection of the reduced wine grape intake of the drought-affected 2007 vintage, which was 26% lower than the intake for the 2006 vintage.

The number of investigations conducted into microbiological instabilities has been steadily decreasing since the 2001/2002 financial year and the number conducted during 2007/2008 is 47% lower than that for the previous year *(Figure 7)*. This result is very encouraging and might indicate that advice and strategies disseminated by the AWRI by various means over the past 10 years, regarding the optimal use of sulfur dioxide (SO_2) in combination with pH adjustment, have been implemented by many wineries. However, whilst there has been a slight decrease in the number of investigations conducted into wines affected by hazes and deposits over the past two years *(Figure 8)*, the number of these types of problems investigated continues to represent a large percentage (34% for 2007/2008) of the total number of investigations performed, and this remains a concern. Consequently, issues related to such instability problems continue to be addressed in AWRI Roadshow workshops and by the *Problem Solving Services* section of the AWRI's website.

Typically, potassium hydrogen tartrate (KHT) crystals are responsible for the majority of deposits encountered in wines after bottling. This year was no exception, with KHT crystals accounting for approximately 23% of the investigations conducted under the category 'hazes and deposits'. Insufficient cold-stabilisation of wines prior to bottling or the application of an inappropriate cold stability test is perceived to be the major cause of these instabilities. The AWRI's preferred method for assessing cold stability in wine is storage for three days at –4°C, as this test corresponded most closely with the observation of the stability of wines stored under cellar conditions for one year (AWRI publications #503).

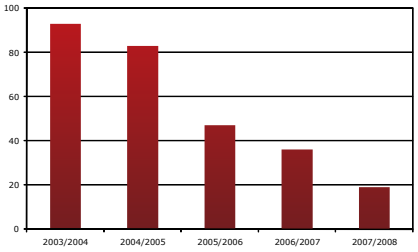


Figure 7. The number of investigations conducted into wines with microbiological instabilities during the period 2003/2004 to 2007/2008

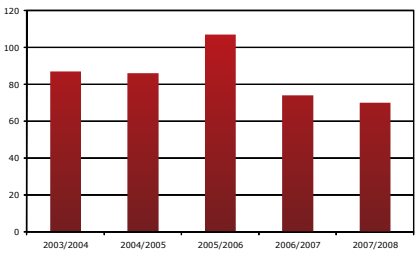


Figure 8. The number of investigations conducted into wines affected by hazes and deposits during the period 2003/2004 to 2007/2008

Table 2. Summary of the number and type of problem solving investigations conducted, and numbers of samples analysed by the Industry Services team during the past three years

Type of investigation	Investigations conducted and samples analysed		
	2005/06	2006/07	2007/08
Identification of hazes and deposits	107	74	70
Microbiological investigations	47	36	19
Sensory assessments	37	26	33
Taint problems	118	80	58
Other investigative analyses	48	36	25
Closure-related investigations	11	26	4
Total number of investigations	**368**	**278**	**209**
Total number of samples analysed	**2255**	**2000**	**1042**

The figure for the number of investigations conducted during 2007/2008 is 26% lower than the figure for the previous year. Many post-bottling problems associated with the 2007 vintage were investigated by the problem solving team during the 2007/2008 financial year. Therefore, the decrease in the number of investigations might, to some degree, be a

Historically, the incidence of copper-related hazes in Australian wines has not been high. However, the rate of occurrence of this type of instability has increased in recent years and is now a cause for concern, with copper hazes representing approximately 20% of the investigations conducted this year under the category 'hazes and deposits'. The increase in the number of copper-related hazes investigated by the Industry Services team seems to parallel the increase in the use of screw-cap closures by winemakers. One trend the team has observed since the larger acceptance and use of the screw-cap closure is an increase in copper additions to wines immediately prior to bottling, regardless of whether any reductive characters are detected in the wine. This is being done in an attempt to safeguard, or prevent, any possible post-bottling 'reductive' character forming in wine sealed with this type of closure.

There are many different compounds that can produce, or contribute to, a reductive character in wine, some of which are not removed by copper treatment. Copper ions react immediately with hydrogen sulfide to form the highly insoluble precipitate copper sulfide. However, when copper is added to a wine when no reductive character is present, or to a wine with a reductive character that is not able to be removed with copper ions, the resulting excess copper ions might react with other wine components. These excess copper ions can facilitate the formation of a haze, particularly in white wine, as they are able to complex with small amounts of protein that might remain in the wine after bentonite fining. Given that copper is also a catalyst for oxidation (Ribéreau-Gayon et al. 2000), the presence of excess copper in wine is something that should be avoided.

Copper instability is usually avoided by allowing sufficient time for the formation of any haze prior to bottling, followed by close filtration to remove the precipitate. The AWRI has, for many years, recommended that last-minute 'panic' additions of copper sulfate should be avoided. Winemakers should prepare wines for bottling well in advance and perform any necessary treatments several weeks before the bottling date (Bruer and Sneyd 1991). If 'reductive' characters are detected shortly before the pre-determined bottling date, then it is recommended that the bottling be re-scheduled so that the wine can be treated in advance of bottling.

Apart from copper instabilities, hazes due to the growth of micro-organisms and KHT deposits, other hazes and deposits encountered during the year include: protein hazes; crystalline deposits such as quercetin, calcium L-tartrate and calcium DL-tartrate; cork dust and coating material; grapeseed oil; diatomaceous earth; polysaccharides; and caramel.

The largest change in the numbers in Table 2 is observed for investigations into closure-related problems, where the number of investigations conducted decreased dramatically (by 85%) from that of the previous year. This category mainly includes problems such as leakage or high extraction force issues, which can be due to a range of factors for bottles sealed with natural cork, synthetic and screw-cap closures, and loss of carbon dioxide in the case of sparkling wines. Problems due to cork-type taint are classified under the 'Taint' category and hence the figure for the number of closure-related problems would be larger (more than double) if these types of investigations were classified as closure-related.

Several cork-type taint investigations are conducted each year and nine such investigations were conducted during 2007/2008. In five of these nine investigations, natural corks affected by either 2,4,6-trichloroanisole (TCA) and/or 2,4,6-tribromoanisole (TBA) were determined to be the cause of the problems. Estimates of the incidence of taint in these cases ranged from approximately 13% for one wine to approximately 54% for another, indicating that cork-type taint continues to cause serious difficulties for the wine sector.

In the remaining four cork-type taint investigations (i.e. in four of the nine cases investigated), the incidence of taint was determined to be 100%. In each of these four cases, there was very little variation in the analytical results for the concentration of TCA and/or TBA in the majority of samples. In these cases, the consistency of the results suggested that the wines contained the taint compound(s) at the time of bottling.

In one case, where the wine contained a low level (1–2 ng/L, or parts per trillion) of TCA, the source of taint was traced back to a particular winery water outlet. It is assumed that the TCA entered the wine via water used to dissolve wine additives or processing aids (e.g. tartaric acid and sulfur dioxide), or via a small amount of water residue that might have remained in the tank after cleaning. Further investigations showed that other wines from the same winery also contained similar low levels of TCA. In another case, investigations suggested that storage of wine in an atmosphere contaminated with TBA resulted in the wine becoming tainted with this compound. The AWRI had identified TBA as being responsible for the taint observed in wines from this winery during the previous financial year and it is likely that these wines also became tainted during storage in the TBA-contaminated atmosphere. Investigations are continuing; however, it appears that the insulated walls of a storage area contained 2,4,6-tribromophenol (TBP), the precursor of TBA, which was converted to TBA by mould growing on the walls. Lack of ventilation resulted in the accumulation of TBA in the storage area atmosphere, which was able to taint bulk wine stored there. Chatonnet et al. (2004) have shown that wine can become tainted with TBA during storage in premises where the atmosphere is contaminated with this compound. These researchers indicated that polyethylene- or polyester-based winemaking equipment, vulcanised rubber gaskets and silicone bungs readily absorb pollutants from the air and then release them into wine over time. The source(s) of taint was not identified in the remaining two cases investigated. Previous similar investigations conducted by the AWRI have shown that contaminated oak barrels, oak chips and diatomaceous earth have been responsible for the development of cork-type taints in wines prior to bottling. Other wine additives and processing aids might also be potential sources of taint.

The AWRI recommends that wineries implement simple screening programs of additives and processing aids in order to prevent the accidental introduction of taints into wines. Screening methods are discussed during AWRI Roadshow workshops and are available on the AWRI's website.

The Industry Services team received almost double the usual number of queries related to stuck fermentations during the year, the majority of which were most likely related to a heat wave that affected much of southern Australia in the first half of March 2008. A number of these queries resulted in samples being submitted to the team and these were tested as part of the problem solving service.

There appear to have been a number of factors that might have caused or contributed to the stuck fermentations, many of which can often occur individually without consequence. However, it is considered that high must sugar concentration was the most important factor leading to the stuck or sluggish fermentations, due to the higher concentration of ethanol produced. However, some red wine 'stuck ferment' samples were determined to contain high concentrations of acetic acid and many had either finished, or were undergoing malolactic fermentation (MLF). In addition, sensory analysis revealed that a number of the samples were also affected by mousy off-flavour. The results of analysis of these samples showed they had high pH values; contained high concentrations of acetic acid; low concentrations of malic acid; and contained various microorganisms.

Daytime temperatures were not only very hot during the heat wave, but persisted for over two weeks. The nights were also hot, and records for the hottest March nights were set in both Adelaide and Melbourne (Australian Government Bureau of Meteorology 2008). Furthermore, no rain was reported during this period and, in some areas, irrigation was limited due to drought conditions. Winemakers reported that fruit sugar concentration continued to increase rapidly during the first week of the heat wave, however, during the second week the grapes dehydrated quickly and shriveled. The presence of damaged berries and any berries split due to dehydration, or leakage of sugar from the berries due to loss of turgidity, can be expected to result in the berries carrying a higher than usual microbial load. Mechanical harvesting leads to further damage of the fruit. The fruit would be especially susceptible to damage given the lack of turgidity of the dehydrated berries. This, in turn, stimulates further growth of indigenous yeast and bacteria (including aerobic and anaerobic) during transport to the winery, unless preventative action is taken.

Rankine (1989) reported that growth and formation of volatile acidity by acetic acid bacteria is twice as fast at 23°C as at 18°C, and four times as fast at 28°C. Therefore, hot conditions can dramatically increase the rate of formation of acetic acid by any acetic acid bacteria present on the grapes and could explain why one winemaker reported a volatile acidity (VA) concentration of 0.8 g/L in one batch of juice tested.

Growth of lactic acid bacteria (LAB) such as the lactobacilli and pediococci is encouraged at higher (>3.5) pH and unless controlled by acid additions and use of SO_2, substantial populations of these microorganisms might develop, especially under warm (30°C to 35°C) conditions (Fugelsang and Edwards 2007). LAB such as *Lactobacillus* sp. can produce acetic acid when growing on grape sugars. Strains such as *Pediococcus* sp. can also produce acetic acid when growing on pentose sugars (Sponholz 1993). When ethanol or acetaldehyde are present from fermentative yeast growth, the presence of grape sugars stimulates mousy compound formation by LAB (AWRI publication #710), which would explain the mousy characters observed in the 'high VA' wines investigated at the AWRI. Apart from spoilage, acetic acid and associated products of LAB metabolism represent potent inhibitors to fermentatively growing *Saccharomyces*, delaying the onset of fermentation and potentially causing fermentation to become stuck. In addition, there is the potential for more acetic acid to be produced by LAB at pH >3.5, both during growth on grape sugars and during MLF (Fugelsang and Edwards 2007). A high concentration of acetic acid in the presence of a relatively high concentration of ethanol could contribute to a stuck fermentation, as ethanol increases the toxicity of other compounds (Kunkee 1991).

Whilst there was potential for LAB activity to have contributed to the stuck fermentations observed in the 'high VA' wines, it is possible that other additional inhibitory mechanisms were involved, such as high alcohol concen-

trations, high fermentation temperatures (due to problems encountered in cooling musts sufficiently given the high ambient temperatures during the heat wave), lower than usual YAN concentrations (which is known to reduce yeast growth and fermentation power) and larger populations of indigenous microflora (which would have removed nutrients from the juice at a greater rate than usual).


Florian Bauer (South Africa)

Although investigations conducted into 'unknown' plastic-like taints (which accounted for increased numbers of investigations and sample numbers in the previous two years) concluded during the last financial year, the number of investigations conducted into taints and contaminations continues to be of concern. These types of investigations currently represent 28% of the total number of investigations conducted. In order to increase awareness in these areas, a large proportion of time is devoted to the issues related to taint and the minimisation of the risks of tainting wine during AWRI workshops. These issues are also addressed by the AWRI's website.

Some of the cases investigated during the year under the 'Taints' category include issues relating to hydraulic oil and refrigerant 'brine' contaminations. Burst hydraulic oil lines on mechanical harvesters are usually responsible for hydraulic oil contaminations, however, leaking hydraulic oil lines on winery mechanical bin tippers can also cause this type of contamination. Before using mechanical harvesters, the AWRI recommends that winemakers ensure that the harvesters have been serviced and maintained and check that all hose clamps are tight and that hoses are in good condition. Similar recommendations are made in relation to refrigerant 'brine' hoses and clamps.

Investigations conducted during the year showed that oak barrels and perlite (a clarifying agent) are capable of becoming contaminated with aromatic hydrocarbons. In another case, a wine became contaminated with naphthalene after having been transported in a flexible bulk wine container. Aromatic hydrocarbons (e.g. alkylbenzenes) have been previously detected in wines contaminated with diesel or other petroleum-derived products. Naphthalene is a constituent of diesel and jet fuels and is also a constituent of consumer products such as mothballs, toilet deodorants and shaving brushes, and is a constituent of creosote used for timber impregnation. Aromatic hydrocarbons are widespread throughout the environment and are discharged by incomplete combustion processes from industrial, domestic and natural sources, such as motor vehicles, shipping and air traffic, residential heating with fossil fuels, gasoline burning, industrial plants and forest fires. It is suspected that the oak barrels, perlite and flexible bulk container mentioned above, were each exposed to an atmosphere containing the taint compound(s) during transport. However, in the case involving the flexible bulk container, the flexible container material itself can not be ruled out as a possible source of the taint compounds, as that material was not tested.

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Theme 3: Wine in society

Wine quality and consumer needs

Staff

Dr Leigh Francis, Brooke Travis, Patricia Osidacz, Belinda Bramley

Collaborators

Professor Larry Lockshin and Dr Simone Mueller, Ehrenberg-Bass Institute for Marketing Science, University of South Australia; Professor Jordan Louviere, University of Technology Sydney; Professor John Consadine, University of Western Australia

The Sensory team provides the resources and specialist expertise for all sensory evaluation activities at the AWRI. The team manages sensory panels for the application of rigorous and reliable sensory analyses and preference tests. A major role of the Sensory team is to interact closely with teams from the Research group, Industry Development and Support, and Analytical Service, to run tests, analyse and report results. In addition to this collaborative role in numerous AWRI projects, the Sensory team is responsible for projects assessing aspects of wine quality from a consumer perspective.

Sensory panellists

An important change to how sensory analysis is conducted at the AWRI involved the recent recruitment of specialist paid part-time sensory panellists to be used primarily for sensory descriptive analysis studies. Fourteen panellists have been selected from a total of 236 applicants, on the basis of a number of criteria, including performance in several sensory acuity screening sessions according to International Standards Organisation guidelines. The panel is generally convened three days a week for two hours per day. This is a significant milestone to greatly improve efficiency and throughput of sensory data. This change also increases the capacity of the AWRI as a whole through restricting the use of research staff time in sensory work, and allows expansion of capacity for increased commercial and contract studies. The panel has performed extremely well in four major descriptive studies to date.

Collaborative studies

Numerous sensory descriptive analysis studies have been completed over the past year, including an investigation of yeast strain effects on Sauvignon Blanc wines as part of the flavour-enhancing yeast project; effect of nitrogen additions prior to fermentation on flavour of Langhorne Creek Shiraz wines; effect of yeast strains on Chardonnay sensory properties as part of ethanol tolerant yeast work; assessment of mouth-feel properties of a set of white wines as part of the white wine phenolics project; a collaborative study as part of the University of Western Australia Margaret River Chardonnay project assessing aroma of wines made from fruit from 11 different vineyards; and a study investigating Pinot Noir sensory properties and 'Brett' compounds. Aroma threshold testing of the taint compounds 6-chloro-o-cresol (6-CC) and indole in white wine was also conducted

(continued over page...)

and it was found that 6-CC had an aroma threshold of 70 ng/L, while the value for indole was 23 µg/L.

Under the direction of Brooke Travis, the AWRI technical quality panel has assessed 289 wines as part of sensory evaluations for clients of Industry Development and Support and Analytical Service. Projects conducted with Analytical Service have included a major closure trial assessing a Semillon wine bottled with numerous closures, with assessments conducted on four bottle replicates of wines from each closure type, at six and twelve months post-bottling. The new Industry Applications group has worked with the Sensory team to conduct a study with a winemaker panel to assess a set of Pinot Gris or Pinot Grigio wines, rating sensory attributes as well as a scale to indicate what style each sample represented. This study should provide guidance to assess what compositional and sensory properties relate to wines of these styles.

A collaborative consumer project run with Professor Larry Lockshin and Dr Simone Mueller of the University of South Australia's Ehrenberg-Bass Institute for Marketing Science has involved a set of commercial Shiraz wines which have been profiled by the trained AWRI panel and assessed for preference by 420 Sydney consumers. The wines were also subjected to an on-line choice experiment where consumers were asked to choose the most preferred and least preferred wines from a set based on brand and non-sensory information. The project will give insight into the relative importance to consumers of non-sensory aspects such as price, label type, brand and region compared to sensory properties of the wines.

Wine consumers in China

A large study evaluating preferences of consumers in China for red wine styles was completed in June in a joint project with Tragon, a California-based market research and sensory analysis company. Fourteen commercial red wines were tested in Beijing, Shanghai and Guangzhou by 310 consumers. Four of the wines were international benchmark wines sold in the Chinese market, including one Chinese Merlot, a Bordeaux appellation wine, a Californian Cabernet Sauvignon and an Argentinian Malbec. The Australian wines ranged in retail price from A$6-$20, with four Cabernet Sauvignon based wines included, five Shiraz wines, and one Merlot. The wines represented major commercial styles, with varied residual sugar levels, alcohol, tannin, oak and fruit flavour profiles. Chemical compositional data have also been collected on these wines. Detailed information on the consumers and their wine usage and attitudes patterns was also obtained. The wines were subjected to sensory characterisation by the trained AWRI panel using consumer-based language.

The data collected will provide Australian wine producers with direction regarding wine sensory properties that drive the preferences of Chinese consumers, as well as information that is currently scarce regarding the attitudes of Chinese consumers to wine and their consumption patterns. This project has been guided by a group of Australian producers who have greatly assisted in the planning and decision-making involved in such a large study. Patricia Osidacz did an outstanding job planning and coordinating the project, including a period of two weeks in China supervising the consumer testing under challenging conditions.

Human health, nutrition and food safety issues impacting on the Australian wine sector

Staff

Creina Stockley

One of the activities of the AWRI has been to provide health and nutritional advice and assistance to the Australian wine sector, through Creina Stockley, the Health and Regulatory Information Manager. From 1 July 2007 until 30 June 2008, 88 independent information health and nutrition requests were received by the Health and Regulatory Information Manager from industry, the general public and government.

Committee membership

During the year, support to the sector has been derived from the Health and Regulatory Information Manager's membership of the following committees: the National Drug and Alcohol Research Centre's Young People and Alcohol Project Advisory Group on behalf of the Winemaker's Federation of Australia (WFA), and the Winemaker's Federation of Australia Wine and Social Responsibility Committee. She is also the Department of Agriculture Fisheries and Forestry's nominated Australian delegate for Organisation International de la Vigne et du Vin (OIV) Health and Safety Commission (IV), and is currently the President of the Food Safety Expert Group. Eleven media interviews were conducted including two for international publications and one for the ABC TV program *Catalyst* which aired on the 12 June 2008 (see Appendix 4).

Health and nutrition issues

During the year, the database of research on the beneficial and detrimental health effects of alcohol and in particular, wine, has been added to and these records are available online for levypaying members of the Australian grape and wine sector. This is facilitated by the subscription to relevant medical and scientific journals, and by the formal and informal exchange of information between complementary organisations, both national and international. The journals have been regularly scanned, and articles have been prepared for inclusion in the AWRI's publication, *Technical Review,* and for other Australian wine sector and international alcohol industry newsletters. Articles and other material have also been prepared for the electronic and print media (see Appendix 5). For example, two articles have been prepared for the bimonthly international publication, *AIM—Alcohol in moderation,* one article for the monthly *Australian and New Zealand Grapegrower and Winemaker,* and two articles for the bimonthly *Technical Review,* one for *Healthy and*

Alexander Downer

Heartwise of *Good Health Publications* and one for the *South Australian Retirees' Magazine,* as well as one peer-reviewed paper for the *Vigne et Vin Publications Internationales.*

The Health and Regulatory Information Manager also prepared a 90-page submission to the National Health and Medical Research Council (NHMRC) review of the Australian Alcohol Guidelines of 2001 on behalf of the National Alcohol Beverage Industry Council (NABIC) of which the Winemakers' Federation of Australia is a member. Also prepared was a 49-page submission on Application A576 — Labelling of alcoholic beverages with a pregnancy health advisory label for the Food Standard Australia New Zealand on behalf of the Winemakers' Federation of Australia and The Australian Wine Research Institute. In addition, she prepared an invited submission to the Senate Community Affairs Committee Inquiry into ready-to-drink alcohol beverages and was duly invited to give evidence to the Committee. She was also invited to prepare a brief for the Commonwealth Organisation of Australian Governments (COAG) which had asked the Ministerial Council on Drug Strategy (MCDS) to report back on 'options for reducing alcohol content in products including those aimed at young people' for the June 2008 National Alcohol Forum.

An invited keynote presentation was made at the Third International Congress on Wine and Health in Bordeaux, France on 20 September 2007, and at DrinkWise Australia/International Centre for Alcohol Policies Workshop on intoxication and drunkenness in Paris, France on 15-16 October 2007. Two presentations were made at the Organisation de la Vigne et du Vin (OIV) Commission IV Expert Group meetings in Paris, France on 4-7 March 2008. Full details are provided in Appendix 1.

In addition, the Health and Regulatory Information Manager has continued her part-time external PhD program in the Faculty of Health Sciences at Flinders University entitled *It is not per capita alcohol consumption that matters but per occasion alcohol consumption.*

Compilation, interpretation and communication of issues pertaining to responsible use of agrochemicals in Australian viticulture

Staff
Dr Sally-Jean Bell, Marcel Essling

The Senior Viticulturist, with Jelka Software, developed an 'Online Search Facility for Agrochemicals' which provides a searchable web-based format, delivering a more efficient way of retrieving agrochemical information currently available on the AWRI website.

The new AWRI Online Search Facility for Agrochemicals can be accessed by visiting the agrochemical section of the AWRI website www.awri.com.au/agrochemicals/. Eleven thousand copies of the AWRI publication 'Agrochemicals registered for use in Australian viticulture 2008/2009' have been produced and the booklet can be downloaded from the website. The booklet was also inserted into the recently published Annual Technical issue of the *Australian New Zealand Grapegrower and Winemaker*.

The update of the AWRI maximum residue limit (MRL) database for 2007/2008 was completed and was made available on the AWRI website. One new export market was added (Belgium). The MRL database for 2008/2009 is currently being updated. A list of Chinese MRLs was obtained. Based on value, China is now one of Australia's top ten wine export markets.

The AWRI organised and conducted the annual Agrochemical Industry Reference Group meeting to review changes to the agrochemical booklet and associated issues.

New and existing data for Switch (cyprodinil and fludioxonil) and carbendazim products were reviewed in order to assess if it was valid to make changes to the recommended restriction on use for export grapes. Information on fruit fly control for New South Wales was also updated.

Four agrochemical updates were prepared and made available to Australian grape and wine producers on the AWRI agrochemical website and via the AWRI email subscriber's service.

The Australian Pesticides and Veterinary Medicines Authority (APVMA) 'off-label' permits for the agrochemical website were regularly updated. In order to provide additional information that will further aid the Australian grape and wine sectors to make informed decisions regarding the use of agrochemicals, we have collated and added to the agrochemical database new information. The first was the stock feed/grazing restrictions for actives registered for use in viticulture. This was originally initiated in response to a number of enquiries in regards to the use of grape marc as stock feed. The presence of chemical residues in meat is tightly regulated.

We have also collated the herbicide label withholding periods and restrictions on use and added the specifics on mode of action and the poison schedule for each active. The intention is to add this information to the agrochemical database so that it is available to levy payers who have access to the Online Search Facility for Agrochemicals.

In response to a request by Paul Chapman of Primary Industry and Resources SA, the Senior Viticulturist contacted Agrochemical reference group members representing the major Australian companies responsible for exporting wine overseas, to seek comment on the issue of Canadian MRLs. The Senior Viticulturist and the Manager of the Trace Analysis Laboratory liaised with chemical companies in regards to trials and data required to set or change export withholding periods (e.g. Sipcam, DuPont, and Dow).

The Viticulture team members reviewed and contributed comment to the Wine Industry Tasmania submission regarding the Implementation of Regulatory Controls for Aerial Spraying and Ground Spraying Agricultural Chemical Products – A Consultation Paper April 2008.

Regulatory, technical and trade issues impacting on the Australian wine sector

Staff
Creina Stockley

One of the activities of the AWRI has been to provide regulatory and technical advice and assistance to the Australian wine sector, through the Managing Director, the Health and Regulatory Information Manager and the Industry Development and Support group of which the Health and Regulatory Information Manager is a member. From 1 July 2007 until 30 June 2008, 133 independent regulatory, science and technical-related information requests were received by the Health and Regulatory Information Manager from wine producers, the general public and government.

Committee membership
During the year, support to the sector has been derived from the Health and Regulatory Information Manager's membership of the following committees: AWBC/WFA Wine Industry Technical Advisory Committee (as Technical Liaison); and the Wine Industry National Environment Committee; and was a Department of Agriculture, Forestry and Fisheries nominated Australian delegate for Organisation International de la Vigne et du Vin (OIV) Expert Group meetings.

Technical and regulatory issues
The technical and regulatory support to the Australian wine sector is ongoing as issues are regularly raised by the sector or government, both in Australia and internationally, and often span several years. During 2007/2008, technical and regulatory information and/or issues that have been reviewed, and material prepared includes: the status of the concentration of ethyl carbamate in Australian grapes and wines together with the present actual and potential ethyl carbamate analyses; the status of the concentration of chlorides including sodium chloride in grapes and wine in the context of the current drought and water allocation revisions and restrictions; and the status on the concentration of free and total sulfur dioxide in Australian wines with sugar levels of between 5-35 g/L and above 35 g/L, to determine whether Australia could harmonise its maximum limits for sulfur dioxide with those of its export destinations. In addition, the Health and Regulatory Information Manager was a member of two OIV working groups — *Standard drink definition* and *Protocol for the evaluation of the risks related to food safety for new oenological treatments*. The latter encompassed preparation of a 'decision tree' and accompanying protocols for evaluation of the risks related to food safety of new oenological treatments. This decision tree and protocols were presented to, and adopted at, the OIV General Assembly in Verona, Italy in June 2008 to facilitate the future adoption of new oenological treatments by the OIV, and by Food Standards Australia New Zealand to which the OIV is a reference body. Furthermore, the Health and Regulatory Information Manager convened and presented at a workshop entitled *The A-Z of labelling for the domestic and export marketplace* at the Thirteenth Australian Wine Industry Technical Conference, Adelaide on 28/7 and 2/8, in conjunction with the Australian Wine and Brandy Corporation.

The Health and Regulatory Information Manager also coordinates Course 3005WT *Grape industry practice, policy and communication* for the School of Agriculture, Food and Wine at The University of Adelaide. In its thirteenth year, 17 students enrolled in the Course, which exposes students to organisational, commercial, environmental, political, societal and technical issues relating to the wine sector's operating environment.

Project coordination
Through Creina Stockley, the AWRI has played a coordinating and a participating role in a GWRDC-funded research project on a medical and technical aspect of wine consumption entitled ADF02/01 *The identification and measurement of potential allergens in wine* in conjunction with the Department of Allergy, Asthma and Clinical Immunology at The Alfred Hospital and Monash University. A paper entitled *Development and application of specific and sensitive enzyme-linked immunosorbent assays for detection of residual allergenic food proteins in fined bottled wine* has been published in the *Journal of Agriculture and Food Chemistry*.

Theme 4: Information and knowledge transfer

Transfer of knowledge relating to viticulture

Staff

Dr Sally-Jean Bell, Marcel Essling

During 2007/2008, the Viticulture team responded to 363 enquiries, the majority were regarding the use of agrochemicals for pest and disease control, the persistence of residues through winemaking and their effects on fermentation, and issues related to maximum residue limits in overseas markets. The number of enquiries was lower than in previous years due to a season exhibiting low disease pressure.

During the year, the Senior Viticulturist participated in the AWRI Roadshow visits to the Mornington Peninsula (16/10/07), Yarra Valley (17/10/07), Swan Valley (04/12/07) and Mount Barker (05/12/07) delivering presentations entitled: 'Agrochemicals – selling quality wine', 'Manipulation of phenolic profiles in red grapes and wine by viticultural management', 'Effects of powdery mildew on the sensory properties and composition of Chardonnay juice and wine', 'Impact of nitrogen on grape and wine quality' and 'Does grapevine nutrition have an impact on grape and wine quality?'.

The Technical Officer participated in the AWRI Roadshow visits to the Sunraysia (15/5/08) and Riverland (16/5/08) delivering presentations entitled: 'Impact of nitrogen on grape and wine quality', 'Agrochemicals – selling quality wine' and 'Salty wine'.

The Senior Viticulturist facilitated a very successful and well received workshop entitled 'Nitrogen – friend or foe? (Nitrogen nutrition and wine quality)' at the 13th Australian Wine Industry Technical Conference (13th AWITC). The 13th AWITC survey results revealed that Workshop 19: Nitrogen: friend or foe? was one of the 10 workshops rated highest for both content and delivery.

The Senior Viticulturist gave two workshop presentations at the 13th AWITC: (i) 'Impact of nitrogen on grape and wine quality' in W19: Nitrogen – friend or foe?; and (ii) 'Does grapevine nutrition have an impact on wine quality?' in W34: Managing vine nutritional requirements.

The Senior Viticulturist gave a presentation on agrochemicals and maximum residue limits at an IPM Update Seminar in the Barossa Valley (11/07/07).

The Technical Officer gave two presentations at the Wine Industry Tasmania field day (16/11/07) entitled 'Agrochemicals – selling quality wine' and 'Winemaking implications of smoke and bushfire taints and possible management options'.

Abstracts from current technical literature on viticulture were contributed to Technical Review. The Senior Viticulturist participated in the design and implementation of a Smoke Taint Trial with Con Simos (AWRI) in collaboration with The Yalumba Wine Company and The Hardy Wine Company; reviewed a manuscript for the *Australian Journal of Grape and Wine Research* and reviewed a Literature Review on Winegrape Nutrition undertaken by DPI Victoria.

Full details of seminar presentations and workshops presented by the Viticulture team members are provided in Appendix 1.

Transfer of knowledge relating to winemaking

Staff

Con Simos, Adrian Coulter, Geoff Cowey, Matt Holdstock, Emma Kennedy, Sarah Ballantine, Virginia Phillips, Peter Godden and Ella Robinson

The Industry Services (IS) team provides a winemaking consultancy service principally through the Group Manager – Industry Development and Support, Con Simos, and other experienced winemakers including Peter Godden, Adrian Coulter, Geoff Cowey and Matthew Holdstock.

Most queries received are technical in nature and arise predominantly from Australian winemakers; this trend continues in 2007/2008. Other queries are also received from wine sector suppliers and government bodies, as well as a relatively small number from the general public and students. The majority of queries are answered either by telephone or, increasingly, by email. Thus, Industry Services team members facilitate the distribution of more than 2,000 technical papers or other pieces of relevant literature to callers each year, via the John Fornachon Memorial Library. Increasingly, Industry Services team members are also able to direct callers to web-based information, on the AWRI's own website. The support facilities provided by other AWRI research and information services staff members are important in supplying a quality integrated response to callers. Furthermore, the analytical capacity of the Industry Services Laboratory plays an important role in responding to many of these enquiries.

A summary of the enquiries received by Peter Godden, Adrian Coulter, Con Simos, Geoff Cowey and Matthew Holdstock for the year is shown in Table 3, with comparison figures for the previous two years.

Table 3. Enquiries received by Industry Services advisory staff in the period 2005/2006 to 2007/2008

	2005/2006	2006/2007	2007/2008
Wineries	1127	1285	1244
Government organisations	55	36	48
Other	534	369	150
Students	29	21	15
Total	**1745**	**1711**	**1457**

Compared with the previous year, the figures for 2007/2008 show a decrease in the total number of enquiries received. Whilst there has been an overall reduction in enquiries, this drop has largely occurred through the 'other' category; this group consists mainly of suppliers and service providers to the Australian wine sector. There is a slight reduction in enquiries from levy payers, and this should be taken in context of the smaller than anticipated 2007 vintage intake. The highest number of enquiries are received from wineries, and this indicates that a large number of Australian wine producers continue to regard the AWRI as a trusted, reliable, and an important source for quality technical information and problem solving solutions.

The winemaking consultancy and technical problem solving services offered by the Industry Services team are supported by extension activities including a National Roadshow seminar and workshop program, AWITC workshop program, the Advanced Wine Assessment Course, Research to Practice® and tailored workshops on request by sector associations. The team makes regular contributions to *Technical Review,* provides presentations for external seminars and conferences; contributes to the web-based technical reference manual and also provides 12 hours of lectures to Oenology students at the University of Adelaide (see the Appendices for further details).

The National Roadshow seminar and workshop program are currently made on a rotating basis to 33 locations covering Australia's winemaking zones and regions. A Roadshow schedule for the next three years is available on the AWRI website, which is intended to provide advance notice to regions of AWRI's impending visit. These extension activities are now advertised in the national wine press and through the publications of ASVO, AWBC and NWGIC, and through the local wine association websites.

During the year, 19 days of Roadshow seminars and workshops were held throughout Australian winemaking zones and regions including: Mornington Peninsula, Yarra Valley, Mount Barker (Great Southern), Swan Valley, Margaret River, Pemberton, Mildura, Renmark, Rutherglen and Wangaratta (see Appendix 1). This was the first time that the AWRI had presented in Pemberton and underlines our commitment to servicing new regions.

Roadshows are organised in conjunction with winemakers' and growers' regional associations. These associations select the presentations to be made from AWRI's menu of over ninety topics of current AWRI activity, in order that the seminars are closely tailored to the interests and needs of the audience. Whilst Industry Services team members are responsible for the organisation of Roadshow seminars and present a substantial amount of the content, they rely heavily on input from all of the AWRI's teams with at least six senior AWRI staff members making eleven presentations in each full-day seminar.

Roadshow workshops are generally presented solely by Industry Services team members, and are tailored to deliver practical winemaking

advice to the wine sector in an interactive manner involving tastings, diagnostic tests and practical exercises. These workshops are developed specifically to manage current technical issues. The current workshop presented is entitled 'The avoidance of taints and chemical instabilities during winemaking' and was developed to educate and inform Australian wine producers of taints that have affected the wine sector in recent times. New material has been developed for a workshop detailing practical and trouble-free wine bottling and packaging which will begin to be presented throughout the next financial year.

The AWRI has responded to several cases relating to taints and contamination in wines. It is AWRI's position that the issue of taints can only be addressed by engaging key stakeholders at all levels of the supply and process chain. A pro-active workshop program for winery suppliers has been developed and presented which supplements AWRI's existing strategies in taint management specifically targeting the wine-makers of Australia. The unprecedented step was taken to produce a tailored presentation on taints, specific to the needs of the supply chain. Presentations have already been made in both Melbourne and Adelaide, and the last scheduled presentation in this series was held in Sydney; the feedback from these presentations was extremely positive.

New workshop material is often prepared at the specific request of associations in order to accommodate their particular needs. During the year, Industry Services team members responded to a number of requests from regional associations on presenting dedicated content. A number of workshops were developed and presented on topics such as *'Brettanomyces,'* 'Microscopy and winemaking applications' and 'Winemaking to produce desired wine styles'.

In addition to the formal presentations given by team members, Roadshows are also considered an important vehicle for the delivery of informal advice. On current observation, if this contact was formally recorded then it would account for a substantial increase in the number of enquiries responded to, as recorded in Table 3.

The AWRI has formally taken over the 'Research to Practice®' training and education modules from the now disbanded CRC for Viticulture. The existing content will be updated and expanded to include winemaking modules and will be progressively rolled out in 2008/ 2009.

The Industry Development and Support (IDS) group offer information and respond to current sector issues throughout the year. The article entitled 'Calcium DL-tartrate instabilities – a recent increase in their occurrence' was published in the August issue of *Technical Review* (#169), and was written to assist wine-makers to more effectively use racemic tartaric acid or potassium bi-tartrate. An article entitled 'Excessive copper fining of wines sealed under screwcaps – identifying and treating reductive winemaking characters' was published in the April edition of *The Australian & New Zealand Grapegrower & Winemaker* in response to an increase in copper-induced hazes as a result of both high and last minute copper additions to wines being sealed with screw-cap closures. An article entitled 'The implications of smoke taint and management practices' was published in January edition of *Australian Viticulture* and was developed to highlight results of recent winemaking management trials conducted by the team. An article entitled 'Vintage 2008 – A heat wave and stuck fermentations' was prepared for publication regarding an increase in stuck fermentations during the 2008 vintage.

In conjunction with the AWRI's Sensory team, a new section on sensory assessment has been added to the website. The section includes information on recognition of wine taints and faults, screening tests for commonly used wine-making chemicals and processing aids and a diagnostic test for reductive wine characters. Information has also been prepared detailing methods and considerations for conducting sensory assessment in wineries, winery tasting sheet pro-formas and a sensory statistical significance calculator.


David Pearce (NZ)

The 23rd, 24th and 25th Advanced Wine Assessment Courses were held in September 2007, November 2007 and June 2008, respectively. All three courses provided a further ninety participants the opportunity to develop and test their sensory evaluation performance. These courses were presented under a four-day format and, as part of the intensive program, potential judges have the opportunity to evaluate a diverse range of more than 310 wines under simulated wine show conditions. The course consists of more than 40 hours of content and also includes lectures presented by AWRI staff and the participation of 14 leading wine show judges, journalists and winemakers. The top performing participant from each course now has the opportunity to participate as an associate judge at one of Australia's leading wine shows. The first interstate course will be held in Victoria in September 2008.

The IDS section of the AWRI website is beginning to become the primary source of providing winemaking and technical information to Australian wine producers. The quality of the information on the website replaces the majority of written reports previously prepared for wine sector clients by the Industry Services team. The IDS section of the website now receives a total of 82,965 hits, reporting an increase of 53% from the previous financial year. The problem solving section of the website now receives 28,966 of these hits, reporting an increase of 163% from the previous financial year.

The design, functionality and layout of the AWRI website has been reviewed by each team within IDS and a new user-friendly version will be released in late 2008. A new industry services homepage and email address has been created to give winemakers the ability to contact the team at all times, particularly during vintage periods.

In response to demand, a new fortification calculator has been added to the calculators section. New Technical Notes entitled 'Preparation of a malolactic fermentation (MLF) starter culture using freeze dried bacteria' and 'Prevention and management of stuck alcoholic fermentations' have also been added in response to stuck fermentation issues arising during the 2008 vintage. The microbiological instabilities section has been modified to include links to methods for making up two commonly-used types of agar plates.

The IDS group has also added two AWRI webcast presentations entitled 'Taints and contaminations' and 'Winemaking implications for the management of smoke and bush fire taints'.

The AWRI and Industry events calendar has been updated to include other non-AWRI industry events such as ASVO conferences, as well as details of dates for the next 12 months roadshow seminars, workshops and AWACs. Links to the relevant winemaking associations hosting each roadshow are also included on the events calendar.

The IDS group played a crucial role in the organisation of the Thirteenth Australian Wine Industry Technical Conference (13AWITC) workshop program. A program of 56 workshops was staged over five days, with a total of 2,065 places sold. The workshop program was coordinated by Peter Godden, Ella Robinson and Sarah Ballantine, supported by Teegan Waples, Jean Macintyre and Jeremy Hack. A large number of additional AWRI staff also contributed to the staging of the workshops (see report on the Thirteenth Australian Wine Industry Technical Conference).

Workshops at the 13AWITC covered topics from fields including viticulture, oenology, wine business, packaging, marketing and regulation. Twenty-two of the workshops included a wine tasting, with a total of 23,845 glasses poured over the five days.

Some of the most popular workshops included: 'Managing vine nutritional requirements', 'Pinot research and Pinot passion', 'Irrigating in variable environments', 'Tannin and other phenolics in grapes and wine', Measuring key indicators of grape quality', Nitrogen: friend or foe?', 'The power of yeast in influencing wine flavour and quality', 'Flowering and fruitset', and 'Winery waste water management'.

The IDS group also presented three poster papers and co-authored five other poster papers in conjunction with other AWRI teams at the 13AWITC. The Senior Oenologist, Adrian Coulter presented at a colloquium, and the team presented the workshop entitled 'The avoidance of taints and chemical instabilities during wine-making'. The team also prepared and delivered content for the workshop *'Brettanomyces* – Perception, detection, and control' and 'Nitrogen: friend or foe? (nitrogen nutrition and wine quality)'.

Communication and Information Services

Staff

Rae Blair, Linda Bevin (maternity leave from 28 March 2008), Leanne Curtin (from 17 March 2008), Kate Beames, Sean Boden, Ingrid Barratt, Claire St George, Fiona Taylor, Pauline Thornton (concluded August 2007)

The composition of the Communication and Information Services (CIS) team, led by Rae Blair, Communication Manager, changed during the year. The Information and Knowledge Manager (Linda Bevin) went on maternity leave in March, and Leanne Curtin was appointed as Project Manager – Information and Knowledge Management to cover Linda's absence. Rae Blair reduced her working hours to .4 FTE and is meeting her work commitments out of an office in London. Following the conclusion of the 13th Australian Wine Industry Technical Conference, Kate Beames was appointed to the role of Communications Assistant, also in a .4 FTE capacity. During the year, Sean Boden completed his Graduate Diploma in Information Studies (University of South Australia), and his title changed to Systems Librarian. The team is complemented with Ingrid Barratt, Library Technician and our part-time Library Assistants, Claire St George and Fiona Taylor. The conduct of the Australian Wine Industry Technical Conferences falls within our ambit and as such our team this year also included (until August 2007) Kate Beames as Conference Manager and Pauline Thornton, Conference Assistant.

The CIS team is a service unit within the AWRI, and its stakeholders include AWRI staff; members of the Australian grape and wine sector; researchers and students; Australian grape and wine organisations' staff; members of the Australian and State governments; sector suppliers; and wine producers and suppliers from overseas countries. The CIS team members handled over 3,860 requests for information during the year.

The operations of the CIS team complements and supports the communication activities of all AWRI staff in general, but particularly the activities of the Industry Development and Support group (of which the CIS team is now a member). Our specific activities include the following:

- Information and knowledge management
- Facilitating effective communication between the AWRI and its stakeholders
- Maintaining the collection held within the John Fornachon Memorial Library
- Management of the AWRI website, and web-accessible information databases
- Production of corporate publications, including *Technical Review* and the Annual Report
- Provision of an editorial service for AWRI staff
- Media and VIP visit coordination
- Management of the Australian Wine Industry Technical Conferences

Progress reports on our activities are shown below. However, some of the highlights for the 2007/2008 financial year include:

- The successful conduct of the 13th Australian Wine Industry Technical Conference (13AWITC)
- The editing and distribution (in record time) of the Proceedings of the 13AWITC
- Eight webcasts of AWRI staff presentations made available on-line
- Response to more than 3,860 requests for information
- Conducting a stand at WineTech – the Australian Wine Industry Trade Exhibition (as part of the 13AWITC), where we were able to meet many of our customers, and introduce our service to new ones
- Launch of the re-developed AWRI website – with increased user-friendliness and value
- Launch of the EndNote Master Library for the increased benefits for AWRI staff
- Launch of the new AWRI Grape and Wine Search Portal
- Launch of the refreshed AWRI and Industry Events Calendar
- Implementation of a new, simplified classification reference system for the JFML print collection to make it easier for AWRI staff, visiting members of the Australian wine sector, and students

Provision and development of mechanisms for the efficient transfer of knowledge and technical information to the Australian grape and wine sector

Staff

Rae Blair, Sean Boden, Kate Beames

The AWRI utilises several strategic and effective mechanisms to disseminate knowledge and information to Australian grape and wine producers. Reported above are the physical extension activities – the body contact sport – undertaken by the members of the Industry Development and Support group. Below are details of the less direct, or personal, extension/communication mechanisms.


Paul Henry

AWRI website

The AWRI website has undergone significant maintenance over the past 12 months. The new template and functionality noted in the previous Annual Report was successfully implemented in July 2007. These enhancements resulted in increased awareness by Australian grape and wine producers of what the website can offer to visitors, and also encouraged AWRI staff to contribute new content. Some of the major additions to the website over the past year include the Winemaking Calculators (which produced a noticeable spike in increased pageviews in January 2008, see Figure 9 for details), AWRI Grape and Wine Search Portal, AWRI Agrochemical Online Search facility and the AWRI 'webcast' presentations.

Compared to the previous financial year, the website recorded a 33.52% increase in pages viewed during the course of the financial year (Table 4). The combination of new content, on-going promotion of the website's features in *Technical Review* and email bulletins can all be attributed to this significant increase. The strong promotion of the website at the trade exhibition held at the 13AWITC (28 July to 1 August 2007), contributed to a sustained higher visit rate of the website from August 2007.

Table 4. Website statistics

Website pageviews comparison	
1 July 2006 – 30 June 2007	264,512
1 July 2007 – 30 June 2008	353,165
% change	33.52%

Technical Review

Technical Review is a bimonthly publication produced by the AWRI and provides progress reports to producers on the AWRI's research, as well as updates on relevant conferences, regulatory amendments and medical issues. The 'Current Literature' section provides citation details and abstracts of recently published technical and scientific articles. Based on feedback received from readers, various improvements have been made to the presentation of information in *Technical Review*. These initiatives are aimed at reducing 'information clutter' and to package the information in an easy-to-digest form for the busy reader.

In the financial year of 2007/2008, more than 18,000 copies of *Technical Review* were distributed to Australian grapegrowers and winemakers who pay the *Grape Research Levy* or *Winegrapes* Levy and subscribers in Australia and overseas. Over 300 articles featured in *Technical Review* were requested and forwarded.

An electronic version of *Technical Review* is available to levy payers via a secured section of the AWRI website and the annual CD-ROM. The 2007/2008 edition of the *Technical Review* CD-ROM will be the last to be produced due to planned improvements in search capability on the AWRI website – which will make the annual CD-ROM an unnecessary expense.

Dr Barbara Hardy AO and her family continue to support the publication of *Technical Review* through regular generous financial contribution to the Thomas Walter Hardy Memorial Trust, and their ongoing support is gratefully acknowledged.

Email service

The Email Advice and Information on Technical Issues Bulletin service continues to be a fast and cost-efficient way of disseminating important technical information to interested members of the Australian wine industry. There are >3,500 email addresses recorded to receive the email bulletins, and interested Australian producers should submit their email address (to infoservices@awri.com.au) should they wish to receive the email bulletins. Ten email bulletins were issued during the year and are shown in Table 5.

Editorial services

The Australian Wine Research Institute contributes a regular column in the *Australia and New Zealand Wine Industry Journal* and continues to publish in the *Australian and New Zealand Grapegrower & Winemaker* and Australia's *WBM* amongst other Australian and international industry journals. All AWRI papers to be published in non-peer reviewed publications are edited by the Communication Manager (details of the articles published are in Appendix 5). The Communication Manager also reviews all material to be uploaded to the AWRI website. During the year, the Communication Manager managed the editing and production process of the Proceedings of the Thirteenth Australian Wine Industry Technical Conference.

Media liaison

The AWRI is often approached for comment on wine technical matters from national and international media. Many requests from the media were handled during the year, and specific details can be found in Appendix 4.

Thirteenth Australian Wine Industry Technical Conference

A media strategy was developed for the 13th Australian Wine Industry Technical Conference to maximise and manage the media coverage of the four-day triennial conference with the key objectives being to:

1 Explain the significance of the conference;

2 Highlight particular scientific breakthroughs; and

3 Highlight specific issues such as climate change and consumer trends.

Subsequently, a total of four media releases were developed and released on a progressive schedule before and during the conference to maximise media interest and coverage. The media releases were aimed at highlighting specific presentations that would be of most interest to a general audience. Media coverage was strongest on the AWRI's pepper aroma breakthrough story, which was closely followed by stories on climate change, consumer trends and Generation Y news angles, consistent with the media releases issued before and during the conference.

Media coverage was achieved on all media (radio, television, newspapers and online) and appeared within SA, nationally and internationally.

One other media release was prepared and distributed to Australian industry publications on the launch of the AWRI Grape and Wine Portal.

Provision of scientific, technical and regulatory information

Staff

Linda Bevin (maternity leave from 28 March 2008), Leanne Curtin (from 17 March 2008), Sean Boden, Ingrid Barratt, Claire St George, Fiona Taylor

The John Fornachon Memorial Library holds the largest collection of grape and wine technical literature in the Southern Hemisphere, covering winemaking, viticulture, wine microbiology, flavour chemistry, phenolics, food chemistry, wine and health, wine and the environment, and more. The collection includes books, journals, article reprints, conference proceedings, reports, theses, standards and legislations, as well as a reference collection of foreign dictionaries and atlases.

Table 5. Email bulletins sent during 2007/2008

Date	Bulletin topic	Author
2 Jul 07	The AWRI publication Agrochemicals registered for use in Australian viticulture 2007/2008 is now available	Sally-Jean Bell
10 Jul 07	Carbendazim label suspensions	Sally-Jean Bell
17 Aug 07	Calcium-DL-tartrate instabilities	Adrian Coulter
3 Sep 07	Agrochemical update	Sally-Jean Bell
5 Nov 07	Agrochemical update: downy mildew	Sally-Jean Bell
9 Jan 08	Calculators now available on AWRI website	Rae Blair
1 Apr 08	April 2008 TR now available on-line	Rae Blair
9 Apr 08	New agrochemical online search facility	Sally-Jean Bell
23 Apr 08	AWRI: Finding grape and wine technical information has never been easier!	Rae Blair
17 Jun 08	AWRI presentations - Australian winemakers and grapegrowers can view now online	Rae Blair

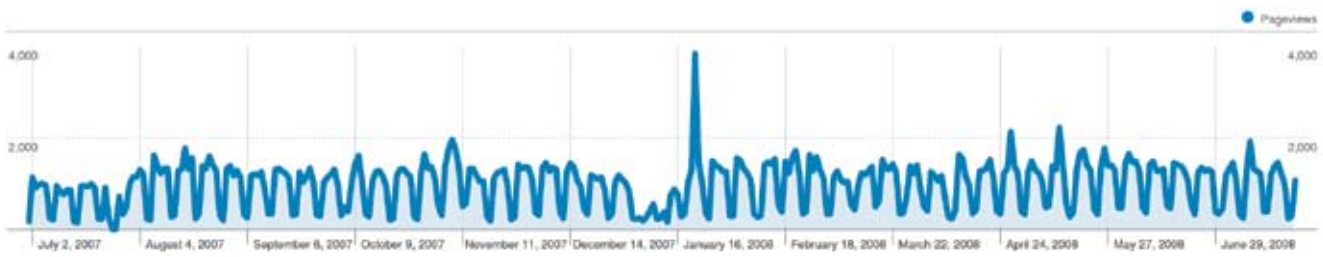


Figure 9. Website pageviews for 1 July 2007 – 30 June 2008


Peter Hayes

The AWRI has an ever-growing knowledge base and technology is providing opportunities for the John Fornachon Memorial Library to evolve beyond the traditional concept of libraries and focus on the expansion of electronic information access and delivery. Printed publications will continue to be an important part of our collection, but a 'modernisation' program is under development to ensure our information services continue to be of value and relevance to our customers.

Online information databases

Three information databases, available via the AWRI website, can be accessed by all grape-growers and winemakers who pay the *Grape Research Levy* or *Winegrapes Levy*. The databases are a valuable information resource comprising books, journal articles, conference proceedings, reports, standards and legislation held in the AWRI collection, and users of the databases can also request items online.

In order to make the print collection easier to access for AWRI staff, visiting members of the Australian wine sector, and students, every book in the collection has been reclassified with a simpler cataloguing reference number. The process was completed during the course of the 2007/2008 financial year and has been positively received by users of the AWRI's library service. In addition, this reclassification project resulted in the AWRI's databases being significantly reviewed and updated, resulting in a significantly higher than usual level of record maintenance (during the April-June 2008 period the library recorded an estimated 1394% increase in maintenance compared to the average of a typical quarter). See Table 6 for a list of statistics regarding the information databases.

There is strong demand for information access via the web, which is available 24 hours a day, 7 days a week. Customers continue to show support for the *Industry* information database, which demonstrated a 34% increase in usage compared to figures reported last year. Figure 10 provides a summary of database usage during 2007/2008.

Table 6. Description and size of online information databases and library catalogues

Web accessible information databases	No. records
Industry (with searchable abstracts)	56,336
Environment	573
REGS: European Community wine legislation	412
Library catalogues databases	
AWRI_database (library catalogue)	56,865
Journals (journals, theses, statistics and annual reports)	423
New items and maintenance to the information databases	
New monographs	39
New conference proceedings	2
Theses	3
Record maintenance	12,166
Reprint collection to date (see below for details)	**24,383**
- Reprints	16,243
- AWRI publications	1051
- Articles indexed via Technical Review	6,662
- Inter-library loans	427

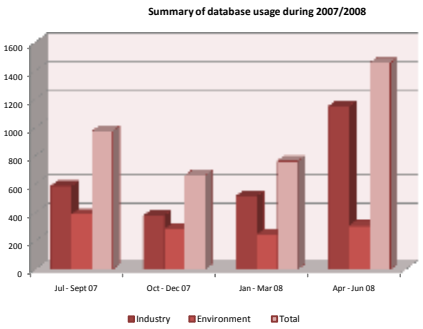


Figure 10. Summary of database usage during 2007/2008

John Fornachon Memorial Library catalogue databases

The Library holds over 56,000 books, conference proceedings, theses and scientific, technical and medical reprint articles. They are indexed in the Library's database catalogue which is accessible via the John Fornachon Memorial Library. Details of the Library's journal holdings including newsletters, statistics and annual reports are held in the *Journals* database. A summary of the size of the Library's catalogue and information databases is given in Table 6.

Specialised information services

While the usage of the AWRI's *Industry* online information database is increasing and the database is available free-of-charge to all Australian grapegrowers and winemakers who pay the *Grape Research Levy* or *Winegrapes Levy*, customers are continuing to request the Library to conduct online searches using commercial databases on a fee-for-service basis.

Document delivery services

'Document delivery' supplies journal articles, books or other library items to customers upon request via post, fax or electronically via email in PDF format. This also includes sourcing items held by other Australian and overseas libraries if required (interlibrary loans are provided on a fee-for-service basis). The ability to order items online means that most interlibrary loan requests are able to be completed within five days.

The electronic ordering facility available from the AWRI website continues to be an efficient method for customers to request AWRI publications. This year, we serviced a 62% increase in publications requested over that reported in the previous year (Table 7).

Copyright services

During the period October – December 2007, the Information and Knowledge Manager was successful in establishing an agreement with the Copyright Agency Limited (CAL) that allowed full document delivery of all papers under standard copyright conditions to all members of staff automatically. This will result in more efficient document delivery of research papers to all AWRI staff in both hardcopy and electronic formats.

In addition, in December 2007, following advice from the Australian Copyright Council, the Librarian began implementing a framework to support digital document delivery for the John Fornachon Memorial Libary's clientele that allows the library to send articles electronically whilst adhering to current Australian copyright legislation. The new system involves supplying the requested document to the client via email in PDF format, and has proven extremely popular amongst our users. While the new system is still being fine-tuned, over 90% of all documents delivered by the end of the financial year are now being supplied digitally.

Library collection

A total of 39 monographs, three theses and two conference proceedings were added to the collection in the financial year of 2007/2008.

Table 7. Summary of information requests during 2007/2008

	Wine industry		Staff		Other[5]		Total		% Change
	2008	2007	2008	2007	2008	2007	2008	2007	
Information requests	1241	714	741	1089	328	1318	2310	3121	(26%)
Interlibrary loans sent[1]	93	100	553	641			646	741	(13%)
Technical Review requests[2]							96	96	0%
Technical Review articles forwarded[3]							342	328	4%
Articles forwarded[4]							675	417	62%
Number of AWRI publications forwarded							528	1395	-62%

1 Request to another library for an article, **2** Number of requests received fort articles published in *Technical Review*, **3** Number of articles forwarded (usually more than one article is requested), **4** Number of articles forwarded from the library collection, excluding staff publications, **5** Requests from students, Government agencies, private companies and overseas customers.

The library also continues to subscribe to 52 journals and receives over 70 annual reports, newsletters, journals through exchange and donation. The collection also holds over 24,300 reprints of AWRI staff publications, articles featured in *Technical Review* and articles obtained via interlibrary loans (Table 6).

Donations to the Library collection

The AWRI wishes to thank all individuals and companies who contribute to the collection through donations or exchange agreements. The support of the following persons and organisations who have donated books, journals or photographic material is acknowledged:

Australian Bureau of Agriculture and Research Economics, Australian Dried Fruits Corporation, Australian Wine and Brandy Corporation, Australian Wine and Brandy Producers' Association, Commonwealth Scientific and Industrial Research Organisation, Dr B.G. Coombe, the late Dr P. May, Petaluma Australia, K.F. Pocock, Dr B.C. Rankine, and the Winemaker's Federation of Australia Incorporated.

Participation at WineTech – the Australian Wine Industry Trade Exhibition

WineTech 2007, held alongside the 13th Australian Wine Industry Technical Conference in Adelaide, united over 200 exhibitors under the one roof. The AWRI's Information Services booth attracted hundreds of visitors, providing the opportunity to promote our services and to meet winemakers, viticulturists, grapegrowers, researchers, educators, chemists and microbiologists, students and suppliers working in the grape and wine sector within Australia and overseas.

In addition to launching the new AWRI website, we showcased our information services by offering online searching onsite, information packs, demonstration of viticulture software (VineLOGIC and AVi), viticulture presentation CDs, and other publications relating to the grape and wine sector. Over 270 information packs containing AWRI staff publications were provided to visitors, with the 'Control of *Brettanomyces*' and 'Management of malolactic fermentation' packs proving to be the most in demand. Over the three days, the Communication and Information Services Team also answered 248 enquiries.

Improvement of knowledge management, stakeholder communication and culture at The Australian Wine Research Institute

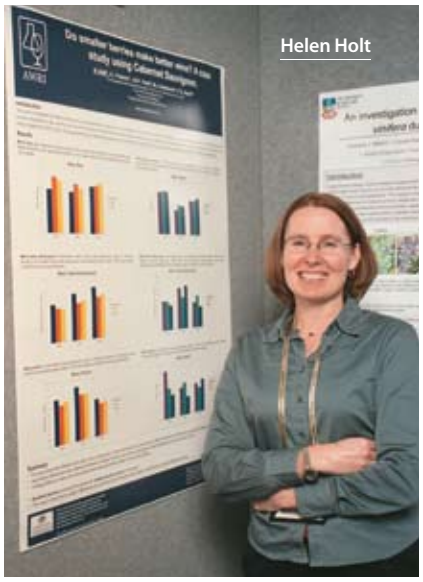
Staff

Rae Blair, Linda Bevin (maternity leave from 28 March 2008), Leanne Curtin (from 17 March 2008)

Stakeholder communication plan

In 2006 (as reported last year) and in 2007, as project #3 of the AWRI's *Ten Year Business Plan*, activities were completed that sought to understand AWRI's positioning in the minds of its stakeholders. We further investigated several issues around AWRI's 'brand equity' when considered in terms of utility (rather than dollar value). A result of 'strong' positioning in our stakeholders' minds and positive utility perception, would indicate effective and broad penetration of AWRI's communication (and extension) activities – hence, greater benefit being achieved by our stakeholders. As reported last year, an on-line survey was emailed to 2,707 sector members (with 35.5% response rate).

From the results of the survey, it was revealed that AWRI's work is much better understood by the winemaking community than the grape-growing community; and by larger winemakers (that is, organisations that process >5,000 tonnes) rather than SMEs. Further, it was revealed that some stakeholders have difficulty in linking AWRI's outputs with their own capabilities and success. A communication strategy was prepared to attempt to improve the penetration, effectiveness and value of AWRI's communication efforts.



AWRI Webcasts

An initiative from the Communication Strategy was the recording of eight AWRI staff presentations and to make them available via the AWRI website. On 17 June, an email bulletin was issued to Australian producers advising that webcast presentations on the following topics were now available for viewing:

1 AWRI wine bottle closure trials - towards a greater understanding of wine development in bottle

2 Taints and contaminants

3 Enhancing varietal flavour in wine

4 Phenolics, tannin and colour

5 Management of wine fermentations

6 Winemaking implications for the management of smoke and bushfire taints

7 *Dekkera/Brettanomyces* yeasts and 'Brett' in Australian red wine

8 Spectroscopy and chemometrics: rapid process monitoring tools for the wine industry

Access to these webcasts has been very favourably received. Further webcasts will be recorded in the next financial year.

Information and knowledge management

Contract negotiations were successfully finalised with the preferred software vendor to develop an Electronic Content Management System (ECMS) using Microsoft Office SharePoint Server (MOSS) 2007.

A number of key tasks outlined in the Implementation Plan were undertaken and completed, including selecting the participants to be involved in the Pilot phase, commencing Design Workshops, commencing the Communication and Awareness Plan, selecting a name for the ECMS Portal ('WiSE' which stands for Wine Information for Scientific Endeavours), and installing and configuring the new SQL server and MOSS 2007.


Dennis Mutton

Commercial (Analytical) Service

Staff

Dr Vince O'Brien, Dr Simon Odell, Dr Jean Macintyre, Oliver Lovat, Leanne Craddock, Nevil Shah, Slavko Bekavac, Daniel Tynan, Yvonne Staeffler, Randell Taylor, Heather Brooks, David Boehm, Pamela Stepancich, Teegan Waples, Jelena Jovanovic, Alana Williams

The AWRI Analytical Service has expanded the scope of their operations to include all AWRI commercial activities. These activities currently incorporate the following:

- Analytical Service;
- Fee-for-service contract research; and
- benchmarking assessments of winemaking supplies.

The Analytical Service incorporates our existing routine and trace analysis capabilities. Our fee-for-service contract research service enables grape and wine producers and suppliers to access the technical expertise within the AWRI for their customised development needs. This service provides support for the following:

- experimental and analytical design;
- interpretation of analytical outcomes;
- customised application of AWRI research outcomes;
- support for applications of AWRI expertise; and
- product development and support.

The benchmarking assessments include activities such as the AWRI closure benchmarking trials and yeast performance assessments.

All excess revenue generated by the AWRI Commercial Services is reinvested to support the levy funded activities; this enhances the benefits produced for Australian grape and wine producers.

The Analytical Service experienced a contraction in their traditional markets over the 2007/2008 financial year. This is a result of wineries internalising analytical capabilities and local competitors providing competition for the remaining markets. In response to these changing sector needs the AWRI has:

- invested in new analytical infrastructure to improve the cost and speed of services offered;
- implemented development programs to commercialise novel technically advanced analytical capabilities targeting strategic needs of Australian wine producers;
- developing services which enable the customers to use the AWRI's expertise to provide context to analytical outcomes; and
- expanded the scope of its services to increase revenue streams through opening up new markets

The benefits from these development initiatives are expected to be evident for our customers in the 2008/2009 financial year.

New services

Development programs have produced the following new services:

- Taint kits;
- a new sensory panel for commercial purpose;
- low molecular weight sulfur compound analytical suite;
- certification of natural versus synthetic tartaric acid, cream of tartar and calcium tartrate;
- a microbial identification service to identify yeast and bacterial species; and
- extensions to the smoke taint and halogenated phenols analytical capabilities

Taint kits

Wine taints can lead to significant product loss or downgrade. Managing problems causing wine taints often relies on early detection by winemakers or winery staff while taints are at low concentrations. Early detection of taints is an operation often performed poorly due to:

- operators or winemakers sensitivity to taints varies significantly from one person to the next; and
- tainting compounds have very different attributes in different wine matrixes.

Brettanomyces still causes significant quality loss to wines in Australia. Early stage detection often requires identification during the high risk period of secondary fermentation when the

Table 8. Suite of commercially available low molecular weight compounds

Compound	Odour descriptor	Aroma threshold (µg/L)	Typical range
Hydrogen sulfide	Rotten egg, sewage like	1	0 – 370
Methanethiol	Rotten cabbage, burnt rubber, putrefacation	1.5	0 – 11
Ethanethiol	Onion, rubbery, burnt match, sulfidy, earthy	1.5	0 – 50
Dimethyl sulfide	Blackcurrant, cooked cabbage, asparagus, canned corn, molasses	25	0 – 980
Carbon disulfide	Sweet, ethereal, slight green, rubber, sulfidy, chokingly repulsive	5	0 – 140
Diethyl sulfide	Garlic, rubbery	1	0 – 10
Methyl thioacetate	Sulfurous, cheesy, egg	40	0 – 115
Dimethyl disulfide	Vegetal, cabbage, intense onion-like (at high levels)	10	0 - 22
Ethyl thioacetate	Sulfurous, garlic, onion	70	0 – 180
Diethyl disulfide	Bad smelling, onion	4	0 – 85

young wines have low sulfur levels and fresh fruity attributes. The AWRI taint kit provides wineries with the ability to screen staff sensitivity levels and indicates to winemakers and winery staff what early warning signs to look for.

Available kits include:

- *Brettanomyces* spoilage taints;
- Smoke taint;
- Cork related taint;
- Oxidation;
- Volatile acidity; and
- Reductive characters

Sensory panel

A sensory panel has been recruited, screened and trained to quantify wine flavour, aroma and taint levels on a fee-for-service basis. The AWRI's sensory evaluation services available now include:

- quantitative assessment of wine quality and taint levels;
- difference testing;
- descriptive analysis; and
- consumer preference testing.

Low molecular weight sulfur compound analytical suite

The AWRI Analytical Service has recently commercialised the capability to test low molecular weight sulfur compounds. These compounds are known to be associated with reductive characters (struck flint and cabbagey), which can be formed under low oxygen ingress seals in wines.

This service is of particular importance to wine producers as recent studies soon to be published by the AWRI Research Sensory Team have show reductive characters in wines can be linked to low consumer preference scores.

Optical rotation

The AWRI Analytical Service has recently commercialised the capability to determine whether tartaric acid, cream of tartar and calcium tartrate are natural L-isomers or synthetic D or DL-racemic mixtures.

Yeast and bacteria identification service

The AWRI Analytical Service now offers a microbial identification service. It is a PCR-based method which can conclusively identify yeast and bacteria species. Uses include identification of microbial spoilage problems in must and wines, determination of the ID of yeast or 'malo' starter cultures, or the naturally occurring yeast or bacteria in your winery.

Other new capabilities

The analysis of halogenated phenols was expanded to include testing of additives like tartaric acid. Guaiacol and 4 methylguaiacol analysis was extended to include the analysis of leaves and canes.

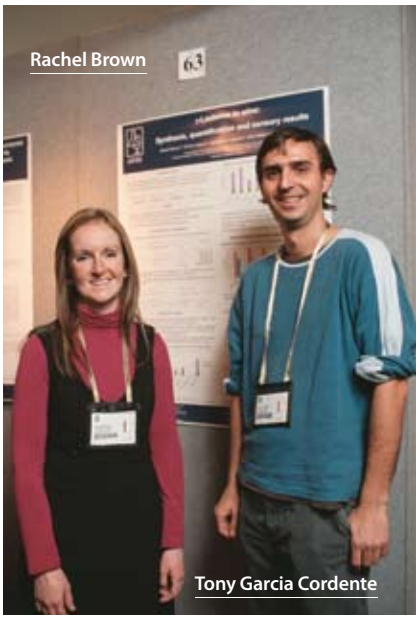
Technologies in the pipeline

The AWRI Analytical Service is implementing a number of programs targeting the improvement of our customer services. Focus areas include:

- turn around time for results;
- cost of our services;
- improving the quality of interaction at our customer contact points;
- developing tests to quantify methoxypyrozines responsible for the green characters in wines; and
- relocation to a new facility enabling us to increase the level of our specialist services


Sean Bowden


Dimitra Capone


Rachel Brown

Tony Garcia Cordente

Financial Report – Directors' report

Hans Schultz (Germany)

Your Directors present their financial report for the year ended 30 June 2008.

Review of Operations

As the major contributor, the AWRI took a leading role in the conduct of the Thirteenth Australian Wine Industry Technical Conference (AWITC), held in July 2007. The AWITC is the AWRI's premier knowledge transfer and extension event. The feedback has been extremely positive and very satisfying for many AWRI staff who worked tirelessly irrespective of whether they were a plenary speaker, workshop presenter, or welcoming delegates at the registration desk. Good scientific momentum has been maintained following world-wide interest in the AWRI's discovery of the flavour compound responsible for the peppery character in Shiraz. Other examples include the isolation of yeast strains able to reduce the undesirable effects of sulfur during fermentation which are now undergoing commercial trials, sequencing a wine yeast genome and undertaking a major sensory study in China of red wine consumer preferences. On the problem solving technical advisory front, further investigations on smoke taint was conducted with a number of collaborators. Information regarding exposure of vineyards to industrial pollution has been researched, as has the potential impact of a eucalyptus plantation in close proximity to a vineyard. On the development side, a rapid UV spectral tannin assay has been validated with six industry laboratories, and an NIR method for the measurement of tannin and total dry matter in grapes has been developed and is undergoing industry trials. Further examples of the diversity of investigations being undertaken at the AWRI include: the modelling of computational fluid dynamics of wine fermentors and spectral analysis of Australian and international Pinot Gris/ Grigio wines to enhance the understanding of wine producers and the distribution chain of Pinot Gris/Grigio wine styles. These examples are illustrative of the discrete yet complementary work being undertaken at the AWRI and readers are encouraged to review our annual report in detail for full details of our activities.

Our exclusive focus on the Australian grape and wine sector, and our unique RDE&C model (see Managing Director's report on page 4) is what makes the AWRI different from other research providers. Whilst the AWRI's involvement in the new Wine Innovation Cluster (WIC) offers enhanced collaboration opportunities, there is a risk of the AWRI's identity, independence and potentially funding being compromised, that needs to be recognised and managed.

The challenges of water availability, salinity and climate change are likely to necessitate the need for greater integration of research, development and extension along the whole value chain from the grapes to the consumer. This paradigm shift of the traditional demarcation of research and extension activities and disciplines by providers is critical for the benefit of the grape and wine sector. Similarly, there is also a risk that the difficult conditions faced by the sector could become a scapegoat for reducing funding to the AWRI that is critical to maintain the existing level of intellectual capital.

Results of Operations

Revenue of almost $13.1m included $9.4m project funding from the GWRDC. In addition $3.4m from the GWRDC for the fitout of the new WIC building was also received and paid to the University of Adelaide as per the WIC Project Charter. Analytical Service income was down reflecting difficult vintage conditions, the preparatory work to reposition the unit into different market segments, and that method development and validation for new equipment was slower than expected. Other commercial income showed a healthy increase as the AWRI looks to exploit contract research and other commercial opportunities as part of its diversification to become less vulnerable to fluctuations in industry funding. Unspent funding of $442k reflects both the increasing difficulty of attracting quality scientists with specific skills and experience, as well as prudent expenditure. Increased travel expenditure reflects greater overseas collaboration and staff members increasingly attending overseas conferences as invited speakers to give greater international exposure to their research and hence assisting to improve Australia's influence.

Significant changes in state of affairs

There are no significant changes in the state of affairs of the AWRI.

PRINCIPAL ACTIVITIES

The principal activities of the AWRI have not significantly changed and are best described as:

Research activities which strive for scientific excellence and industry relevance,

Development activities that seek to bridge the gap between scientific discovery and uptake of value-adding technology or processes,

Extension activities that seek to disseminate research and development outcomes to facilitate the rapid understanding and uptake by Australia's grape and wine producers. In addition, problem-solving and information services complemented with an on-line information retrieval, search capacity and updated website is also provided.

Commercial services aimed at providing competitive specific and/or tailored solutions for individual entities within the grape and wine sector, which supports and leverages from the other key activities of the AWRI.

INFORMATION ON DIRECTORS

Directors of The Australian Wine Research Institute in office at any time during or since the end of the year:

Name and Qualifications and Experience	Special responsibilities	No. of Directors' meetings attended	No. of Audit meetings attended	No. of N & R* meetings attended
Robin Elliott Day, BAgSc, BAppSc(Wine Science), Chairman , Director of Domain Day, former Board Member, Australian Wine and Brandy Corporation, National and International wine show judge, 35 years of production and R&D experience in the Australian win sector.	Chairman Member N & R Committee	6		
James Frederick Brayne, BAppSc(Wine Science), Production Director/Chief Winemaker McWilliam's Wines Pty Ltd, National wine show judge, 35 years technical and winemaking experience in the Australian wine sector (to 12 Nov 2007).		1		
Paul Conroy, LLB(Hons), Comm., Legal Affairs Director, Foster's Group Ltd, member of Chartered Secretaries of Australia, the Australian Corporate Lawyers Association. Admitted as solicitor in the Supreme Courts of NSW, Victoria and the High Court of Australia, over 17 years legal and management experience working in Australia, Asia, United Kingdom and United States.	Member of Audit Committee	5		
Peter James Dawson, BSc, BAppSc(Wine Science), Senior Vice President Group Operations and Technical Constellation Wines, Adjunct Professor, Faculty of Science and Technology, Deakin University, National wine show judge, Inspector, Australian Wine and Brandy Corporation Export Approval Panel, 29 years technical and winemaking experience in the Australian wine sector.	Member Audit and N & R Committees	5	1	1
Timothy Wickham Bevan James, AssDip(Wine Prod), former Chief Executive and current Director, Wirra Wirra Vineyards, past President, SA Wine and Brandy Industry Association, past Deputy Chair, Grape and Wine Research and Development Corporation, Senior National Wine Judge, past Panel Chairman Sydney, McLaren Vale and Hunter Wine Shows, Deputy Chairman of the Adelaide Wine Show, past Chairman of the Barossa Valley Wine Show, past Chairman of the Canberra Wine Show, past Chairman of Cowra Wine Show, Graduate of Melbourne University Advanced Management Program 1985, Member of ASVO Publishing Committee, 31 years technical and winemaking experience in the Australian wine sector.	Member Audit Committee (to February 2008)	4	1	
Geoffrey Raymond Linton, BAppSc(App Chem), Grad Dip(Systems Analysis), Manager, Technical and Research, Yalumba Wine Company, member of the Wine Industry Technical Advisory Committee (AWBC, WFA), member Strategic Directions Group (WFA), 35 years experience in the Australian wine sector.	Member Executive Council	6		1
Stephen Brian Millar, BA(Acc), CPA, former CEO, Constellations Wines , Former Executive Member, Winemakers' Federation of Australia, former Chair, Winemakers' Federation of Australia Audit Committee, Director, Drinkwise, former Deputy Chair, Australian Wine Export Council, former Member, South Australian Wine Industry Council (to 1 Nov 2007).	Chair Audit Committee (to October 2008)	1	1	
Brett Malcolm McKinnon, BAgSc (Oenology) (Hons), General Manager Viticulture and Winemaking, Orlando Wines, Executive Member SA Wine Industry Association, Member SA Wine Industry Council, Member WFA/WGGA Wine Industry Relations Committee, ASVO Professional Member, Graduate Leadership in Innovation Program INSEAD France, 20 years technical, winemaking, viticulture and commercial experience (from 1 Jan 2008).		4		
Jan Sheree O'Connor, BEd (PE), Managing Director, O'Connor Harvesting, Committee Member, Robinvale & District Wine Grape Growers Association, Committee Member, Murray Valley Winegrowers Inc, Murray Valley Industry Development Committee, Phylloxera & Plant Health Technical Reference Group, and Australian Wine & Brandy Corporation Knowledge Development Advisory Committee, 22 years experience in the Australian wine sector.		5		
Mark Richard Watson, BEc, MBA , ACA ,IPAA, AICD partner Corporate Finance division of MHM Chartered Accountants , previously CFO Wirra Wirra and Manager, Corporate Strategy and Development, FH Faulding & Co Ltd (from 24 June 2008).	Chair Audit Committee (from July 2008)	0		
Stehen John Webber, BAppSc (Oenology), Chief Winemaker De Bortoli Yarra Valley, Chairman of Judges Melbourne Wine Show, Former Chairman of Cowra and Australia Small Winemaker Shows and 20 years of wine judging. 26 years technical and winemaking experience in Australia and France. *Australian Gourmet Traveller* Winemaker of the Year 2007. Winemaker and Director PHI Wines, a joint venture between the De Bortoli and Shelmerdine families (from 6 May 2008).		1		

**N & R' is Nominations and Remunerations Committee*

Name and Qualifications and Experience	Special responsibilities	No. of Directors' meetings attended	No. of Audit meetings attended	No. of N & R* meetings attended
Isak Stephanus Pretorius, BSc Agric(Hons) PhD, Managing Director, The Australian Wine Research Institute Ltd, Professor Extraordinary in Oenology, University of Stellenbosch, Affiliate Professor in Oenology, University of Adelaide, Committee Member: Wine Industry Technical Advisory Committee (WFA/AWBC), Wine Committee Royal Agricultural and Horticultural Society (South Australia), Member, International Commission of Yeasts, Scientific Board of L'Institutdes Sciences de la Vinge et du vin (ISVV) Bordeaux, France, Scientific Committee, Institut Catalá de Recerca en Enologia i Viticultura (ICREV) Tarronga Spain, Editorial Board Member, *American Journal of Enology and Viticulture, Annals of Microbiology, FEMS Yeast Research, South African Journal of Enology and Viticulture,* and Chair of the Australian Wine Industry Technical Conference, 31 years experience in microbiology and biotechnology.	Member of N & R Committee	6		
Alternate Directors				
Nigel Peter Blieschke, BAppSc, GradCertVit, Viticulturist/Nursery Manager, Yalumba Wine Company.		1		
Leon Phillip Deans, BAppSc, Grad Dip (Business Administration), Innovations Manager, Pernod Ricard Pacific, committee member, Wine Industry Technical Advisory Committee, Board Member of Australian Wine and Brandy Corporation, 29 years winemaking experience in the Australian wine sector.				
James Northey, BSc, Grad Dip (BusAdmin), Management Systems Manager, Constellation Wines, member of the South Australian Wine Industry Association Environment Committee, 27 years experience in the Australian wine sector.				
Alan David Kennett, BSc, BAppSc (Wine Science), Chief Winemaker, Casella Wines Pty Ltd, committee member, WFA Technical and Packaging Committee, committee member, CSU Course Advisory Committee, 15 years experience in the Australian wine sector (to 12 Nov 2007).				
Alexander Nikolai Sas, BSc Agric(Hons), Regional Viticulturist, Constellation Wines, 19 years experience in viticultural R&D and grape supply management.				
Secretary				
Hans Englebert Muhlack BEc CPA				
Six Board meetings, one Audit and one Nomination and Remuneration (N& R) Committee were convened during the year				

**N & R' is Nominations and Remunerations Committee*

SHARE OPTIONS

No options to shares in the chief entity have been granted during the year and there were no options outstanding at the end of the year.

Indemnification of officers and auditors

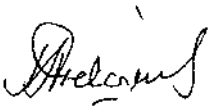
The Company has not, during or since the end of the year, in respect of any person who is or has been an officer or auditor of the chief entity or a related body corporate indemnified, or made any relevant agreement for indemnifying, against a liability, including costs and expenses, in successfully defending legal proceedings, or paid, or agreed to pay, a premium in respect of a contract insuring against a liability for the costs or expenses to defend legal proceedings.

Auditor's independence declaration

The auditor's independence declaration under section 307C is attached.

Signed in accordance with a resolution of the Board of Directors this 18th day of November 2008.

R.E. Day
Chairman



I.S. Pretorius
Managing Director

INCOME STATEMENT
FOR THE YEAR ENDED 30 JUNE 2008

	Notes	2008 $	2007 $
Revenue from operating activities			
Grape and Wine Research and Development Corporation			
Project operating funds		8,841,018	7,893,851
Project equipment funds		173,021	420,814
WIC Building and Other Capital		173,861	0
Other Grant Funding		629,808	0
Analytical Service		1,614,288	2,169,063
Contract Research and other Commercial Income		539,247	238,206
Interest income		639,855	346,743
Other revenue		457,173	341,227
Expenses from operating activities			
Employee benefit expense		8,586,085	7,705,624
Analytical & Project Operating expenses		1,625,648	1,568,771
Infrastructure & general services expenses		763,302	678,730
Depreciation and amortisation expense	4	725,142	731,386
Travel expenses		340,279	237,184
Borrowing cost expense		0	0
Profit for the period		1,027,814	488,209
Net gain (loss) on disposal of assets			
Motor vehicles		27,230	23,442
Other		(1,680)	211,863
Profit from ordinary activities		**1,053,364**	**723,514**
Total changes in equity		**1,053,364**	**723,514**

The Income Statement should be read in conjunction with the accompanying notes.

BALANCE SHEET
AS AT 30 JUNE 2008

	Notes	2008 $	2007 $
Current assets			
Cash assets		5,576,903	5,188,344
Commercial bills	11	2,908,845	2,719,779
Trade and other Receivables	2	763,187	2,225,774
Other current assets	3	201,220	184,399
Total current assets		9,450,155	10,318,296
Non current assets			
Leasehold buildings	4	1,336,650	1,373,750
Plant and equipment	4	2,466,634	2,055,146
Interest in WIC Building	5	1,994,595	0
Total non current assets		5,797,879	3,428,896
TOTAL ASSETS		**15,248,034**	**13,747,192**
Current liabilities			
Payables and accruals	6	3,605,190	2,926,429
Project funds not expended and repayable			
GWRDC		907,338	1,358,363
Provisions	7	1,341,490	1,074,476
Total current liabilities		5,854,018	5,359,268
Non current liabilities			
Payables and accruals	6	62,014	79,796
Provisions	7	170,926	200,416
Total non current liabilities		232,940	280,212
TOTAL LIABILITIES		**6,086,958**	**5,639,480**
NET ASSETS		**9,161,076**	**8,107,712**
EQUITY			
Reserves	8	0	700,000
Retained earnings	9	9,161,076	7,407,712
TOTAL EQUITY		**9,161,076**	**8,107,712**

The Balance Sheet should be read in conjunction with the accompanying notes.

STATEMENT OF CHANGES IN EQUITY FOR THE YEAR ENDED 30 JUNE 2008

	Retained Earnings	Other Reserves	Total
As at 1 July 2006	**6,684,198**	**700,000**	**7,384,198**
Profit for the year	723,514		723,514
Total recognised income & expenses for the period	723,514		723,514
As at 1 July 2007	**7,407,712**	**700,000**	**8,107,712**
Profit for the year	1,053,364		1,053,364
Total recognised income & expensesfor the period	1,053,364		1,053,364
Transferring reserves to retained earnings	700,000	(700,000)	
As at 1 July 2008	**9,161,076**	**0**	**9,161,076**

STATEMENT OF CASH FLOWS FOR THE YEAR ENDED 30 JUNE 2008

	Notes	2008	2007
		$	$
CASH FLOWS FROM OPERATING ACTIVITIES			
Grants and other income		13,616,741	10,658,936
Interest received		639,855	346,743
Payments to suppliers and employees		(11,582,460)	(8,552,876)
Net cash provided by operating activities	**10**	2,674,136	2,452,802
CASH FLOWS FROM INVESTING ACTIVITIES			
Receipt from SA Government for Provisor Pty Ltd		0	0
Payment for commercial bills		(189,067)	(161,598)
Lease repayments		(8,199)	(7,451)
Payments for plant and equipment		(2,118,342)	(328,497)
Proceeds from Adelaide Uni Deed of Endowment		0	
SA Gov Assistance paid to Provisor Pty Ltd			
Proceeds from sale of plant and equipment		30,032	34,616
Net cash used in investing activities		(2,285,576)	(462,929)
CASH FLOWS FROM FINANCING ACTIVITIES			
Repayment of loans		0	0
Proceeds from loans		0	0
Net cash provided by financing activities		0	0
Net increase (decrease) in cash held		388,560	1,989,873
Cash at 1 July		5,188,343	3,198,470
Cash at 30 June		5,576,903	5,188,343

The Statement of Cash Flows should be read in conjunction with the accompanying notes.

Notes to and forming part of the Financial Report

1. STATEMENT OF ACCOUNTING POLICIES

The financial report has been prepared in accordance with applicable accounting standards, other mandatory professional reporting requirements and the Corporations Act 2001. The financial report has also been prepared on the basis of historical costs and does not take into account changing money values. Where necessary, comparative information has been reclassified to achieve consistency in disclosure with current financial year amounts and disclosures.

Australian Accounting Standards include Australian equivalents to International Financial Reporting Standards (IFRS). Compliance with the Australian equivalents to IFRS (AIFRS) ensures that the financial report complies with IFRS. No new Standards or Interpretations that have been issued but not adopted have been used in the preparation of this financial report.

The following is a summary of the significant accounting policies adopted by AWRI in the preparation of the financial report.

(a) Receivables and revenue recognition

Sales are recorded when goods or services have been provided to a customer.

Trade debtors are recognised at the amount receivable and are due for settlement within 30 days from the date of the invoice.

(b) Non-current assets

The cost method of accounting is used for the acquisition of assets. The acquisition of assets must be initiated by a purchase order.

The carrying amounts of non-current assets are reviewed at balance date to ensure that they are not valued in excess of their recoverable amount.

Plant and equipment is depreciated on a straight line basis to write off the net cost of each item of plant and equipment over its expected useful life. The expected useful lives are between 3 and 10 years.

Buildings and improvements are valued at cost and amortised over the estimated useful life of the buildings of 50 years.

(c) Payables and expenditure recognition

Purchases are recorded when a supplier has supplied goods or services. Trade creditors are unsecured and usually paid within each supplier's trading terms.

(d) Employee entitlements

(i) Wages, salaries and annual leave

Wages, salaries, annual leave and other employee benefits expected to be settled within twelve months of the reporting date are measured at their nominal amounts, including related on-costs.

(ii) Long service leave

Long service leave liabilities expected to be settled more than twelve months after the reporting date are measured such that the liability is not materially different from the estimate determined by using the present value of the estimated future cash outflows in respect of services provided up to the reporting date.

(e) Leases

Leases of fixed assets, where substantially all the risks and benefits incidental to the ownership of the asset, but not the legal ownership, are transferred to the entity are classified as finance leases.

Finance leases are capitalised, recording an asset and a liability equal to the present value of the minimum lease payments, including any guaranteed residual values.

Leased assets are depreciated on a straight line basis over their estimated useful lives where it is likely that the entity will obtain ownership of the asset. Lease payments are allocated between the reduction of the lease liability and the lease interest expense for the period.

Lease payments for operating leases, where substantially all the risks and benefits remain with the lessor, are charged as expenses in the period in which they are incurred.

Lease incentives under operating leases are recognised as a liability and amortised on a straight-line basis over the life of the lease term.

(f) Impairment

At each reporting date, the entity reviews the carrying values of its tangible and intangible assets to determine whether there is any indication that those assets have been impaired. If such an indication exists, the recoverable amount of the asset, being the higher of the asset's fair value less costs to sell and value in use, is compared to the asset's carrying value. Any excess of the asset's carrying value over its recoverable amount is expensed to the Income Statement. No adjustments for impairment were made this year.

Where the future economic benefits of the asset are not primarily dependent upon on the assets ability to generate net cash inflows and when the entity would, if deprived of the asset, replace its remaining future economic benefits, value in use is depreciated replacement cost of an asset.

Where it is not possible to estimate the recoverable amount of an assets class, the entity estimates the recoverable amount of the cash-generating unit to which the class of assets belong.

(g) Cash and Cash Equivalents

Cash and cash equivalents include cash on hand, deposits held at-call with banks, other short-term highly liquid investments with original maturities of three months or less, and bank overdrafts.

	2008 $	2007 $
2 RECEIVABLES		
Trade debtors	570,858	841,263
Other debtors	192,329	1,384,511
	763,187	2,225,774
3 OTHER CURRENT ASSETS		
Course materials	44,540	57,648
Prepayments	156,680	126,751
	201,220	184,399

4 NON CURRENT ASSETS: AMORTISATION AND DEPRECIATION

	Leasehold buildings	Plant and equipment
Written down value		
Balance 30/06/2007	1,373,750	2,055,146
Additions		1,104,000
Disposals		(4,470)
Depreciation expense	(37,100)	(688,042)
Balance 30/06/2008	1,336,650	2,466,634

Proceeds on disposal of plant and equipment were $30,032 in 2008 and $34,616 in 2007

Notes to and forming part of the Financial Report

5 INTEREST IN WIC BUILDING

AWRI has a 50 year nominal occupancy right to approximately 56% of the space in the WIC Central building owned by the University of Adelaide. The other occupants are the University of Adelaide and SARDI. The term of occupancy is reviewable after 30 years based on the remaining economic life of the building. The value assigned to AWRI's interest in the building as at 30June 2008 is $5.395m less the $3.4m contributed by the GWRDC. The South Australian State Government has also contributed $9.5m to the cost of the building on behalf of all interested parties

	2008 $	2007 $

6 PAYABLES AND OTHER ACCRUALS

Current

Trade creditors	1,584,102	571,950
Income received in advance	1,132,290	1,382,875
PAYG and GST	305,848	457,616
Other creditors and accruals	573,167	505,789
Lease Liability	9,783	8,199
In 2007 "trade creditors" included accruals that should have been included under "other creditors and accruals". This has been reclassified in 2008 with the comparative 2007 figure shown.		
	3,605,190	2,926,429

Non current

Other creditors	30,001	38,000
Lease liability	32,013	41,796
	62,014	79,796

7 PROVISIONS

Current

Employee entitlements	1,341,490	1,074,476

Non current

Employee entitlements	170,926	200,416
Number of Employees (FTE's)	95.8	89.1

8 RESERVES

Capital reserve

Balance at the beginning of the year	700,000	700,000
Transferred to retained earnings	(700,000)	0
Balance at the end of the year	0	700,000

The Reserve was transferred to Retained Earnings on the basis that the Reserve was not created from any Asset revaluation, nor was there any residual mandated purpose for which the reserve had to be used.

9 RETAINED EARNINGS

Retained earnings at the beginning of the year	7,407,712	6,684,198
Profit from ordinaryactivities	1,053,364	723,514
Transfer from Capital Reserve	700,000	
Retained earnings at the end of the year	9,161,076	7,407,712

10 RECONCILIATION OF NET CASH PROVIDED BY ORDINARY ACTIVITIES WITH ORDINARY PROFIT

Profit from ordinary activities	1,053,364	723,514
Non cash flows in operating profit		
Amortisation and depreciation	725,142	731,386
(Profit) loss on the sale of plant and equipment	(25,550)	(360,305)
Charges to (reduction in) provisions	237,523	183,212
Changes in assets and liabilities		
(Increase) decrease in receivables and other current assets	1,171,507	(404,929)
Increase (decrease) in sundry creditors and accruals	(487,849)	1,579,923
Net cash provided by ordinary activities	2,674,136	2,452,801

11 FINANCIAL INSTRUMENTS

Maturity analysis

A CBA Commercial Bill was held at the end of June and redeemed on 6 August 2008. The value at maturity was $2,946,061.

A $2 million loan facility has been arranged to cover any short term peak cash demands for calls still to be made for the WIC building of approximately $5 million.

Credit risk is managed by requiring new customers to complete an application for credit which seeks information about the organisation and their current trading activities to make trade reference enquires. The application is approved if positive information is received. In the interim work is only undertaken on a prepayment basis. Monthly statements are issued and customers are contacted when invoices are more than 45 days overdue. Existing customers' work is held if any of their invoices are overdue more than 60 days. Credit on seriously overdue accounts is stopped and placed in the hands of a debt collection agency as a last resort. The aging of trade debtors as at 30 June 2008 compared to 2007 was as follows:

	2008 $	2007 $
Current	338,442	638,730
Overdue: less than 30 days	144,515	125,592
Overdue: 30-60 days	82,628	74,421
Overdue: more than 60 days	5,273	2,519

Cash flow analysis

Creditors are usually paid within 30 days unless specific other arrangements are entered into. Should any large foreign currency payment be required, exchange rate movements are usually hedged by taking out an appropriate forward exchange contract. The balance of the working account is checked daily and money is transferred from the 'at call' CBA cash management account, if anticipated payments are likely to reduce the balance of the working account under $100,000. Major funding income is deposited into the cash management account.

Sensitivity analysis

Given the strong cash position and minimal gearing of the AWRI finances the impact of a 2% interest rate movement would not be considered material.

12 REMUNERATION OF KEY MANAGEMENT PERSONNEL

Key management personnel comprise directors and other persons having authority and responsibility for planning, directing and controlling the activities of the AWRI.

Short-term employee benefits	1,328,834	1,077,056
Post-employment benefits	159,175	128,739
Termination benefits	0	0
Total	1,488,009	1,205,795

13 AUDITORS REMUNERATION

(a) For auditing the financial report	14,500	15,750
(b) For other services	3,595	3,410
	18,095	19,160

14 RELATED PARTIES

The following directors held office during the year:

Directors	Alternate Directors
Robin Elliott Day	Leon Phillip Deans
Jan Sheree O'Connor	
Paul David Conroy	
Stephen Brian Millar	
Timothy Wickam Bevan James	James Northey
Geoffrey Raymond Linton	Nigel Peter Blieschke
James Frederick Brayne	Alan David Kennett
Peter James Dawson	Alexander Sas
Brett McKinnon	
Steve John Webber	
Mark Richard Watson	
Isak Stephanus Pretorius	

Remuneration of Directors and key management personnel is disclosed in Note 12 to these accounts

Related Entities	2008	2007
	$	$
Transactions between related parties		
Administrative services charged to		
AWITC	44,785	45,973
Services received from Related Entities	92,185	75,298
Services provided to Related Entities	273,913	612,752

The Related Entities from whom the AWRI received services were:

- Australian Wine Industry Technical Conference Inc
- Provisor Pty Ltd
- Constellation Wines
- Domain Day Wines
- Wirra Wirra Vineyards
- McWilliam's Wines
- Orlando Wines

The Related Entities to whom the AWRI provided services to were:

- Australian Wine Industry Technical Conference Inc
- Provisor Pty Ltd
- Constellation Wines
- Wirra Wirra Vineyards
- McWilliam's Wines
- Orlando Wines
- Drinkwise Australia

Services were provided to related entities on a purely arms length commercial basis with no additional discounts provided.

15 FINANCIAL REPORTING BY SEGMENTS

The AWRI operates predominantly in one industry. The principal activities in the course of the financial year were research, development, extension and commercial scientific activities in connection with winemaking and viticulture. The AWRI operates predominantly in one geographical area, being Adelaide, South Australia.

16 LIMITED LIABILITY

The company is limited by guarantee. In the event of the company being wound up, the liability of each member (both during the time he or she is a member and within one year afterwards) is limited to two dollars.

Notes to and forming part of the Financial Report

DIRECTORS' DECLARATION

In the opinion of the directors:

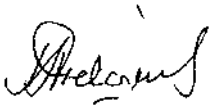
(a) the accompanying financial report and notes set out on pages 38 to 45 are in accordance with the Corporations Act 2001, comply with the accounting standards and give a true and fair view of the company's financial position as at 30 June 2008 and of its performance for the year ended on that date; and

(b) at the date of this declaration there are reasonable grounds to believe that the company will be able to pay its debts as and when they become due and payable.

Signed in accordance with a resolution of the directors

R.E. Day

Chairman



I.S. Pretorius

Managing Director

At Adelaide this 18th day of November 2008.

AUDITOR INDEPENDENCE DECLARATION

To the Directors of The Australian Wine Research Institute Ltd

As lead engagement partner for the audit of The Australian Wine Research Institute Ltd for the year ended 30 June 2008, I declare that, to the best of my knowledge and belief, there have been:

(a) no contraventions of the auditor independence requirements of the Corporations Act 2001 in relation to the audit; and

(b) no contraventions of any applicable code of professional conduct in relation to the audit.

PKF

Chartered Accountants

I.J. Painter

Partner

Signed at Adelaide, this 18th day of November 2008.

INDEPENDENT AUDIT REPORT TO MEMBERS OF THE AUSTRALIAN WINE RESEARCH INSTITUTE

We have audited the accompanying financial report of The Australian Wine Research Institute Ltd, which comprises the balance sheet as at 30 June 2008, and the income statement, statement of changes in equity and cash flow statement for the year ended on that date, a summary of significant accounting policies, other explanatory notes and the directors' declaration.

Directors' Responsibility for the Financial Report

The directors of the company are responsible for the preparation and fair presentation of the financial report in accordance with Australian Accounting Standards (including the Australian Accounting Interpretations) and the Corporations Act 2001. This responsibility includes establishing and maintaining internal controls relevant to the preparation and fair presentation of the financial report that is free from material misstatement, whether due to fraud or error; selecting and applying appropriate accounting policies; and making accounting estimates that are reasonable in the circumstances. In Note 1, the directors also state, in accordance with Accounting Standard AASB 101 Presentation of Financial Statements, that compliance with the Australian equivalents to International Financial Reporting Standards ensures that the financial report, comprising the financial statements and notes, complies with International Financial Reporting Standards.

Auditor's Responsibility

Our responsibility is to express an opinion on the financial report based on our audit. We conducted our audit in accordance with Australian Auditing Standards. These Auditing Standards require that we comply with relevant ethical requirements relating to audit engagements and plan and perform the audit to obtain reasonable assurance whether the financial report is free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial report. The procedures selected depend on the auditor's judgement, including the assessment of the risks of material misstatement of the financial report, whether due to fraud or error. In making those risk assessments, the auditor considers internal controls relevant to the entity's preparation and fair presentation of the financial report in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal controls. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of accounting estimates made by the directors, as well as evaluating the overall presentation of the financial report and the remuneration disclosures in the directors' report.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Independence

In conducting our audit, we have complied with the independence requirements of the Corporations Act 2001.

Auditor's Opinion

In our opinion the financial report of The Australian Wine Research Institute Ltd is in accordance with the Corporations Act 2001, including:

(a) giving a true and fair view of the company's financial position as at 30 June 2008 and of its performance for the year ended on that date; and

(b) complying with Australian Accounting Standards (including the Australian Accounting Interpretations) and the Corporations Regulations 2001.

PKF

A South Australian Partnership
Chartered Accountants

I.J. Painter
Partner

Signed at Adelaide this 18th day of November 2008.

Memorial Funds

THE JOHN FORNACHON MEMORIAL LIBRARY ENDOWMENT FUND

THE THOMAS WALTER HARDY MEMORIAL TRUST FUND

THE H.R. HASELGROVE MEMORIAL TRUST FUND

THE STEPHEN HICKINBOTHAM MEMORIAL RESEARCH TRUST FUND

STATEMENT BY DIRECTORS OF THE TRUSTEE COMPANY

As detailed in note 2 to the accounts, the Trusts are not reporting entities because, in the Trustee's opinion, it is unlikely that users exist who are unable to command the preparation of reports tailored so as to satisfy, specifically, all of their information needs. This is a special purpose financial report that has been prepared to meet the reporting obligations of the Trustee.

In the opinion of the directors of The Australian Wine Research Institute Ltd:

1 (a) The Income Statements give a true and fair view of each Trust's surplus for the year ended 30 June 2008;

(b) The Balance Sheets give a true and fair view of each Trust's state of affairs as at 30 June 2008.

2 At the date of this statement, there are reasonable grounds to believe that the Trusts will be able to pay their debts as and when they fall due.

This statement is made in accordance with a resolution of the Board of Directors of the trustee company and is signed for and on behalf of the directors by:

R.E. Day
Chairman

Dated this 18th day of November 2008.

INCOME STATEMENTS	The John Fornachon Memorial Library Endowment Fund		The Thomas Walter Hardy Memorial Trust Fund		The H. R. Haselgrove Memorial Trust Fund		The Stephen Hickinbotham Memorial Research Trust Fund	
	2008	2007	2008	2007	2008	2007	2008	2007
For the year ended 30 June 2008	$	$	$	$	$	$	$	$
Income								
Interest	6,540	5,645	6,925	5,412	4,399	3,679	6,548	5,463
Donations		-	-	5,000				-
	6,540	**5,645**	**6,925**	**10,412**	**4,399**	**3,679**	**6,548**	**5,463**
Expenditure								
Advertising	-	-	-	-	-	-	-	-
Audit fees	550	550	550	540	550	540	550	540
Bank charges	-	-	-	-	-	-	-	-
Technical Review contributions	-	-	-	-	-		-	-
Sponsorship	-	-	10,000	-	-		5,000	-
	550	**550**	**10,550**	**540**	**550**	**540**	**5,550**	**540**
SURPLUS (DEFICIT) FOR THE YEAR	**5,990**	**5,095**	**-3,625**	**9,872**	**3,849**	**3,139**	**998**	**4,923**

Memorial Funds

BALANCE SHEETS	The John Fornachon Memorial Library Endowment Fund		The Thomas Walter Hardy Memorial Trust Fund		The H. R. Haselgrove Memorial Trust Fund		The Stephen Hickinbotham Memorial Research Trust Fund	
As at 30 June 2008	**2008**	**2007**	**2008**	**2007**	**2008**	**2007**	**2008**	**2007**
	$	**$**	**$**	**$**	**$**	**$**	**$**	**$**
Current Assets								
Cash at Bank	2	1	9	7	0	0	0	0
Receivables	1,744	-	1,846	-	-	-	-	-
Total Current Assets	1,746	1	1,855	7	0	0	0	0
Non-Current Assets								
Investments	103,650	98,855	109,722	104,645	68,659	64,260	102,192	95,644
Total Assets	**105,396**	**98,856**	**111,577**	**104,652**	**68,659**	**64,260**	**102,192**	**95,644**
Current Liabilities								
Sundry creditors	1,100	550	16,100	5,550	1,100	550	6,100	550
NET ASSETS	**104,296**	**98,306**	**95,477**	**99,102**	**67,559**	**63,710**	**96,092**	**95,094**
TRUST FUNDS								
Settled Sum	12,785	12,785	50	50	20,000	20,000	50	50
Founders Donation		-	25,000	25,000	-	-	-	-
	12,785	12,785	25,050	25,050	20,000	20,000	50	50
ACCUMULATED SURPLUS								
Opening balance	85,521	80,426	74,052	64,180	43,710	40,571	95,044	90,121
Surplus for the year	5,990	5,095	-3,625	9,872	3,849	3,139	998	4,923
Closing balance	91,511	85,521	70,427	74,052	47,559	43,710	96,042	95,044
TOTAL TRUST FUNDS	**104,296**	**98,306**	**95,477**	**99,102**	**67,559**	**63,710**	**96,092**	**95,094**

Memorial Funds

THE JOHN FORNACHON MEMORIAL LIBRARY ENDOWMENT FUND

THE THOMAS WALTER HARDY MEMORIAL TRUST FUND

THE H.R. HASELGROVE MEMORIAL TRUST FUND

THE STEPHEN HICKINBOTHAM MEMORIAL RESEARCH TRUST FUND

1 NOTES TO AND FORMING PART OF THE ACCOUNTS

(a) The John Fornachon Memorial Library Endowment Fund was established on 30 September 1970, to provide for the establishment and maintenance of the Fornachon Memorial Library, for the promotion of study and general knowledge of the wine industry. The Fund was established by way of public appeal on a memorial to the late John Charles Macleod Fornachon, the Director of Research of The Australian Wine Research Institute from 1955 to 1968.

(b) The Thomas Walter Hardy Memorial Trust Fund was established on 29 June 1993 to assist in the communication of information within the wine industry and associated activities, allied to the wine industry on behalf of the Trust. The Trust was established in memory of the late Thomas Walter Hardy.

(c) The H.R. Haselgrove Memorial Trust Fund was established on 12 December 1979 to provide for the promotion and encouragement of wine research by, or under the direction of, The Australian Wine Research Institute as a memorial to the late Harry Ronald Haselgrove.

(d) The Stephen Hickinbotham Memorial Research Trust was established on 7 October 1986 to provide financial assistance and support in the pursuit of scientific research and associated activities, allied to the wine industry. The Trust was established in memory of the late Stephen John Hickinbotham. The Australian Wine Research Institute assumed responsibility for the Trust on 25 May 1992.

2 STATEMENT OF ACCOUNTING POLICIES

In the opinion of the Trustee, the Trusts are of a type identified in Statement of Accounting Concepts 1 as non-reporting entities. Accordingly, the financial statements constitute a 'Special Purpose Financial Report' which has been prepared solely to meet the reporting obligations of the Trustee, and the limited information needs of the Trusts' members.

The financial statements have been prepared in accordance with accounting standards, except as stated below, and other mandatory professional reporting requirements.

The following accounting standards have not been adopted because, in the opinion of the Trustee, the cost of compliance out weighs the benefit of the resultant information:

AAS22 Related Party Disclosures

AAS28 Statement of Cash Flows

AAS33 Presentation and Disclosure of Financial Instruments

The financial statements have been prepared on an accrual basis.

Accounting policies have been consistently applied, with the only significant policy being in relation to investments.

Investments comprise money on deposit, and are recorded at their nominal value. Interest is brought to account as earned, with accrued interest at balance date being included in the balance sheet as receivables.

AUDITOR'S REPORT

TO THE TRUSTEE OF

THE JOHN FORNACHON MEMORIAL LIBRARY ENDOWMENT FUND

THE THOMAS WALTER HARDY MEMORIAL TRUST FUND

THE H.R. HASELGROVE MEMORIAL TRUST FUND

THE STEPHEN HICKINBOTHAM MEMORIAL RESEARCH TRUST FUND

Scope

We have audited the financial statements, being special purpose financial reports, of The John Fornachon Memorial Library Endowment Fund, The Thomas Walter Hardy Memorial Trust Fund, The H.R. Haselgrove Memorial Trust Fund and The Stephen Hickinbotham Memorial Research Trust Fund for the year ended 30 June 2008, as set out on pages 47 to 48. The Trustee is responsible for the preparation and presentation of the financial statements and the information they contain and has determined that the accounting policies used and described in Note 2 to the accounts are appropriate to meet the needs of the members. We have conducted an independent audit of these financial statements in order to express an opinion on them to the members on their preparation and presentation.

Our audit has been conducted in accordance with Australian auditing standards. Our procedures included examination, on a test basis, of evidence supporting the amounts and other disclosures in the financial statements and significant accounting estimates. These procedures have been undertaken to form an opinion as to whether, in all material respects, the financial statements are presented fairly in accordance with the accounting policies described in Note 2 to the accounts. These policies do not require the application of all accounting standards and mandatory professional reporting requirements.

The audit opinion expressed in this report has been formed on the above basis.

Audit Opinion

In our opinion, the financial statements of The John Fornachon Memorial Library Endowment Fund, The Thomas Walter Hardy Memorial Trust Fund, The H.R. Haselgrove Memorial Trust Fund and The Stephen Hickinbotham Memorial Research Trust Fund for the year ended 30 June 2008 are properly drawn up in accordance with applicable Australian accounting standards. As the Trustee has determined that the Trusts are non-reporting entities, accounting standards and other mandatory professional reporting requirements have only been applied to the extent described in Note 2 to the accounts.

PKF

A South Australian Partnership

Chartered Accountants

I.J. Painter
Partner

Signed at Adelaide this 18th day of November 2008.

Appendix 1 – External presentations and talks

Staff	Title of talk	Presented to and where	Date
A.R. Borneman	Transcriptional networks controlling pseudohyphal growth in *Saccharomyces cerevisiae* and their comparison to related yeast species	XXIIIrd International Conference on Yeast Genetics and Molecular Biology, Melbourne, Vic	1–6 Jul 2007
P.J. Chambers	Generating novel wine yeasts using traditional and GM approaches		
C.D. Curtin, J.R. Bellon, E.L. Kennedy, M.A. de Barros Lopes, P.W. Godden, P.A. Henschke	Sulfite tolerance amongst genetically diverse *Dekkera bruxellensis* wine strains isolated from Australian wine		
E.J. Bartowsky	Fermenting new ideas- bacteriology -wine bacteria	Annual Scientific Meeting and Exhibition of the Australian Society for Microbiology 2007, Adelaide, SA	9–13 Jul 2007
C.A. Varela	Persuading wine yeast to make less alcohol		
C.D. Curtin, J.R. Bellon, A.D. Coulter, G.D. Cowey, M.G. Holdstock, E.M.C. Robinson, E.L. Kennedy, B. Bramley, I.L. Francis, M.A. de Barros Lopes, P.A. Henschke, P.W. Godden	*Dekkera/Brettanomyces* yeasts and 'Brett' in Australian red wine		
J.H. Swiegers	Yeast modulation of Sauvignon Blanc wine aroma	Sauvignon Blanc Interest Group Seminar, Durbanville, South Africa	18 Jul 2007
G.K. Skouroumounis	A new non-intrusive method of measuring oxygen ingress through a wine bottle closure	In Vino Analytica Scientia Melbourne, Vic	22–25 Jul 2007
P.A. Smith	Novel and high throughput approaches for red wine tannin analysis		
R.C. Brown, D.L. Capone, M.A. Sefton, G.M. Elsey	An investigation into the enantiomeric distribution of γ-lactones in wine		
S. van Sluyter[1]	Fractionation of grape juice proteins by hydrophobic interaction chromatography		
M. Ugliano	The role of grape, yeast, and winemaking technology in the varietal volatile composition of a non-aromatic white wine		
Y. Hayasaka, K.L. Wilkinson[2], G.M. Elsey, M. Raunkjær[3], M.A. Sefton	Screening of oak lactone precursors using LC-MS/MS combined with Information Dependent Acquisition (IDA)		
M.A. Sefton	Chemical formation and degradation of grape-derived wine flavour compounds – applications of stable isotope dilution analysis		
D. Cozzolino, H.E. Smyth[4], W.U. Cynkar, L.J. Janik. R.G. Dambergs, M. Gishen	Use of direct headspace-mass spectrometry coupled with chemometrics to predict aroma properties in Australian Reisling wine		
R.G. Dambergs, A. Kambouris[5], M.J. Kwiatkowski, M. Gishen, M.J. Herderich	Spectroscopy based rapid measurement of phenolic profiles and varietal classification of red grapes		
C. Bevin[6], R. G. Dambergs, A.J. Fergusson[6], D. Cozzolino	Varietal discrimination of wine by mid-infrared spectroscopy		
I.L. Francis	Sensory issues in the Australian wine sector	The Australian Association of Chemosensory Sciences, Tanunda, SA	26 Jul 2007
E.J. Waters	Improved clarification and stabilisation technologies: protein stability in white wines	13th Australian Wine Industry Technical Conference, main program, Adelaide, SA	30 Jul 2007
A.D. Coulter	Taints and off-flavours in wine – case studies of recent industry problems		30 Jul 2007
J.H. Swiegers	Flavour-enhancing yeast		31 Jul 2007
A.P. Pollnitz, C. Wood, T.E. Siebert, M. Parker, D.L. Capone, G.M. Elsey, M.A. Sefton, M.J. Herderich	Pepper aroma in Shiraz		31 Jul 2007
A.R. Borneman	The potential of Systems Biology for winemaking		1 Aug 2007
C.D. Curtin	Sensory perceptions of 'Brett' and relationship to consumer preference		1 Aug 2007

Affiliations: **1.** AWRI and University of Melbourne, **2.** Currently University of Adelaide, **3.** H. Lundbeck A/S, Process Research, Denmark, **4.** Currently Department of Primary Industries and Fisheries, Emerging Technologies – Delivery, Queensland, **5.** McGuigan Simeon, **6.** Constellation Wines Australia,

Staff	Title of talk	Presented to and where	Date
P.A. Smith	Grape and wine tannin – are there relationships between tannin concentration and variety, quality, and consumer preference?	13th Australian Wine Industry Technical Conference, main program, Adelaide, SA	1 Aug 2007
D. Cozzolino	Introduction to spectroscopy (W2)	13th Australian Wine Industry Technical Conference, Workshop program, Adelaide, SA	28 Jul–2 Aug 2007
R.G. Dambergs	Detection of fungus infections with spectroscopy (W2)		
D. Cozzolino	Novel and future applications (W2)		
C.S. Stockley	Allergen labelling in Australia, Canada, the EU and USA (W3&46)		
C.S. Stockley	Health warning labelling in Australia and the UK (W3&46)		
R.G. Dambergs	Measuring phenolics by spectroscopy (W8&50)		
H.E. Holt	Cabernet Sauvignon Phenolics – from grape to wine to sensory (W8&50)		
M. Parker	An overview of the phenolic chemistry of white juice and wine production (W8&50)		
M.D. Mercurio	Grape and wine tannin: relationships between tannin concentration and variety, quality and consumer preference (W8&50)		
P.A. Smith	Tannin and other phenolics in grapes and wines (W8&50)		
P.W. Godden	*Brettanomyces* in Pinot Noir (W9&40)		
I.L. Francis	Influence of yeast metabolism on wine sensory properties (W10)		
L.J. Janik	Introduction to Environmental monitoring: rapid analytical methods (W12)		
D. Cozzolino	Presentation of AWRI 7-year Plan – Environmental Process Engineering		
M.J. Kwiatkowski	Route of oxygen permeation into wine bottles (W13)		
G.K. Skouroumounis	A new method of measuring oxygen ingress through a wine bottle closure non intrusively (W13)		
C.S. Stockley	The development of alcohol policy in Australia; Role of government agencies, NGOs and industry; An international comparison of alcohol policies, guidelines and recommendations; The NHMRC Australian Alcohol Guidelines 2001; Where to? (W14)		
I.L. Francis	Introduction to sensory analysis (W17)		
I.L. Francis	Sensory descriptive analysis (W17)		
P. Osidacz	Practical sensory methods: Difference testing (W17)		
B. Travis	Sensory investigation of a taint issue (W17)		
M. Ugliano	DAP supplementation of must and composition of red wine – A preliminary study (W19)		
S-J. Bell	Impact of nitrogen on grape and wine quality; What is YAN? (W19)		
C.A. Varela	Effect of YAN on fermentation – White wine composition and flavour (W19)		
M.G. Holdstock	YAN measurement made easy (W19)		
C.D. Curtin	How is 'Brett´ perceived in 2007? (W20&30)		
M.G. Holdstock	Tasting of commercial wines (W20&30)		
C.D. Curtin	*Brettanomyces* yeasts are well adapted to wine (W20&30)		

Appendix 1 – External presentations and talks

Staff	Title of talk	Presented to and where	Date
W.U. Cynkar	Rapid instrumental classification of wines (W20&30)	13th Australian Wine Industry Technical Conference, Workshop program, Adelaide, SA	28 Jul–2 Aug 2007
G.D. Cowey	Threshold tasting and results of AWRI threshold and descriptive studies – perception of 'Brett' in different wine styles (W20)		
C.D. Curtin	'Brett' and Australian consumer preferences (W20)		
P.W. Godden	Managing 'Brett' in the winery – discussion of key points applicable to winery implementation (W20&30)		
J.R. Bellon	Hybrid technology: the future for non-conventional yeasts? (W21&29)		
P.A. Henschke	The nature and use of non-conventional yeasts (W21&29)		
P.J. Chambers, P.A. Henschke	The problems of high ethanol in wines: the AWRI perspective (W28)		
I.L. Francis	Results of AWRI threshold and descriptive studies – perception of 'Brett' in different wine styles (W30)		
I.L. Francis	Current trends in Australian wine consumer preference (W30)		
S-J. Bell	Does nutrition have an impact on wine quality (W34)		
D. Cozzolino	Introduction to multivariate analysis; Data interpretation and analysis. Principal component analysis; Calibration and Validation. Partial least squares and modeling (W42)		
R.G. Dambergs	Vineyards, grape composition and wine quality (W43)		
D. Cozzolino	Calibration and validation (W44)		
R.G. Dambergs	Calibration – near infrared (examples) (W44)		
L.J. Janik	Calibration – mid infrared (examples) (W44)		
D. Cozzolino	Sample selection and validation (44)		
P.J. Costello	Natural and inoculated MLF – What do we know about the differences? (W47)		
P.J. Chambers, P.A. Henschke	The problems of high ethanol in wines: the AWRI perspective (W49)		
C.A. Simos	A current overview of contamination and taints in winemaking (W51)		
A.D. Coulter	Taints and their occurrence in wines; A tasting of wines with simulated taints; Instabilities from wine additives (W51)		
G.D. Cowey	Using the AWRI website; Quality management systems (W51)		
C.A. Simos, A.D. Coulter	A tasting of real wines with 'real' additives (W51)		
M.G. Holdstock	Practical exercise – identification of taints in winemaking additives (W51)		
C.S. Stockley	Better wine for better health?	University of the Third Age, Stirling, SA	4 Aug 2007
M. Parker	Unlocking the mystery of peppery Shiraz wine	Fresh Science at the Pub, Melbourne, Vic	13 Aug 2007
		Fresh Science for school kids, Melbourne Museum, Melbourne Vic	14 Aug 2007
		Fresh Science cocktail reception, Melbourne Museum, Melbourne, Vic	14 Aug 2007
		Fresh Science for school kids, Bendigo High School, Bendigo, Vic	15 Aug 2007
S.A. Schmidt	Careers at the AWRI	AusBiotech Careers night, Adelaide, SA	29 Aug 2007

Staff	Title of talk	Presented to and where	Date
A.D. Coulter	AWBC Simulated tainted/faulty wine tasting	AWBC export tasters, University of Adelaide Sensory Laboratory, Adelaide, SA	20 Sept 2007
C.S. Stockley	How has the Fillmore et al. (2006) paper impacted on alcohol and health policy?	Third International Congress on Wine and Health in Bordeaux, France	20 Sept 2007
B. Travis	Descriptive terminology	The AWRI Advanced Wine Assessment Course, Urrbrae, SA	25 Sept 2007
A.D. Coulter	AWAC Simulated tainted/faulty wine tasting		
E.J. Bartowsky	AWRI, Research and the Wine Biosciences Team	Chr Hansen Wine Microbiology R&D Team, Copenhagen, Denmark	1 Oct 2007
S. van Sluyter[1]	*Botrytis* interactions with grape proteins	Laboratory of Phytopathology, Wageningen University, The Netherlands	5 Oct 2007
C.S. Stockley	Clinical pharmacological perspective of intoxication and drunkenness	Drinkwise Australia/International Centre for Alcohol Policies Workshop on Intoxication and Drunkenness in Paris, France	14 Oct 2007
S. van Sluyter[1]	*Botrytis* interactions with grape pathogenesis-related proteins	University of Padova, Italy	15 Oct 2007
J.H. Swiegers	Enhancing Sauvignon Blanc varietal aroma	University of Auckland, New Zealand	15 Oct 2007
C.A. Simos	Practical QC and bottling aspects	AWRI Roadshow, Five Sons Estate, Mornington Peninsula, Vic	16 Oct 2007
S-J. Bell	Agrochemical issues for grape growers and winemakers		
P.A. Henschke	Winemaking potential with non-*Saccharomyces* yeasts		
H.E. Holt	Grape maturity and tannins: the impact of viticultural treatments on grape and wine tannins		
S-J. Bell	Manipulation of phenolic profiles in red grapes and wine by viticultural management		
P.A. Henschke	Winemaking with the alternative yeast, *Saccharomyces bayanus*: modification of wine composition, flavour and colour		
E.J. Waters	The link between bentonite requirements and vineyard and winemaking practices		
P.A. Smith	Grape and wine tannins, red wine colour and mouth-feel – an overview on current research, emerging applications and future challenges		
P.A. Henschke, J.M. Eglinton, I.L. Francis	Understanding and avoiding sub-optimal fermentation (stuck and off-flavours)		
S-J. Bell	Effects of powdery mildew on the sensory properties and composition of Chardonnay juice and wine		
E.J. Waters	Wine development in bottle – impact of closures, storage conditions and ascorbic acid addition		
P.W. Godden	Results from the AWRI *Brettanomyces* research project: survey data on the incidence of *Brettanomyces* spoilage in Australian wine, and the genetic diversity and morphological differences between *Dekkera/Brettanomyces* strains isolated from Australian wineries; and review of winery applicable detection methods		
H.E. Holt	Grape maturity and tannins: the impact of viticultural treatments on grape and wine tannins	AWRI Roadshow, Swinburne University of Technology, Yarra Valley, Vic	17 Oct 2007
S-J. Bell	Manipulation of phenolic profiles in red grapes and wine by viticultural management		
P.A. Smith	Grape and wine tannins, red wine colour and mouth-feel – an overview on current research, emerging applications and future challenges		
P.A. Henschke, P.W. Godden	Winemaking with the alternative yeast, *Saccharomyces bayanus*: modification of wine composition, flavour and colour		

Affiliations: 1. AWRI and University of Melbourne

Appendix 1 – External presentations and talks

Staff	Title of talk	Presented to and where	Date
D. Cozzolino	Instrumental methods for assessment of wine quality and sensory characteristics	AWRI Roadshow, Swinburne University of Technology, Yarra Valley, Vic	17 Oct 2007
P.A. Henschke, P.W. Godden	Understanding and avoiding sub-optimal fermentation (stuck and off-flavours)		
P.A. Smith	Development and application of a simple and robust assay for quantification of tannins in grape and wine samples		
E.J. Waters	Wine development in bottle – impact of closures, storage conditions and ascorbic acid addition		
P.A. Henschke, E.J. Bartowsky, S. Dillon[7], J.M. Eglinton, K. Lattey[8], T.E. Siebert, I.L. Francis, P.B. Høj[9], M.J. Herderich	Potential for fermentation yeast and bacteria to modify red wine colour and flavour – results from recent laboratory and pilot scale experiments		
D. Cozzolino	Monitoring red wine fermentation using spectroscopic methods		
E.J. Waters	Protein haze in white wines: new solutions to old problems		
P.W. Godden	Results from the AWRI *Brettanomyces* research project: survey data on the incidence of *Brettanomyces* spoilage in Australian wine, and the genetic diversity and morphological differences between *Dekkera/Brettanomyces* strains isolated from Australian wineries; and review of winery applicable detection methods		
J.H. Swiegers	Enhancing Sauvignon Blanc varietal aroma	Montana, Marlborough, New Zealand	17 Oct 2007
M.J. Herderich	Application of quality measures in winery processing	ASVO, Processing/Supply Chain Efficiency Seminar, Tanunda, SA	17 Oct 2007
P.A. Smith	Grape and wine tannins: an overview on current research, emerging applications and future challenges	Orlando Wines, Rowland Flat, SA.	18 Oct 2007
S. van Sluyter[1]	*Botrytis* protease interactions with grape berry proteins	XIVth International *Botrytis* Symposium, Cape Town, South Africa	23 Oct 2007
I.S. Pretorius	The 2006/2007 AWRI Annual Report	New South Wales Wine Industry Association, Sydney, NSW	24 Oct 2007
M. Parker	An overview of the phenolic chemistry of white juice and wine production	Foster's internal technical conference, Saltrams, Angaston, SA	8 Nov 2007
P.A. Smith	Grape and wine tannins: an overview on current research, emerging applications and future challenges	Yalumba, Nuriootpa, SA	14 Nov 2007
I.S. Pretorius	The 2006/2007 AWRI Annual Report	Wine Industry Tasmania Field Day, Hobart, Tas	16 Nov 2007
M. Essling	Agrochemicals – selling quality wine and winemaking implications of smoke and bushfire taints and possible management options		
I.L. Francis	Descriptive terminology	The AWRI Advanced Wine Assessment Course, Urrbrae, SA	20 Nov 2007
A.D. Coulter	Simulated tainted/faulty wine tasting		20 Nov 2007
R. Gawel	Tasting sweet white wine		21 Nov 2007
I.S. Pretorius	The 2006/2007 AWRI Annual Report	Victorian Wine Industry Association, Melbourne, Vic	22 Nov 2007
A.P. Pollnitz	Application of GCMS (and related techniques) to wine science	RACI Analytical & Environmental Chemistry symposium 'Don't sweat the small stuff' Mass spectrometry for small molecule applications, Qld Health Scientific Services, Brisbane	22 Nov 2007
R. Gawel	Measuring wine judge consistency	AWRI Advanced Wine Assessment Course, Urrbrae, SA	23 Nov 2007
A.D. Coulter	Simulated tainted/faulty wine tasting and seminar	Orlando Wines winemakers – pre-vintage Conference, Novotel Barossa Valley Resort	29 Nov 2007
M. Nygaard	AWRI methods for evaluating: flavour scalping and taints, oxygen ingress in bottles	'Performance BiB' conference and general meeting, Nimes, France	26 Nov 2007

Affiliations: **1.** AWRI and University of Melbourne, **7.** Currently The Yalumba Wine Company, **8.** Currently Orlando Wines, **9.** Currently University of South Australia,

Staff	Title of talk	Presented to and where	Date
C.A. Simos	Practical QC and bottling aspects	AWRI Roadshow, Swan Valley, WA	4 Dec 2007
S-J. Bell	Impact of nitrogen on grape and wine quality		
E.J. Bartowsky, J.R. Bellon	New hybrid wine yeast that impart diverse flavours and aromas		
E.J. Waters	The link between bentonite requirements and vineyard and winemaking practices		
A.P. Pollnitz	The ability of various wine bottle closures and fining agents to remove flavour and aroma compounds from wine		
C.D. Curtin	Results from the AWRI *Brettanomyces* research project: survey data on the incidence of *Brettanomyces* spoilage in Australian wine, and the genetic diversity and morphological differences between *Dekkera/Brettanomyces* strains isolated from Australian wineries; and review of winery applicable detection methods		
S-J. Bell	Does grapevine nutrition have an impact on wine quality?		
E.J. Waters	White wine ageing: the role of ascorbic acid, and bottle storage conditions		
E.J. Bartowsky, P.J. Costello, P.A. Henschke	Strategies for successful induction of malolactic fermentation		
C.D. Curtin	Strategies from the control of *Dekkera/ Brettanomyces* during winemaking		
C.A. Simos, P.A. Henschke, P.W. Godden	Understanding and avoiding sub-optimal fermentation		
C.A. Simos	Practical QC and bottling aspects	AWRI Roadshow, Great Southern, Mount Barker Bowling Club, Mount Barker, WA	6 Dec 2007
S-J. Bell	Impact of nitrogen on grape and wine quality		
E.J. Waters	Protein haze in white wines: new solutions to an old problem		
E.J. Bartowsky, J.R. Bellon	New hybrid wine yeast that impart diverse flavours and aromas		
A.P. Pollnitz	Phew! What is that stench? Analysis of low molecular weight sulfur compounds in wine		
E.J. Waters	The link between bentonite requirements and vineyard and winemaking practices		
E.J. Bartowsky	MLF inoculation regimes: co-inoculation or Sequential – Potential aroma and flavour consequences		
A.P. Pollnitz	The ability of various wine bottle closures and fining agents to remove flavour and aroma compounds from wine		
E.J. Waters	White wine ageing: the role of ascorbic acid, and bottle storage conditions		
C.D. Curtin	Strategies from the control of *Dekkera/ Brettanomyces* during winemaking		
C.A. Simos, P.A. Henschke, P.W. Godden	Understanding and avoiding sub-optimal fermentation		
C.A. Simos	Practical QC and bottling aspects	AWRI Roadshow, Pemberton Sports Club, Pemberton, WA	16 Jan 2008
R.G. Dambergs	Does grapevine nutrition have an impact on wine quality?		
J.R. Bellon, P.A. Henschke, J.M. Eglinton, I.L Francis	Winemaking with the alternative yeast, *Saccharomyces bayanus*: modification of wine composition, flavour and colour		
S.J. Bell, R.G. Dambergs	Impact of nitrogen on grape and wine quality		
A.P. Pollnitz	Pepper aroma in Shiraz		

Appendix 1 – External presentations and talks

Staff	Title of talk	Presented to and where	Date
C.D. Curtin	Results from the AWRI *Brettanomyces* research project: survey data on the incidence of *Brettanomyces* spoilage in Australian wine, and the genetic diversity and morphological differences between *Dekkera/Brettanomyces* strains isolated from Australian wineries; and review of winery applicable detection methods	AWRI Roadshow, Pemberton Sports Club, Pemberton, WA	16 Jan 2008
P.J. Costello	MLF inoculation regimes – affect on sensory and chemical composition		
J.R. Bellon	Natural fermentation: Potential of alternative inoculation strategies?		
A.P. Pollnitz	Phew! What is that stench? Low molecular weight sulphur compounds in wine		
C.D. Curtin	Strategies for the control of *Dekkera/ Brettanomyces* during winemaking		
C.A. Simos	Winemaking the implications for the management of smoke and bush fire taints		
S.J. Bell , R.G. Dambergs	Does grapevine nutrition have an impact on wine quality?	AWRI Roadshow, Muresk Institute, Curtin University, Margaret River, WA	17 Jan 2008
P.J. Costello, E.J. Bartowsky, P.A. Henschke	Flavour aspects of MLF – control of the 'butter' diacetyl character in wine		
A.P. Pollnitz	Pepper aroma in Shiraz		
R.G. Dambergs	Grape and wine quality – what to measure and how to do it		
J.R. Bellon, P.A. Henschke	Natural fermentation: potential of alternative inoculation strategies		
P.J. Costello	MLF inoculation regimes – affect on sensory and chemical composition		
A.P. Pollnitz	The influence of heating processes on oak composition		
R.G. Dambergs	50 Vintages of Wynn's Coonawarra Cabernet – a study of anthocyanin and tannin maturation		
J.R. Bellon, P.A. Henschke, J.M. Eglinton, I.L. Francis	Winemaking with the alternative yeast *Saccharomyces bayanus*: modification of wine composition, flavour and colour		
C.D. Curtin	Strategies for the control of *Dekkera/ Brettanomyces* during winemaking		
C.A. Simos	Winemaking implications for the management of smoke and bush fire taints		
I.S. Pretorius	AWRI Annual Report	Western Australian Wine Industry Association, Perth, WA	18 Jan 2008
E.J. Waters	Wine and oxygen research at the AWRI	Nomacorc Closure Council, UC Davis, Davis, California, USA	28 Jan 2008
A.D. Coulter	The closure issues	Unified Grape and Wine Symposium, Sacramento, California, USA	30 Jan 2008
Y. Hayasaka	A knowledge-based and innovative wine industry; How can the AWRI close the gap between the science and its application?; The application of electrospray mass spectrometry to investigations of grape and wine constituents	National Food Research Institute, Japan	4 Feb 2008
Y. Hayasaka	The application of electrospray mass spectrometry to investigations of grape and wine constituents	The Institute of Enology and Viticulture, Yamanashi University, Japan	5 Feb 2008
I.S. Pretorius	Global growth through collaborative innovation	Annual Oregon Wine Industry Symposium, Eugene, Oregon, USA	11 Feb 2008
C.A. Simos	Winemaking implications for the management of smoke and bush fire taints	King Valley Vignerons Inc., Oxley, Vic	11 Feb 2008

Staff	Title of talk	Presented to and where	Date
Y. Hayasaka	A knowledge-based and innovative wine industry;	Institute for Advanced Biosciences, Japan	13 Feb 2008
	How can the AWRI close the gap between the science and its application?;	Riken, Japan	15 Feb 2008
	The application of electrospray mass spectrometry to investigations of grape and wine constituents'		
M.J. Herderich	Highlights from AWRI's R&D program	Italian winemakers from Puglia, Italy, Waite Campus, Urrbrae, SA	15 Feb 2008
P.A. Henschke	Fermentation strategies for optimising wine aroma and flavour: harnessing yeast to modulate red wine style	Putting the Richness into Rich Ripe Reds, Bendigo Winegrowers Association seminar, Bendigo Regional Institute of TAFE, Bendigo, Vic	21 Feb 2008
G.D. Cowey	Rich, ripe reds – winemaking for desired wine styles		
I.S. Pretorius	AWRI Annual Report	South Australian Wine Industry Association, Adelaide, SA	22 Feb 2008
K.L. Wilkinson[2], A.P. Pollnitz	Smoke taint in grapes and wine	South Australian Wine Industry Council, Parliament House, Adelaide, SA	3 Mar 2008
C.S. Stockley	The draft revised Australian Alcohol Guidelines – for low risk drinking (October 2007)	OIV Consumption, health and nutrition Expert Group meeting, Paris, France	5 Mar 2008
C.S. Stockley	Notification of Application A576—Labelling of alcoholic beverages with a pregnancy health advisory label	OIV Consumption, health and nutrition Expert Group meeting, Paris, France	5 Mar 2008
I.S. Pretorius	Microbial modulation of wine aroma and flavour	Wine Active Compounds Symposium, Burgundy, France	28 Mar 2008
M.D. Mercurio	Tannin concentration: insights into varietal, regional and quality differences	Wine Active Compounds conference, Burgundy, France	27–29 Mar 2008
I.S. Pretorius	Growing markets and delivering benefit to wine producers and consumers through research and cooperative innovation – a perspective and examples from Australia	Geisenheim Research Institute, Germany	31 Mar 2008
E.J. Bartowsky	What are all those yeast and bacteria doing in my wine glass?	'What's for Dinner' SA Branch of Australian Society for Microbiology Food Microbiology Meeting; Hackney Hotel, Adelaide, SA	8 Apr 2008
D. Cozzolino	Authentication and traceability in the wine industry: the role of near infrared spectroscopy	13th Australian NIR conference, Hamilton, Vic	8–11 Apr 2008
R.G. Dambergs, W.U. Cynkar, D. Cozzolino	Detection of grape fungal disease with NIR spectroscopy		
I.L. Francis	Perception of 'Brett' in different wine styles	AWRI/Hunter Valley Vineyard Association *Brettanomyces* Workshop: *Brettanomyces* – perception, detection and control, Hunter Valley Gardens, Hunter Valley, NSW	9 Apr 2008
	'Brett' and Australian consumer preferences		
	Tasting of spiked wines		
	Tasting of wines from the Hunter Valley and other Australian regions		
P.A. Henschke, P.W. Godden, C.A. Simos, A.D. Coulter, M.G. Holdstock, G.D. Cowey	Understanding and avoiding sub-optimal fermentation		
E.J. Bartowsky P.J. Costello, P.A. Henschke	Strategies for successful induction of malolactic fermentation		
C.D. Curtin	'Brett' in the Hunter Valley		
C.D. Curtin, P.A. Henschke, P.W. Godden	Detection of *Dekkera/Brettanomyces* yeasts in wine & monitoring for spoilage		
C.D. Curtin, P.W. Godden A.D. Coulter, G.D. Cowey, E.M.C. Robinson, P.A. Henschke	Strategies for the control of *Dekkera/ Brettanomyces* yeasts during winemaking		
I.L. Francis	Sensory evaluation research at the AWRI	National Grape and Wine Centre, Charles Sturt University, Wagga Wagga, NSW	10 Apr 2008
E.J. Bartowsky, P.J. Costello, J.M. McCarthy, S. Krieger-Weber[10]	Wine aroma and flavour development by *Oenococcus oeni* during malolactic fermentation	15th International Enology Symposium, April 14 – 16 2008, Trier (Germany)	15 Apr 2008

Affiliations: **2.** Currently University of Adelaide, **10.** Lallemand, Germany

Appendix 1 – External presentations and talks

Staff	Title of talk	Presented to and where	Date
A.G. Cordente, A. Heinrich[11], I.S. Pretorius, J.H. Swiegers	Development of commercial yeast strains that produce no detectable hydrogen sulfide	15th International Enology Symposium, April 14 – 16 2008, Trier (Germany)	15 Apr 2008
I.S. Pretorius	Wine yeasts: improvements we can all benefit from	Australian Genome Research Facility 10th Anniversary Symposium, Melbourne, Vic	16 Apr 2008
E.J. Bartowsky, P.J. Costello, J.M. McCarthy, S. Krieger-Weber[10]	Wine aroma and flavour development by *Oenococcus oeni* during malolactic fermentation	Weinsberg, Germany	17 April 2008
P.J. Chambers	Genetically modified yeast in winemaking	VI Foro Mundial Del Vino Conference, Logroño, La Rioja, Spain	23–25 Apr 2008
D.L. Johnson	Regionality of Australian wine	BioInnovation SA Networking Forum, Waite Campus, Urrbrae, SA	1 May 2008
T.E. Siebert	An aromatic marker in Syrah	International Syrah Symposium, Lyon, France	13–14 May 2008
P.A. Henschke	Natural fermentations: potential of alternative inoculation strategies	AWRI Roadshow Seminar, Mildura Murray Darling Region, Sunraysia Institute of TAFE, Mildura, Vic	15 May 2008
M.A. Sefton	The ability of various wine bottle closures and fining agents to remove flavour and aroma compounds from wine		
P.A. Henschke, P.J. Costello	Causes and control of mousy off-flavour in wine		
S.J. Bell, R.G. Dambergs	Does grapevine nutrition have an impact on wine quality?		
I.L. Francis	Effects of powdery mildew on the sensory properties and composition of Chardonnay juice and wine		
E.J. Waters	Protein haze in white wines: new solutions to an old problem		
P.A. Smith	Grape and wine quality – what to measure and how to do it		
E.J. Waters	Wine development in bottle – impact of closures, storage conditions and ascorbic acid addition		
I.L. Francis	Consumer preferences for Australian Riesling and unwooded Chardonnay wines		
R.G. Dambergs	Using vineyard profiling to predict red grape quality		
C.A. Simos, P.A. Henschke, P.W. Godden	Understanding and avoiding sub-optimal fermentation (stuck and off-flavours)		
C.A. Simos	Practical QC and bottling aspects	AWRI Roadshow Seminar, Riverland Region, Riverland Wine Industry Association, Renmark, SA	16 May 2008
R.G. Dambergs	Impact of nitrogen on grape and wine quality		
S.J. Bell, M. Essling	Agrochemical issues for grape growers and winemakers		
R.G. Dambergs	Manipulation of phenolics profiles in red grapes and wine by viticultural management		
P.A. Smith	An industry survey of grape colour, tannin, TSS (Brix) and crop yield – with some implications for winemaking		
I.L. Francis	Consumer preferences for Australian Shiraz and Cabernet Sauvignon wines		
R.G. Dambergs	Using vineyard profiling to predict red grape quality		
M. Essling	Salty wine		
P.A. Smith	Grape and wine quality – what to measure and how to do it		
E.J. Waters	Wine development in bottle – impact of closures, storage conditions and ascorbic acid addition		
R.G. Dambergs	Does grapevine nutrition have an impact on wine quality?		
S-J. Bell	Nitrogen and the secondary metabolites of Shiraz grapes and wine	6th International Symposium on Mineral Nutrition of Fruit Crops, University of Algarve, Faro, Portugal	19–23 May 2008

Affiliations: **10.** Lallemand, Germany, **11.** AB Mauri Australia

Staff	Title of talk	Presented to and where	Date
R. Gawel	The effect of alcohol and glycerol on the perceived body of Riesling wines	Benziger winemakers, Sonoma, California, USA	29 May 2008
I.S. Pretorius	Supporting quality, differentiation and sustainability – the Australian model	Korean delegation from Chungcheongnam –do Provincial Council, AWRI, Adelaide, SA	29 May 2008
D. Cozzolino	Near infrared measurement of grape and wine quality: Are we there yet?	International Workshop on the Use of Non Destructive Portable Instruments for Grape Quality, Pisa, Italy	31 May 2008
I.S. Pretorius	Wine Innovation Cluster	South Australian Wine Industry Council, Parliament House, Adelaide, SA (on behalf of the WIC Leadership Group)	2 Jun 2008
R.G. Dambergs	Spectroscopy and chemometrics – rapid, non-destructive analysis tools to monitor wine oxidation	O_2 inWine Conference, Montpellier, France	3 Jun 2008
E.J. Waters	New method for measuring oxygen		
R. Gawel	Food grade purification of white wine polysaccharides using high speed counter-current chromatography	Macrowine Conference, Montpellier, France	4–6 Jun 2008
R.G. Dambergs	Spectral and HPLC profiling of 50 vintages of Cabernet Sauvignon wines		
H.E. Holt	From grape to wine – the effects of pruning on berry size, berry composition, wine comp and wine sensory properties for Cabernet Sauvignon (*Vitis vinifera* L.).		
I.L. Francis	Descriptive terminology	Advanced Wine Assessment Course, Adelaide, SA	10 Jun 2008
G.D. Cowey	Simulated tainted/faulty wine tasting and seminar		
I.L. Francis	Statistical analysis of taster performance		13 Jun 2008
I.S. Pretorius	The AWRI	SA Chief Scientist, Professor Ian Chessell, Waite Precinct, Urrbrae, SA	16 Jun 2008
L. Craddock	AWRI OenoFoss Validation Report	FOSS Directions 2008, Christchurch, New Zealand	17–18 Jun 2008
R. Muhlack	Engineering Fermentation	'Improving Winery Performance', Winery Engineering Association 2008 Conference, Nuriootpa, SA	18–19 Jun 2008
M.J. Herderich	Application of quality measures in winery processing		
P.A. Smith	Why on Earth would an engineer want to know about tannins?		
B. Travis	Consumer testing – what people really think		
C.S. Stockley	Wine safety		
P.J. Chambers, P.A. Henschke	Getting stuck into sub-optimal fermentations		
M. Ugliano, T.E. Siebert, D.L. Capone, M.D Mercurio, P.A. Henschke	Modulation of Shiraz volatiles, color and aroma aging potential through di-ammonium phosphate addition	American Society of Enology and Viticulture Annual Meeting, Portland, Oregon, USA	17–20 Jun 2008
I.L Francis	Wine profiles – chasing the aromas and flavours preferred by wine consumers	American Society of Enology and Viticulture Annual Meeting, Sensory Science Symposium, Portland, Oregon, USA	20 Jun 2008
C.A. Simos	An overview of the AWRI: Adding value to Australia's grape and wine industries by delivering world-class research and integrated solutions	CHR Hansen, Hørsholm, Denmark	20 Jun 2008

Workshops

Coordinated by	Title of workshop	Held	Date
M.A. Sefton	Grape and wine flavour	13th Australian Wine Industry Technical Conference, Adelaide, SA	28 Jul – 2 Aug 2007
R.G. Dambergs, D. Cozzolino	Applications of spectroscopy: from laboratory to the consumer		
C.S. Stockley	A – Z of labeling for domestic and export marketplace		
P.A. Smith, AWRI Tannin Team	Tannin and other phenolics in grapes and wine		
J.H. Swiegers	The power of yeast in influencing wine flavour and quality		
L.J. Janik	Environmental monitoring: rapid analytical methods		
E.J. Waters, G.K. Skouroumounis	White wine colour: how to measure it and what the data mean		
C.S. Stockley	The pros and cons to health of wine consumption		
I.L. Francis, B.Travis, P.C. Osidacz, B.R. Bramley	Sensory evaluation methods		
S–J. Bell, M. Ugliano	Nitrogen: friend of foe? (nitrogen nutrition and wine quality)		
C.D. Curtin, P.A. Henschke	*Brettanomyces*: perception, detection and control		
J.R. Bellon	Winemaking with non–conventional yeast		
D. Cozzolino	Application of process engineering improvements for wineries		
D. Cozzolino	Multi–variate analysis: applications in the grape and wine industry		
D. Cozzolino, L.J. Janik	How to build a successful spectroscopic calibration		
E.J. Bartowsky	Malolactic fermentation		
A.D. Coulter, C.A. Simos, G.D. Cowey, M.G. Holdstock	The avoidance of taints and chemical instabilities during winemaking		
A.D. Coulter, M.G. Holdstock, C.A. Simos	The avoidance of taints and chemical instabilities during winemaking	Swinburne University of Technology – Lilydale Campus, Yarra Valley, Vic	18 Oct 2007
A.D. Coulter, M.G. Holdstock, L. Craddock, C.A. Simos	The avoidance of taints and chemical instabilities during winemaking	Five Sons Estate, Mornington Peninsula, Vic	19 Oct 2007
C.A. Simos, A.D. Coulter	The avoidance and management of taints during the winemaking supply process	AB Mauri Global Technology Group, North Ryde, Sydney	16 Nov 2007
A.D. Coulter, M.G. Holdstock, G.D. Cowey	The avoidance of taints and chemical instabilities during winemaking	Swan Valley Oasis, Swan Valley, WA	3 Dec 2007
A.D. Coulter, M.G. Holdstock, G.D. Cowey	The avoidance of taints and chemical instabilities during winemaking	Mt Barker Bowling Club, Great Southern, Mount Barker, WA	5 Dec 2007
G.D. Cowey, M.G. Holdstock	Microscopy and winemaking applications	Houghton's Wine Company – Swan Valley, WA	14 Jan 2008
A.D. Coulter, G.D. Cowey, M.G. Holdstock	The avoidance of taints and chemical instabilities during winemaking	Muresk Institute – Curtin University, Margaret River, WA	15 Jan 2008
		Pemberton Sports Club, Pemberton, WA	17 Jan 2008
C.D. Curtin, E.M.C. Robinson, P.A. Henschke, I.L. Francis	AWRI/ Hunter Valley Vineyard Association *Brettanomyces* Workshop, *Brettanomyces* – perception, detection & control	Grand Mecure Hunter Valley Gardens, Hunter Valley, NSW	9 Apr 2008
A.D. Coulter, G.D. Cowey, M.G. Holdstock	Mildura Murray Darling Region: The avoidance of taints and chemical instabilities during winemaking	Sunraysia Institute of TAFE, Mildura, Vic	14 May 2008
	Riverland: The avoidance of taints and chemical instabilities during winemaking	Remark Hotel Function Centre, Renmark, SA	15 May 2008
	Rutherglen: The avoidance of taints and chemical instabilities during winemaking	Tuileries Complex, Rutherglen, Vic	27 May 2008
	Wangaratta: The avoidance of taints and chemical instabilities during winemaking	Murdoch House, Wangaratta, Vic	29 May 2008
AWRI IDS Group, E.M.C. Robinson	Advanced Wine Assessment Course	AWRI, Adelaide, SA	10–13 Jun 2008

Posters

Author(s)	Title of poster	Presented at	Date
D.R. Kutyna[1], C.A. Varela, P.A. Henschke, G. Stanley[1], P.J. Chambers, I.S. Pretorius	Adaptive evolution of wine yeasts for the production of low alcohol wines.	XXIIIrd International Conference on Yeast Genetics and Molecular Biology, Melbourne, Vic	1–6 Jul 2007
J.R. Bellon, M. De Barros Lopes[2], P.J. Chambers	Evidence of genome loss in interspecific hybrids of *Saccharomyces* yeast		
A.R. Borneman, A. Forgan, P.J. Chambers	Creation of a wine yeast whole genome deletion library		
S. Schmidt, U. Nasution[3], E. Leng Tan[4], O. J. Macintyre[4], E. J. Waters, P.A. Anderson[3]	Phthalate and yeast nitrogen base supplementation of basal salt medium increase yield of recombinant Hpf2 in *Pichia pastoris*		
S. Harnal[1], J. Johnson[1], S. Fraser[1], S.A. Schmidt, P.J. Chambers, G. Stanley[1]	Enhancing ethanol tolerance in a wine strain of *Saccharomyces cerevisiae* using adaptive evolution		
T.M. Tran[1], S.A. Schmidt, J.R. Bellon, G.A. Stanley[1], P.J. Chambers	Identifying genes that confer ethanol tolerance in *Saccharomyces cerevisiae*		
O.J. Macintyre[4], P.J. Chambers, B.K. O'Neill[4], I.S. Pretorius, C.B. Colby[4], E.J. Waters	Expression and purification of a yeast mannoprotein from *Saccharomyces cerevisiae*		
S. Callegari[2], A Heinrich[5], H.P. Tan[2], T.M. Tran[1], J.R. Bellon, V. Jiranek[6], S. Andrews[2], M.A. De Barros Lopes[2]	Characterisation of genes involved in ethanol tolerance of *Saccharomyces cerevisiae*		
M. Arévalo–Villena[7], D.L. Capone, M.A. Sefton, E.J. Bartowsky	Potential production of off–flavours derived from indole by wine–associated microorganisms	Australian Society for Microbiology National conference, Adelaide, SA	9–13 Jul 2007
J.M. McCarthy, E.J. Bartowsky	Effect of inoculation regime and length of malolactic fermentation by *Oenococcus oeni* on chemical composition of Chardonnay wine		
T.E. Siebert, A. P. Pollnitz	Determination of ten low molecular weight sulfur compounds in wine	In Vino Analytica Scientia, Melbourne, Vic	22–25 Jul 2007
D.L. Capone, K.A. van Leeuwen, A.D. Coulter, M.A. Daniel[3], G.M. Elsey, K.H. Pardon, M.A. Sefton	Identification and analysis of various new taint compounds using GCMS–ODP and GCMS–SIM		
M.J. Kwiatkowski, G.K. Skouroumounis, D. Cozzolino, K.A. Lattey[8], E.J. Waters	Use of visible and near–infrared spectroscopy to monitor a red wine closure trial		
R.G. Dambergs, A. Kambouris[9], M.J. Kwiatkowski, M. Gishen, M.J. Herderich	Spectroscopy based rapid measurement of phenolic profiles and varietal classification of red grapes		
A. Kambouris[9], P.A. Smith, M.J. Herderich, R.G. Dambergs	A survey of red grape total soluble solids, anthocyanins and tannin in relation to crop yield		
R.G. Dambergs, C. Bevin[10], M. Parker, M.D. Mercurio, W.U. Cynkar, L.J. Janik, M.J. Herderich, D. Cozzolino	White wine varietal classification using UV spectroscopy and HPLC profiles		
L.J. Janik, D. Cozzolino, W.U. Cynkar, R.G. Dambergs, M. Gishen	Preliminary study on the use of mid–infrared spectroscopy – attenuated total reflectance (ATR) to analyse chemical composition in grapes		
W.U. Cynkar, D. Cozzolino, L.J. Janik, R.G. Dambergs, M. Gishen	Effect of temperature on the analysis of wine using a head space mass spectra electronic nose instrument		
M. Parker, D. Cozzolino, W.U. Cynkar, R.G. Dambergs, P.A. Smith, M.D. Mercurio, M. Gishen, M.J. Herderich	Pre–processing of high performance liquid chromatography data for wine fingerprinting		
D. Cozzolino, H.E. Smyth[11], W.U. Cynkar, L.J. Janik, R.G. Dambergs, M.A. Sefton, M.J. Herderich, M. Gishen	Near infrared spectroscopy as a rapid tool to predict volatile aroma compounds in Australian Riesling wine		
V. Bouyer[12], K.L. Wilkinson[6], G.M. Elsey, D.L. Capone, J.M. McCarthy, M.A. Sefton, E.J. Bartowsky	Wine bacterium *Oenococcus oeni* can liberate oak lactone from its glucoside precursor	13th Australian Wine Industry Technical Conference, Adelaide, SA	28 Jul–2 Aug 2007
J.M. McCarthy, E.J. Bartowsky	Effect of inoculation regime and length of malolactic fermentation by *Oenococcus oeni* on chemical composition of Chardonnay wine		

Affiliations: **1.** Victoria University, **2.** University of South Australia, **3.** Flinders University, **4.** School of Chemical Engineering, University of Adelaide, **5.** School of Agriculture, Food and Wine, Univeristy of Adelaide, **6.** AB Mauri Yeast Australia, **7.** Univeristy Castilla La–Mancha, Spain, **8.** Currently Orlando Wines, **9.** McGuigan Simeon, **10.** Constellation Wines Australia, **11.** Department of Primary Industries and Fisheries, Emerging Technologies – Delivery, Queensland, **12.** Université de Technologie Compiègne, France

Posters

Author(s)	Title of poster	Presented at	Date
I. Blazquez Rojas[7], P.A. Smith, M.D. Mercurio, J.M. McCarthy, E.J. Bartowsky, M.J. Herderich	Influence of *Saccharomyces* species and hydrid yeasts on colour and phenolic composition in Cabernet Sauvignon wine	13th Australian Wine Industry Technical Conference, Adelaide, SA	28 Jul–2 Aug 2007
M. Arévalo–Villena[7], D.L. Capone, M.A. Sefton, E.J. Bartowsky	Potential production of off–flavours derived from indole by wine–associated microorganisms		
M. Ugliano, T.E. Siebert, D.L Capone, M.D. Mercurio, P.A. Henschke	Colour, aroma and flavour compounds in Shiraz wine as affected by DAP addition before fermentation		
M. Ugliano, F. Carrau[13], L. Moio[14], P.A. Henschke	Pathways of formation of monoterpene alcohols during alcoholic fermentation		
C.D. Curtin, P.W. Godden P.A. Henschke, T. McMeekin[15], T. Ross[15], M. Tamplin[15]	Towards the application of predictive microbiology in understanding and controlling wine spoilage by *Dekkera/Brettanomyces* yeasts		
C.D. Curtin, J.R. Bellon, E.L. Kennedy, M.A. de Barros Lopes[2], P.W. Godden, P.A. Henschke	Sulfite tolerance amongst genetically diverse *Dekkera bruxellensis* yeast strains isolated from Australian red wine		
B.R. Bramley, C.D. Curtin, G.D Cowey, M.G. Holdstock, I.L. Francis, A.D. Coulter, E.L. Kennedy, B. Travis, P.W. Godden	'Brett' flavour compounds in red wines		
C.D. Curtin, B.R. Bramley, G.D Cowey, M.G. Holdstock, I.L. Francis, A.D. Coulter, E.L. Kennedy, B. Travis, P.W. Godden	'Brett' is more than 'Bandaid' aroma – a sensory study of volatile phenol ratios, and what this means for Cabernet Sauvignon wines made in different regions of Australia		
C.D. Curtin, R.G. Dambergs, B.R. Bramley, G.D Cowey, M.G. Holdstock, A.D. Coulter, E.L. Kennedy, B. Travis, I.L. Francis, P.W. Godden	Perception of 'Brett' in Australian and New Zealand Pinot Noir wines		
A. Molina[16], R.L. Willmott, C.A. Varela, J.H. Swiegers, I.S. Pretorius, E. Agosin[16]	Volatile compounds production by industrial wine yeast strains		
C.A. Varela, T.E. Siebert, D. Cozzolino, L. Rose[17], H. McLean[8], P.A. Henschke	Discovering a chemical basis for the 'natural ferment' character		
C.A. Varela, D.R. Kutyna[1], P.A. Henschke, G.A. Stanley[1], P.J. Chambers, I.S. Pretorius	Generating wine yeasts for the production of low alcohol wines		
A.R. Borneman, A. Forgan, P.J. Chambers	Creation of a wine yeast whole genome deletion library		
R.L. Willmott, J.H. Swiegers, I.S. Pretorius	Searching for *Saccharomyces cerevisiae* genes encoding flavour producing enzymes during wine fermentation		
A.G. Cordente, J.H. Swiegers, I.S. Pretorius	Modulating flavour production by *Saccharomyces cerevisiae* during wine fermentation by manipulating carnitinte acetyltransferases		
E.S.A. King[6], J.H. Swiegers, I.L. Francis, B. Travis, I.S. Pretorius	Enhancing Sauvignon Blanc wine aroma through co–inoculated fermentations		
S.A. Schmidt, C.A. Varela, P.J Chambers	Non–GM approaches to wine yeast development: Adaptive evolution and finding the needle in the haystack		
P.J. Costello, E.J. Bartowsky, S. Krieger–Weber[18], A. Markides[19], I.L. Francis B. Travis	Influence of malolactic fermentation on wine mouth–feel and other sensory and chemical properties in Cabernet Sauvignon wine		
R.C. Brown[3], D.L. Capone, M.A. Sefton, G.M. Elsey	γ–Lactones in wine: synthesis, quantification and sensory results		
T.E. Siebert, A. P. Pollnitz	Determination of ten low molecular weight sulfur compounds in wine		
K.A. van Leeuwen, K.H. Pardon, G.M. Elsey, M.A. Sefton, D.L. Capone	Determination of 1,8–cineole 'eucalyptol' in red and white wines		
D.L. Capone, K.A. van Leeuwen, A.D. Coulter, M.A. Daniel[3], G.M. Elsey, K.H. Pardon, M.A. Sefton	Identification and analysis of various new taint compounds using GCMS–ODP and GCMS–SIM		

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Author(s)	Title of poster	Presented at	Date
Y. Hayasaka, G.A. Baldock, D. Boehm, M.J. Kwiatkowski, W.U. Cynkar, T.E. Siebert, C.S. Stockley, S–J. Bell, P.W. Godden	Accidental or unforeseen contamination with 2,4–D: how can it be monitored?	13th Australian Wine Industry Technical Conference, Adelaide, SA	28 Jul–2 Aug 2007
G.K. Skouroumounis, K. Pardon, M. Schwarz[20], E.J. Waters	A new method of measuring oxygen ingress through a wine bottle closure non intrusively		
K. Pocock, G. Alexander[6], Y. Hayasaka, P. Jones, E.J. Waters	Sulfate is a possible essential factor in formation of protein haze in white wine		
P. Majewski[2], C.B. Colby[4], E.J. Waters	Removing protein from white wine with functionalised silica		
O.J. Macintyre[4], P.J. Chambers, C.B. Colby[4], B.K. O'Neill[4], I.S. Pretorius, E.J. Waters	Haze protective factor 2 – a possible alternative to bentonite?		
B.R. Bramley, C.D. Curtin, G.D. Cowey, M.G. Holdstock, A.D. Coulter, E.L. Kennedy, B. Travis, S. Mueller[2], L. Lockshin[2], P.W. Godden, I.L. Francis	Wine style alters the sensory impact of 'Brett' flavour compounds in red wines		
B. Travis, I.L. Francis, B.R. Bramley, C.A. Simos, A.D. Coulter	The relative contribution of individual chlorophenol and bromophenol compounds to 'chemical/plastic' tainted wines		
G.D. Cowey, L.J. Janik, M.G. Holdstock, E.L. Kennedy, A.D. Coulter	Forensic Spectroscopy – applications in winemaking		
A.D. Coulter, G.D. Cowey, E.M.C. Robinson, M.G. Holdstock, P.W. Godden	Variable, post–bottling growth of *Dekkera/Brettanomyces* yeast		
Y. Hayasaka, A.D. Coulter, G.A. Baldock, E.L. Kennedy, M.G. Holdstock, G.D. Cowey, C.A. Simos	A common wine additive contaminated with highly chlorinated compounds: Taint investigations with a liquid chromatograph–tandem mass spectrometer (LC–MS/MS)		
S.M. Boden, L.M. Bevin, I.B.M. Barratt, R.J. Blair	Technical publications from The Australian Wine Research Institute		
	AWRI Online Image Collection		
	Electronic information from The Australian Wine Research Institute		
C.S. Stockley, R.O'Hehir[21], J. Rolland[21]	An investigation of the potential residual allergenic fining proteins in wine and their effect on egg, fish, milk or nut allergic subjects		
Y. Hayasaka, K.L. Wilkinson[6], G.M. Elsey, M. Raunkjær[22], M.A. Sefton	Identification of oak lactone precursors in oak wood		
K.R. Kennison[23], K.L. Wilkinson[6], A.P. Pollnitz, M.R. Gibberd[23]	The timing and duration of grapevine exposure to smoke effects the chemical composition of wine		
D. Jeffery, M.D. Mercurio, M.J. Herderich, P.A. Smith	Development of new methods for HPLC analysis of condensed tannins in red wine		
E. Dennis, D. Jeffery, M.V. Perkins[3], P.A. Smith	Catechin Dimers: A new synthetic method via boronic acids		
H.E. Holt, I.L. Francis, J.B.F. Field[24], M.J. Herderich, P.G. Iland[25]	Do smaller berries make better wine? A case study using Cabernet Sauvignon		
M.D. Mercurio, R.G. Dambergs, M.J. Herderich, P.A. Smith	Grape and wine tannin – a survey of grape and wine tannin concentration using the Methyl Cellulose Precipitable (MCP) Assay		
M.D. Mercurio, R.G. Dambergs, I.L. Francis, M.J. Herderich, P.A. Smith	Grape and wine tannin – are their relationships between tannin concentration and variety, quality and consumer preference?		
M. Parker, D. Cozzolino, R.G. Dambergs, W.U. Cynkar, P.A. Smith	Principal component analysis as a tool for smart HPLC method development for the study of white wine phenolics		
C. Bevin[10], A.J. Fergusson[10], W.B. Perry[10], L.J. Janik, D. Cozzolino	Development of a rapid 'fingerprinting' system for wine authenticity by mid infrared (MIR) spectroscopy		

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Posters

Author(s)	Title of poster	Presented at	Date
D. Cozzolino, G.D. Cowey, K. Lattey[8], P.W. Godden, W.U. Cynkar, R.G. Dambergs, L.J. Janik, M. Gishen	Challenging the near infrared spectra – prediction of sensory panel response	13th Australian Wine Industry Technical Conference, Adelaide, SA	28 Jul–2 Aug 2007
W.U. Cynkar, D. Cozzolino, R.G. Dambergs, L.J. Janik. M. Gishen	Feasiblity study on the use of head space mass spectrometry electronic nose (MS e_nose) to monitor read wine spoilage induced by *Brettanomyces* yeast		
D. Cozzolino, M. Gishen, R.G. Dambergs, W.U. Cynkar, L.J. Janik	Calibration transfer between FOSS NIR Systems and Zeiss Corona instruments for determination of colour in red grapes		
L. Liu[4], D. Cozzolino, W.U. Cynkar, R.G. Dambergs, L.J. Janik, B.K. O'Neill[4], C.B. Colby[4], M. Gishen	Combination of visible–near infrared spectroscopy with chemometrics to classify Riesling wines from different geographical origins		
D. Cozzolino, W.U. Cynkar, R.G. Dambergs, L.J. Janik, M. Gishen	Data mining and multivariate analysis as a tool to interpret chemical composition of red wine grape varieties grown in Australia		
E.J. Bartowsky, I. Blazquez Rojas[7], P.A. Smith, D. Cozzolino, W.U. Cynkar, L.J. Janik, R.G. Dambergs, M. Gishen	The use of visible and near infrared spectroscopy combined with chemometrics to analyse spectral patterns related to different *Sacchromyces* species and strains in red wine		
D. Cozzolino, H.E. Smyth[11], K. Lattey[8], W.U. Cynkar, L.J. Janik, R.G. Dambergs, I.L. Francis, M. Gishen	Use of direct headspace–mass spectrometry electronic nose (MS e_nose) coupled with chemometrics as an objective method to predict sensory properties in Australian Riesling wine		
D. Cozzolino, L. Liu[4], W.U. Cynkar, R.G. Dambergs, L.J. Janik, C.B. Colby[4], M. Gishen	Effect of temperature on the visible and near infrared spectra of wine and their consequences on the partial least square calibrations developed to measure chemical composition		
D. Cozzolino, H.E. Smyth[11], W.U. Cynkar, L.J. Janik, R.G. Dambergs, M.A. Sefton, M.J. Herderich, M. Gishen	Preliminary study on the use of near infrared spectroscopy as a rapid tool to predict volatile aroma compounds in Australian Riesling wine		
W.U. Cynkar, D. Cozzolino, R.G. Dambergs, L.J. Janik, M. Gishen	Use of near infrared reflectance spectroscopy to measure chemical composition in white grape samples		
D. Cozzolino, W.U. Cynkar, R.G. Dambergs, L.J. Janik, M. Gishen	Using multivariate analysis to evaluate the effect of temperature and biological variability in the analysis of wines by head space mass spectrometry		
L. Liu[4], D. Cozzolino, W.U. Cynkar, M. Gishen, C.B. Colby[4]	Geographic classification of Spanish and Australian Tempranillo red wines by visible and near infrared spectroscopy combined with multivariate analysis		
W.U. Cynkar, D. Cozzolino, R.G. Dambergs, L.J. Janik, M. Gishen	Predicition of glycosylated compounds (G–G) in white grape juice by visible and near infrared spectroscopy		
W.U. Cynkar, D. Cozzolino, H.E. Smyth[11], R.G. Dambergs, M. Gishen	Usefulness of chemometrics and mass spectrometry based electronic nose to classify Australian white wines by their varietal origin		
W.U. Cynkar, D. Cozzolino, R.G. Dambergs, L.J. Janik, M. Gishen	Preliminary report on the effect of sample storage on total soluble solids, pH, and total phenolics concentration of white grape juice		
R.G. Dambergs, D. Cozzolino, W.U. Cynkar, L.J. Janik, M. Gishen	Monitoring the NIR spectral fingerprint of 4–ethylphenol in red wine using two–dimensional correlation spectroscopy		
R.G. Dambergs, S. Hodder[26], M. Parker, H.E. Holt, P.W. Godden, M.J. Herderich	Spectral profiling of 50 vintages of Coonawarra Cabernet Sauvignon wines		
P. Burne[27], D. Cotsaris[27], A. Pietsch[27], R.G. Dambergs	Prediction of red grape colour using vineyard profiling		
R.G. Dambergs, R. Lardner[28], D. Cozzolino, M. Gishen, N. Mahoney[29], E.S. Scott[6]	Monitoring metabolites of Eutypa lata using UV spectroscopy		

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Author(s)	Title of poster	Presented at	Date
R.G. Dambergs, B. Stummer[6], C. Bevin[10], A. Lim[10], D. Cozzolino, M. Gishen, E.S. Scott[6]	Rapid analysis of powdery mildew in grapes: an industry trial	13th Australian Wine Industry Technical Conference, Adelaide, SA	28 Jul–2 Aug 2007
R.G. Dambergs, A. Kambouris[9], D. Cozzolino, W.U. Cynkar, L.J. Janik, M. Gishen	A comparison of ultraviolet and mid–infrared spectroscopy for varietal classification of red grapes		
R.G. Dambergs, C. Bevin[10], I. Atkinson[30], D. Cozzolino, W.U. Cynkar, L.J. Janik, M. Gishen	The use of commercial construction polymers as Vis–NIR reflectance reference materials		
R. De Bei[6], W. Sullivan[6], W.U. Cynkar, D. Cozzolino, R.G. Dambergs, S.D. Tyerman[6]	NIR spectroscopy to detect water status of grapevines		
L.J. Janik, D. Cozzolino, R.G. Dambergs, W.U. Cynkar	The application of mid–infrared attenuated total reflectance (MIR–ATR) spectroscopy for tannin characterisation		
L.J. Janik, E. Wilkes[31], T. Trethewey[31], R.G. Dambergs, D. Cozzolino, W.U. Cynkar	Prediction of cold stability in red and white wines by PLS regression and mid–infrared spectroscopy		
L.J. Janik, R.G. Dambergs, D. Cozzolino, W.U. Cynkar, M. Gishen	Combined partial least–squares and neural networks regression for improved prediction of grape anthocyanins concentration by vis–NIR spectroscopy		
G.D. Cowey, L.J. Janik, E.L. Kennedy, M.G. Holdstock, A.D. Coulter	Forensic spectroscopy – applications in winemaking		
S. van Sluyter[32], F. Pettolino[32], A. Bacic[32], E.J. Waters	*Botrytis cinerea* effects on grape proteins: potential winemaking applications	234th American Chemical Society National Meeting held in Boston, MA, USA	19–23 Aug 2007
E. Boido[13], L. Fariña[13], D. Cozzolino, F. Carrau[13], R.G. Dambergs, W.U. Cynkar, E. Dellacassa[13]	Prediction of glycosylated aroma compounds in tannat grapes by Near Infrared Spectroscopy	XI Latino American Congress of Viticulture and Oenology, Mendoza, Argentina	26–30 Nov 2007
M. Arévalo–Villena[7], D.L. Capone, M.A. Sefton, E.J. Bartowsky, A. Briones[7]	Production of off–flavours derived from indole by wine associated microorganisms during fermentation process	Wine Active Compounds, International Symposium, Beaune, France	27–29 March 2008
E.S.A. King[6], J.H. Swiegers, I.L. Francis, S. Bastian[6], I.S. Pretorius	Yeast co–inoculation influences wine aroma composition and sensory properties	Wine Active Compounds, International Symposium, Beaune, France	27–29 March 2008
D. Cozzolino, W.U. Cynkar, R.G. Dambergs	Use of visible and near infrared reflectance spectroscopy to predict wine spoilage poster	13th Australian NIR conference, Hamilton, Vic	8–11 Apr 2008
R. De Bei[6], W. Sullivan[6], W.U. Cynkar, D. Cozzolino, R.G. Dambergs, S.D. Tyerman[6]	Use of near infrared reflectance spectroscopy to measure leaf water potential		
W.U. Cynkar, D. Cozzolino, R.G. Dambergs	Prediction of glycosylated compounds (g–g) in white grape juice by visible and near infrared spectroscopy		
M.J. Kwiatkowski, G.K. Skouroumounis, I.L. Francis, B. Travis, P. Kilmartin[33], L. Nicolau[33], M.Herbst[33], P. Patel[33], E.J. Waters	Impact of packaging decisions on the development of Sauvignon Blanc wines	Second International Symposium on Macromolecules and Secondary Metabolites of Grapevine and Wines, Macrowine 2008, Montpellier, France	4–6 June 2008
P. Kneknopoulos[6], Y. Hayasaka, D. Taylor[6], G.K. Skouroumounis	Tentative identification of new grape reaction products isolated from Pinot Noir grape skins		

Affiliations: **6.** AB Mauri Yeast Australia, **7.** Univeristy Castilla La–Mancha, Spain, **9.** McGuigan Simeon, **10.** Constellation Wines Australia, **13.** Universidad del la Republica, Uruguay, **30.** Currently Cooperative Research Centre for Irrigation Futures, **31.** Fosters Group, **32.** University of Melbourne, **33.** Chemistry Department, The University of Auckland, New Zealand

Appendix 2 – Teaching responsibilities of AWRI staff during 2007/2008

Subject	No. of Lectures	AWRI Staff
2007 — Semester 2		
Adelaide University		
3003WT Wine packaging and quality management	1	G.K. Skouroumounis
3045WT/7048WT Advances in oenology	3	P.A. Henschke
	3	E.J. Bartowsky
	2	M.J. Herderich
	1	C.A. Simos
7046WT/3046WT/3046WA Fermentation Technology	1	P.A. Henschke
Flinders University		
BTEC 3630 Medical and Molecular Biology	1	P.J. Chambers
MMED 3921 Industrial and Pharmaceutical Microbiology/BTEC 9670 Bioprocessing and Industrial Biotechnology	2	P.A. Henschke
University of South Australia		
Spectroscopy and sensory analysis	1	D. Cozzolino
2008 — Semester 1		
The University of Adelaide		
3047WT/WA/7047WT Oenology – Winemaking at vintage	2	P.A. Henschke
2001WT/7030WT Wine in society	1	C.S. Stockley
3007WT Stabilisation and clarification	3	E.J. Waters
Oenology	5	P.W. Godden, C.A. Simos, G.D. Cowey
	2	A.D. Coulter
3005WT Grape Industry Practice Policy and communication	Approx. 50 hours	C.S. Stockley
	1	I.S. Pretorius
3002WT Biotechnology and the Food and Wine Industries	1	P.J. Chambers
MBA Course	1	I.S. Pretorius
Flinders University		
Aromaticity and pericyclic reactions (Chemistry Honours program)	Lecture course	G.M. Elsey

Appendix 3 – Graduate and Honours student supervision responsibilities of AWRI staff for 2007/2008

Student	Supervisor/s	Source of funds
PhD		
A. Anderson	D. Cozzolino, C. Bevin[1]	GWRDC
J.R. Bellon	C. Ford[2], P.J. Chambers, A.R. Borneman	AWRI
E. Dennis	P. A. Smith, M.V. Perkins[3]	GWRDC/APA
B. Fedrizzi	D. Jeffery, D.L. Capone, G. Versini[5]	AWRI/Italian Government Scholarship
V. Hazlewood	M. Herderich, S. Bastian[2], C. Ford[2]	University of Adelaide
E.S.A. King	J.H. Swiegers, I.L Francis, I.S. Pretorius, S. Bastian[2]	GWRDC
S. Nordestgaard	E.J. Waters, C.B. Colby[4], B.K. O'Niell[4]	APA/GWRDC
C. Payne	M. Herderich, S. Bastian[2], G. Jones[2]	University of Adelaide
T. Tran	P.J. Chambers, G. Stanley[6], M.A. de Barros Lopes[7]	Victoria University/AWRI
S. van Sluyter	E.J. Waters, F. Pettolino[8], A. Bacic[8]	Australian Government (IPRS), University of Melbourne (MIRS & MATS/AWRI/Australian Society of Plant Scientists)
N. Warnock	S.A. Schmidt, E.J. Waters, P. Anderson[3]	Flinders University/ AWRI
G. Winter	V. Higgins[10], M. Ugliano	University of Western Sydney/AWRI/Laffort Oenology
Hons		
N. Chee Ming	R. Muhlack, B.K. O'Neill[4]	University of Adelaide
T.B. van Heeswijck	R. Muhlack, B.K. O'Neill[4]	University of Adelaide
G. Langhans	P. Grbin[2], C.D. Curtin	University of Adelaide
A. Betteridge	M.A. Barros Lopes[7], C.D. Curtin	University of South Australia
R. Kilday	K. Wilkinson[2], C.D. Curtin	University of Adelaide
Paris Grant-Preece	G.B. Elsey, T. Cordente	Flinders University
Masters		
P. Knekopoulos	G.K. Skouroumounis, Y. Hayasaka, D. Taylor[1]	Private

1. Constellation Wines Australia , **2.** School of Agriculture, Food and Wine, University of Adelaide, **3.** Flinders University, **4.** School of Chemical Engineering, University of Adelaide, **5.** University of Padova, Italy, **6.** Victoria University, **7.** University of South Australia, **8.** School of Botany, University of Melbourne, **9.** School of Chemistry and Physics, University of Adelaide, **10.** University of Western Sydney

Theses completed – Honours/PhD

Student	Hon/PhD	Title of thesis	Supervisors
D.R. Kutyna	PhD	Isolation of low–ethanol producing yeast strains using adaptive evolution	P.J. Chambers, C.A. Varela, P.A. Henschke, G. Stanley[2]
O. J. Macintyre	PhD	Expression and production of the *Saccharomyces cerevisiae* haze protective factor 2 for sensory studies and further investigation into the role of glycosylation	E.J.Waters, I.S.Pretorius, B.O'Neill[1], C.B.Colby[1]
A. Fudge	Hon	Quantification of glucosyl precursors to oak lactones in oakwood	G.M. Elsey, Y. Hayasaka
J. Giaccio	Hon	An investigation into the potential role of ring–opened glycosides as precursors to γ–lactones in grapes and wine	G.M. Elsey
H. Heading	Hon	Development of SIDA protocols for the quantification of aldehydes in wine	G.M. Elsey, D.L. Capone
J. Smith	Hon	Expression and characterisation of a recombinant *Botrytis cinerea* aspartic protease for the reduction of haze formation in white wine	S.A. Schmidt, E.J. Waters, P. Anderson[3]
S. Stranks	Hon	Theoretical and experimental investigation of the aggregation of proteins	E.J. Waters, L. von Smekel[4], J. Carver[4]

1. School of Chemical Engineering, University of Adelaide, **2.** Victoria University, **3.** Flinders University, **4.** School of Chemistry and Physics, University of Adelaide

Appendix 4 – Media interviews

Date	Staff member	Discussed	Media
24 Jul 2007	I.S. Pretorius	Australian biotechnology industry	Vera Sprothen, Freelance Journalist for Wirtschafts Woche (German Business Weekly Magazine)
24 Aug 2007	I.S. Pretorius	Innovation at AWRI	Sally Moore for pilot episode of 'Seeds' by Anvil Media
31 Jul 2007	A.P. Pollnitz	Shiraz pepper compound	ABC Radio National News
			ABC 891 7:45 Report
			ABC TV Midday Show
			ABC 891 Drive Program
			ABC Country Hour
	A.P. Pollnitz, R.E. Day		ABC TV National News, also shown on Channel 7
			ABC TV Lateline
	M. Parker		Jude Townsend, The Australian
			Radio NZ pre–recorded interview
			ABC
1 Aug 2007	A.P. Pollnitz, M. Parker		Sydney Morning Herald
			The Australian
	I.S. Pretorius, A. P. Pollnitz		The Age
2 Aug 2007	A.P. Pollnitz		101.5 FM Radio Adelaide
10 Aug 2007	A.P. Pollnitz, M. Parker		Thirty Fifty Co. (UK)
31 Aug 2007	A.D. Coulter	Proposed pulp mill in the Tamar Valley, Tas	Mark Smith, The Examiner newspaper
3 Sept 2007	A.D. Coulter	Proposed pulp mill in the Tamar Valley, Tas	Matthew Denholm, The Australian newspaper
5 Sept 2007			Sandy Eloise, ABC News Radio, Rolling News (Sydney)
5 Sept 2007	C.S. Stockley	Low alcohol wine	Paula Goodyear, Sydney Morning Herald
6 Sept 2007		Allergies and intolerances to wine	Shay Bayly, GrapeGrowers & Vignerons and The SA Grower, Fairfax Media
12 Sept 2007	E.J. Bartowsky	Matching scientists with sciences teachers	Adelaide Matters
22 Sept 2007	C.S Stockley	Does wine reduce the risk of cardiovascular and other old–age disease?	Diana Macle, La Vigne magazine, France
2 Nov 2007	I.L. Francis	Gender differences in wine tasting	Erika Gelinard, Sydney Morning Herald Good Living
26 Nov 2007	I.S. Pretorius	GMOs	Max Allen
1 Feb 2008	C.S. Stockley	Health warning labels	Bianca Turner, Australian New Zealand Grapegrower and Winemaker
5 Feb 2008		Draft revised NHMRC Australian Alcohol Guidelines	Nadine Williams, The Advertiser
20 Mar 2008			Helen Signy, Sydney Morning Herald
31 Mar 2008		Drinking patterns and health	Helen Signy, Sydney Morning Herald
Apr 2008	B. Travis	Beer tasting	Winestate
7 Apr 2008	C.S. Stockley	Standard drinks	Huon Hook, Sydney Morning Herald
17 Apr 2008	I.S. Pretorius	ML01 GM yeast	Katherine Haywood, Quickfire Media for Channel 4 UK
24 Apr 2008	P.J. Chambers	Genetically modified yeasts in winemaking	Press conference: VI Foro Mundial Del Vino Conference, Logroño, La Rioja, Spain
29 Apr 2008	C.S. Stockley	Draft revised NHMRC Australian Alcohol Guidelines	ABC National
1 May 2008		Allergies and intolerances to wine	Katherine Haywood, Quickfire Media for Channel 4 UK
7 May 2008	I.S. Pretorius	Wine yeast genomics	The Australian (Higher Education pages)
13 May 2008	P.J. Chambers	Low alcohol wine yeast research	Alexandra Parry, ABC Riverland and Mallee
14 May 2008	C.S. Stockley	J–shaped curve	Norman Swan, ABC Catalyst
15 May 2008	A. D. Coulter	Taint issues and the wine industry	ABC Radio, Renmark
15 May 2008	I.L. Francis	Consumer preferences	ABC Radio, Renmark
15 May 2008	P.J. Chambers	Low alcohol wine yeast research	Geoff Hutchinson, Morning Program, ABC, Perth
			Grant Cameron, Drive, 891, ABC, Adelaide

Date	Staff member	Discussed	Media
16 May 2008	P.A. Smith	Measuring quality in grapes and wine	ABC Radio 'Rural Report'
22 May 2008	I.L. Francis	Sherry tasting	Australian and New Zealand Wine Journal
29 May 2008	A.D. Coulter, G.D. Cowey	Taint issues and the wine industry	The Weekly Times (Wangaratta)
Jun 2008	E.J. Bartowsky	Role of MLF and *Oenococcus oeni* in releasing oak compounds (oak lactone)	Grapegrower and Vigneron (published July 2008)
2 Jun 2008	I.L. Francis	Taste preferences	Triple M Radio, Breakfast Show

Appendix 5 – AWRI Staff publications

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Absent: Sarah Ballantine, Ingrid Barratt, Kate Beames, Linda Bevin, Rae Blair, Catherine Borneman, Belinda Bramley, Adrian Coulter, Marcel Essling, Leigh Francis, Markus Herderich, Jelena Jovanovic, Stella Kassara, Jane McCarthy, Vince O'Brien, Patricia Osidacz, Kevin Pardon, Mango Parker, Susie Rock, Irina Rusinova, Claire St. George, Con Simos, Sam Stranks, Daniel Tynan, Steven van Sluyter, Cristian Varela, Teegan Waples