INDIVIDUAL MEMBERSHIP

APPLICATION

Dear Applicant:

Thank you for your interest in becoming a member of the American Society for Enology and Viticulture.

Membership in the Society is available to any person who identifies with the objectives of the Society and may be obtained by completing the membership application and providing the appropriate U.S. dollars. The Society has several categories of membership as defined in the Bylaws.

- Professional
- Associate
- Student

Your membership benefits are based on the calendar year and will include:

- Annual subscription (online only or online and printed copy) to the quarterly American Journal of Enology and Viticulture. This publication is the most widely read Journal in enology and viticulture throughout the English-speaking world
- Reduced registration rates at the Unified Wine & Grape Symposium in January and at the Society's Annual Meeting in June
- Quarterly newsletter and Technical Update
- Reduced registration rates at any other ASEV sponsored seminar
- Reduced rates on all ASEV/AJEV publications
- Membership directory
- No page fees for published Journal articles if member is corresponding author

If your application is received on or after November 1, your membership will be effective for the next calendar year unless you request otherwise on the application. If you opt for membership at this point in the current year, you will be sent an invoice for the upcoming year dues.

If you need additional information on the Society, please visit www.asev.org or contact our office.

Sincerely,

The Board of Directors

Rev. 2/2007

P.O. Box 1855 Davis, CA 95617-1855 USA (530) 753-3142 Fax (530) 753-3318 society@asev.org www.asev.org

AMERICAN SOCIETY FOR ENOLOGY AND VITICULTURE
Since 1950

INDIVIDUAL MEMBERSHIP APPLICATION

PLEASE TYPE OR PRINT CLEARLY. Illegible or incomplete applications will be returned. The Membership Committee is dependent on your complete information in order to activate your membership.

❑ Dr. ❑ Mr. ❑ Miss ❑ Ms. ❑ Mrs.

Name ____
Last First Middle Initial

Occupation: (choose only one)

Academic/Research
- ❑ Education/Research
- ❑ Extension/Outreach
- ❑ Student

Viticulture/Vineyard
- ❑ Grower
- ❑ Vineyard Owner or Manager
- ❑ Vineyard Personnel
- ❑ Viticulturist

Winemaking/Winery
- ❑ Cellar/Bottling Personnel
- ❑ Enologist/Winemaker
- ❑ Laboratory Personnel
- ❑ Tasting Room/Tours
- ❑ Winery Owner and/or General Manager

Other
- ❑ Association Staff
- ❑ Finance/Accounting
- ❑ Marketing
- ❑ Professional Services
- ❑ Purchasing
- ❑ R&D - Industry
- ❑ Supplier/Vendor
- ❑ Retired

Company/Organization Name ____

Address ❑ Home ❑ Business ____

City ______________ State/Province______________ ZIP/Postal Code ______________ Country ______________

Business Phone (   ) ______________ Business Fax (   ) ______________

Home Phone (   ) ______________ Email ______________

Have you ever been an ASEV Member? ❑ Yes ❑ No If known, what year(s)? ______________

APPLICATION INSTRUCTIONS

This application must be submitted prior to registering for any upcoming conference at reduced member rates.

CURRENT ASEV MEMBERS: Current ASEV members wishing to change their membership category should request a MEMBERSHIP REVIEW FORM. Do not complete a new membership application.

STUDENT MEMBERSHIP REQUIREMENTS: If you are currently a **full-time** student enrolled in a degreed program as an undergraduate or graduate student at an accredited institution of higher learning and your major field of study is in enology, viticulture or is closely related to these scientific fields of study, please proceed to SECTION II. All other applicants proceed to SECTION I.

SECTION I • NON-STUDENTS

APPLICATION FOR INDIVIDUAL (NON-STUDENT) MEMBERSHIP

Full-time students please refer to instructions above.

Please read carefully. Incomplete applications **cannot** be considered.

EDUCATIONAL HISTORY - List most recent degrees received first.

No. years in degree program	Type of degree(s) received	Year degree received	Major Field of Study/Emphasis	Academic Institution

Continued

SECTION I - Continued

CURRENT EMPLOYMENT - This is required for membership approval.

Present Employer ______________________________

Since (month/year) ______________________________

Job Title ______________________________

Specific Responsibilities ______________________________

____

Check One: ❑ Full-time Employment ❑ Part-time Employment

PRIOR EMPLOYMENT - List only jobs directly related to grape or wine production or research. Please put "none" in grid below, if this is the case.

Dates From (mo/yr)	Dates To (mo/yr)	Employer	Position & Duties	Part-time or Full-time

SECTION II • STUDENTS

APPLICATION FOR STUDENT MEMBERSHIP ONLY

Please refer to Application Instructions on previous page for Student Membership requirements.

Student membership is extended for two years maximum for Associate Science degree, five years maximum for undergraduate degree, three years maximum for masters degree and four years maximum for doctorate degree. Certificate programs may not qualify.

INSTITUTION YOU ARE CURRENTLY ATTENDING ON A FULL-TIME BASIS:

____

DECLARED MAJOR FIELD OF STUDY (ex. Fermentation Science): ______________________________

OFFICIAL NAME OF DEGREE (ex. Food Science-Enology): ______________________________

If you are not pursuing a degree directly in enology or viticulture, you are required to describe your science degree program as it relates to these fields of study to be eligible for Student Membership. Please use additional sheet if necessary.

____

____

TYPE OF DEGREE PROGRAM YOU ARE ENROLLED IN FULL-TIME: ❑ AS ❑ BS ❑ MS ❑ PhD ❑ Other ______________ Specify

(If your degree is not listed, please mark the one that is most similar.)

Number of years to obtain degree in your current degree program: ____________ Date degree is expected: ______________ Month / Year

ACADEMIC ADVISOR'S VERIFICATION SIGNATURE:

I verify that this student is enrolled **full-time** in a qualified program as stated in the instructions and as indicated in this section. Part-time enrollment does not qualify for student membership, and certificate programs also may not qualify.)

____

Name Title Institution Phone Number

MEMBERSHIP DUES

The current year annual dues rates are on the rate schedule below*. Students are offered a reduced annual dues rate. **ASEV Membership and the corresponding dues are based on a calendar year. All fees must accompany the application for membership. Refunds will not be issued.** Payment is to be made **only in U.S. dollars** and **must** be through a U.S. bank or correspondent within the U.S. Payment may be made by check, money order or by credit card (MC or VISA). Bank checks must have complete numeric coding to avoid collection fees.

Claims for damaged or missing journals must be placed within four months after date of mailing within in the U.S.A. and within six months after date of mailing to outside of the U.S.A.

Membership includes an annual online subscription to the American Journal of Enology and Viticulture (AJEV). A print copy can be added for a nominal fee and will be sent by surface mail. **There is an additional air mail option for the Journal delivery.** The air mail rates are listed below.

2007 Membership Dues (U.S. $):	AJEV Online Only	AJEV Print & Online
U.S.	$170	$210
Int'l	$175	$225
Student (U.S.)	$35	N/A
Student (Int'l)	$40	N/A

Air Mail - Optional (U.S. $):	
Canada & Mexico	$25
Western Hemisphere & Europe	$40
Asia, Africa & Pacific Rim	$55

***Dues will be applied to the next calendar year for applications received on or after November 1 unless otherwise noted. Please check here ❑ if you wish to have your dues applied to the PRESENT calendar year, receive ALL issues of the American Journal of Enology and Viticulture for this year and be billed in November for the upcoming year.**

If you are interested in a company affiliation, please request or download an Industrial Affiliate application.

ASEV PRIVACY POLICY

The following use of contact information is a condition of ASEV membership: All current ASEV members are listed in the Membership Directory each calendar year. The Membership Directory is only provided to current members and Industrial Affiliates and in printed form only. The Membership Directory is not available for sale. ASEV provides the contact information for each member to ASEV contractors such as for registration, newsletters, and other distributions to members for postal and/or electronic mailing as stipulated by ASEV. The Conference Directory of Registrants is offered for sale.

PAYMENT INFORMATION

Payments must be made payable to ASEV. Please mail the completed application and dues payment or credit card information to the following address:

Secretary-Treasurer
American Society for Enology and Viticulture
P.O. Box 1855
Davis, CA 95617-1855 USA
FAX: (530) 753-3318 (ONLY FOR CREDIT CARD PAYMENTS)

INFORMATION REQUIRED FOR PAYMENT BY CREDIT CARD:

ACCEPTED CREDIT CARDS (CHOOSE ONE) ❑ **VISA** ❑ **MASTERCARD**

Credit Card No.________________________ Expiration Date __________

Printed Name on Credit Card ____________________ Amount $ ________USD

Authorized Signature ______________________________

(authorizes the amount above to be charged to credit card)

OFFICE USE ONLY

COMMITTEE/BOARD APPROVAL

Board Meeting Date ________________

❑ SM ❑ AM ❑ PM

Review Date ________________

❑ Data Entry - Initials ____ Date ________

❑ Check# ________ Amount: ________

Paid by: ________________

❑ Credit Card (Information above)

AJEV: Vol(s) ❑ 1 ❑ 2 ❑ 3 ❑ 4

Newsletter(s) ❑ 1 ❑ 2 ❑ 3 ❑ 4

❑ Membership Directory

❑ Registration (if applicable)

ASEV Technical Update

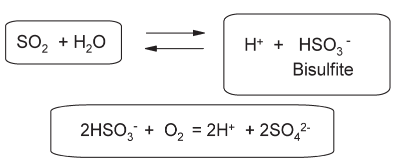
February 2007 Volume 2 Number 1

The Antioxidant Action of Sulfur Dioxide

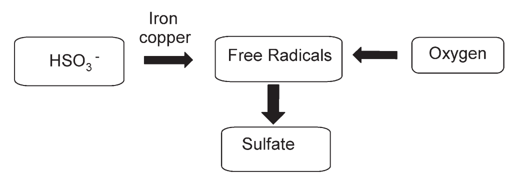
John Danilewicz, Ph.D., Barnsole Vineyard, Canterbury, United Kingdom

Sulfur dioxide (SO_2) has become virtually indispensable in winemaking. It is remarkable that this apparently simple substance can combine three important beneficial properties: antimicrobial and antioxidant activity as well as the ability to add to substances such as acetaldehyde to form nonvolatile derivatives, so preventing their undesirable sensory properties. After long use and extensive study, SO_2 is accepted as having low toxicity. However, more recently it has become apparent that it can induce allergic reactions, primarily in asthmatics. For this reason and the general public's increasing suspicion of any food or drink additive, the trend is to minimize its use in wine. A full understanding of its various mechanisms of action is therefore essential for its appropriate use. The purpose of this article is to examine the manner by which SO_2 exerts its antioxidant action in wine.

The way in which SO_2 reacts with oxygen has been studied thoroughly over the last 100 years because the reaction occurs in flue-gases on burning fossil fuels and also in the atmosphere to produce acid rain. Sulfur dioxide is very soluble in water, with which it reacts reversibly to form bisulfite, the predominant form that exits in wine.

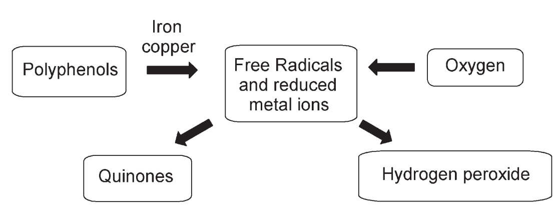


The reaction with oxygen can be simply written as shown above where two bisulfites combine with an oxygen molecule to form two sulfates. The reaction looks very simple, but unfortunately bisulfite is incapable of reacting directly with oxygen and the reaction occurs in a much more complex manner, which has important consequences in wine.



Bisulfite first reacts with iron or copper, which are always present in small amounts in wine, to produce a reactive intermediate substance known as a free radical. This substance is able to react with oxygen to generate even more reactive free radicals, which through a chain of reactions eventually results in the formation of sulfate. However, the reaction is relatively slow and wine contains substances called polyphenols, which can intercept free radicals. This ability to scavenge reactive radicals that could harm us is thought to be the way polyphenols exert their beneficial action on health. Consequently, in wine, polyphenols break the chain reaction and so prevent the reaction of oxygen with bisulfite. Many textbooks tell us that the ability of SO_2 to react with oxygen is the manner by which it protects other wine constituents. This is a simple concept to understand, but unfortunately it is not what actually happens.

The most readily oxidized substances in wine are the polyphenols, which are much more abundant in red than white wines. These substances can interact with oxygen through the catalytic assistance of iron and copper to produce hydrogen peroxide and oxidation products known as quinones.



Hydrogen peroxide itself is relatively unreactive, but in the presence of even traces of metals it is transformed into powerful oxidizing radicals that quickly convert ethanol to acetaldehyde, one of the substances that give wine that characteristic oxidized aroma.

ASEV Technical Update is a publication for ASEV members that provides timely, practical research to the wine and grape industries. The content is peer edited, but not peer reviewed. Please direct your feedback, requests for specific content and mini-reviews, questions for Q&A, and submissions to Judith McKibben, AJEV managing editor (editor@asev.org).

The principal action of SO_2 (often just called sulfite) is to react with the hydrogen peroxide before it can react with ethanol and other wine constituents.

Hydrogen peroxide + HSO_3^- → Sulfate

Sulfur dioxide, therefore, does not protect polyphenols from oxidation but competes with ethanol for the hydrogen peroxide they produce. However, the protection is not complete and some ethanol is always oxidized to acetaldehyde even when high concentrations of sulfite are present. Acetaldehyde binds sulfite strongly, and as a consequence bound sulfite increases to some extent when wine is exposed to air. A further action of sulfite is to interact with the quinones that are formed on polyphenol oxidation. These substances can give yellow pigments that may cause yellowing and browning of wine on oxidation. However, the manner of this interaction with quinones is not understood. One proposal is that sulfite reduces them back to the original polyphenol and so prevents wine yellowing. The action of SO_2 is therefore far more profound than just its simple interaction with oxygen.

Ascorbic acid is sometimes used as an "antioxidant," particularly at bottling. However, it interacts with oxygen in exactly the same way as polyphenols, although rather more quickly. Hydrogen peroxide is formed and the ascorbic acid is oxidized to unstable products that react, possibly with polyphenols, to cause browning. Ascorbic acid can therefore do more harm than good unless SO_2 is also present in adequate concentration: that is, to remove the hydrogen peroxide that is quickly produced and to bind to the ascorbic acid oxidation products in order to prevent them from reacting further.

Red wines benefit from some oxygen exposure to soften them by removing some tannins. These are large polyphenols, which nevertheless are oxidized in the same manner as described above. Oxygen is introduced slowly in barrels or by microoxygenation, but SO_2 levels have to be maintained during the process. White wines, on the other hand, are not thought to benefit from oxygen contact and are even damaged by it. Maintaining adequate SO_2 concentrations to counteract any oxygen exposure during processing and during bottling is therefore most important.

Danilewicz, J.C. 2003. Review of the reaction mechanisms of oxygen and proposed intermediate reduction products in wine: Central role of iron and copper. Am. J. Enol. Vitic. 54:73-85.

Danilewicz, J.C. 2007. Interaction of sulfur dioxide, polyphenols, and oxygen in a wine model system: Central role of iron and copper. Am. J. Enol. Vitic. 58:53-60.

Research Highlight

Reactive oxygen species have a causal role in multiple forms of insulin resistance. *N. Houstis, E.D. Tosen, and E.S. Lander. 2006. Nature 440:944-948.* This landmark paper presents convincing evidence that insulin resistance, which is a metabolic phenomenon that is the precursor of virtually all of the major diseases of developed societies, is largely due to the accumulation of reactive oxygen species. Insulin is a hormone that tells tissues to consume glucose that is present in the bloodstream. If the cells do not receive the insulin message, then the glucose is left to circulate in the bloodstream, which leads to a series of disorders for the individual. Insulin resistance means that the cells do not take up glucose even when the insulin signal is present. This phenomenon is also referred to as glucose intolerance. Reactive oxygen species (ROS) are generated from the metabolism of carbon compounds for energy. Since this is an unavoidable occurrence of metabolism, all organisms have evolved mechanisms to detoxify these reactive species to prevent cellular damage. A problem arises when the generation of the ROS exceeds the capacity of the cells to detoxify, which is why high caloric intake or excessive consumption of any energy source is detrimental to health. These compounds are toxic to cells, which explains why cells opt to ignore the insulin signal until they reduce these compounds below toxic levels. In this study the authors used cell culture model systems to show that treatments designed to decrease ROS levels within cells reduced insulin resistance to varying extents. They observed that high ROS levels lead to the reduction in a cellular protein that mediates the response to insulin but that the reduction did not occur if antioxidants were also administered. They then examined these effects in an obese mouse model. The treatment with antioxidants did not alter the appearance of obesity, but it did increase the response to insulin. More research is needed to understand the mechanisms of these effects, but this research offers another possible explanation for the health benefits of antioxidant consumption and explains the epidemiological studies that have shown the benefits of wine consumption in forestalling the ROS diseases.

—reviewed by Linda F. Bisson

Highlights from the 2006 Aroma and Flavor Symposium and Aroma Research Forum

Susan Ebeler, University of California, Davis

Recent advances and future challenges in our understanding of grape and wine flavor were highlighted during the June 2006 ASEV Annual Meeting. At the day-long Aroma and Flavor Symposium, over 200 attendees heard from internationally recognized speakers with expertise in neurobiology and physiology, sensory analysis, analytical chemistry, and wine flavor chemistry and microbiology.

Terry Acree, Cornell University, opened with an overview of wine flavor chemistry. While several thousand chemical compounds have been identified in grapes and wines, fewer than 1000 of them are aroma active, directly contributing to grape and wine flavor. Advances in analytical methodologies, such as gas chromatography-olfactometry (GC-O), have enhanced our understanding of grape and wine flavor. Individual flavor compounds can be identified through GC-O and, by using a human nose as the detector, their aroma qualities and relative impact on aroma can be determined.

Jeannine Delwiche, Ohio State University, discussed the physiology of taste perception and methods for measuring wine flavor. She emphasized that flavor is a combined sensation of taste, odor, color, and mouthfeel/texture (chemesthesis) properties, all of which impact our overall perception of wine attributes. In one study, the color of wine was changed (by adding coloring to a white base wine), and tasters identified the darker red samples as having flavors consistent with red wines, illustrating the impact that visual clues give to flavor perception.

Stuart Firestein, Columbia University, discussed the mechanisms by which odorants are perceived. Approximately 1000 olfactory receptors have been identified in rodents and ~350 have been identified in humans. When odorants bind to the receptors, a cascade of biochemical responses is triggered that sends a signal to the brain olfactory regions. The patterns of neurons firing in the brain are decoded to give us the recognition of specific odor qualities (such as vanilla and violets).

Donald Wilson, University of Oklahoma, reported that by using multiple tools, including functional magnetic resonance imaging (fMRI), scientists can obtain information about which regions of the brain are activated when individuals smell single odorants and mixtures of compounds. The patterns in the brain that are activated when individuals smell complex mixtures of odorants appear to correspond to the sum of the patterns associated with activation by single odorants. Memory and learning also play fundamental roles in our ability to perceive and discriminate odorants.

Susan Ebeler, UC Davis, presented some of the challenges still remaining in understanding how individuals perceive complex mixtures of odorants. For example, knowledge of odorant concentration alone is not enough to predict odor intensity in a wine sample because other matrix components, such as ethanol and polyphenols, can interact with the odorants to alter their volatility and aroma intensity. Increased knowledge of odor masking and enhancement is also necessary to understand how we perceive complex mixtures of odorants, such as when vegetal and fruity aromas are both present in wines.

Andrew Waterhouse, UC Davis, summarized recent research that has identified specific chemical compounds that may be responsible for the characteristic varietal flavor of many winegrapes. In most cases the unique varietal flavor of a wine can be obtained from a limited number of chemical compounds (usually 10 to 20). However, full characterization of the impact of individual compounds and comparisons among the same variety with slightly different sensory properties are still needed.

Michael Qian, Oregon State University, described his recent research using a new analytical technique, twister stir bar-GC-MS, to study the impact of grape maturity and irrigation practices on wine aroma composition. A group of flavor compounds could be identified in Pinot noir wines made from less mature grapes that were different from those in more mature grapes, and these different compounds appeared to be closely linked to the sensory descriptions of wine from the grapes at the different maturity levels. The aroma composition in the wine is well correlated with the aroma precursors in the grapes.

Thomas Henick-Kling, Cornell University, discussed his research that has shown that the timing of yeast inoculation can have an impact on flavor properties of the resulting wine. Recent studies with *Brettanomyces bruxellenis* show that some strains can contribute distinct fruity or citrus characters to model fermentations. These odorants were identified by GC-O and have not been previously characterized.

Ramón Mira de Orduña, University of Guelph, gave an overview of wine tastants beyond the contributions of sugars, acids, and tannins which contribute to sweetness, sourness, and bitterness. For example, salty perception in some wines has been observed when sodium concentrations are elevated due to vineyard management practices.

Harold McGee, author of *On Food and Cooking: The Science and Lore of the Kitchen*, discussed "molecular gastronomy" and chefs who are merging a sophisticated knowledge of science with culinary techniques, such as the use of distillation to develop flavor essences which are added to food ingredients to impart intense, surprising, or unique flavor qualities. New ingredients combined with advanced technology to develop gels and uniquely textured food products, such as foods reminiscent of the texture of caviar but with citrus or fruity flavors, are also being explored. These novel culinary science skills offer new ways of looking at the food and wine experience and may give winemakers inspiration for combining scientific advances and technologies to the winemaking process.

A white wine varietal tasting led to further discussion of varietal characters and the range of flavor attributes that can comprise individual varieties. A red wine tasting helped to demonstrate complex masking of flavors and the importance of standardizing language and training in communicating and understanding wine flavors.

In a separate Aroma Research Forum led by Michael Qian, academic researchers, students, and industry scientists interested in wine aroma and flavor discussed future directions for research. Several individuals noted the need to develop a sensory concept or precept for the individual wine varieties that can then be used to assist in identification of chemical compounds that contribute to grape and wine varietal character. Much discussion focused on how winemakers can better use analytical flavor chemistry information. Several participants noted that our knowledge of flavor precursors and factors in the vineyard that influence grape and wine composition is lacking and that this information will be critical for fully optimizing and controlling grape quality. Of particular concern is that many viticultural studies on grape quality are limited to evaluation of Brix and titratable acidity, which are not good indicators for grape and final wine flavor properties. Also discussed was the need for analytical tools that can rapidly screen grapes and wines for flavor compounds at various stages in the winemaking process. Most participants agreed that significant limitations in financial resources, both for academics and industry scientists, are currently restricting the progress that can be made in our understanding of grape and wine flavor. However, there was also a consensus that while challenges remain, many new analytical, sensory, and biochemical tools and techniques are now available for studying wine flavor and that the next 10 to 15 years should be an exciting time for wine flavor scientists and industry professionals.

Effects of Processing Must in a Blender before Fermentation on Wine Tannin and Anthocyanin Concentration

Stephanie Haas and Scot Bilbro, report of student research project, University of California, Davis

Tannins and color are critical wine sensory attributes. The quantities of both classes of compounds are influenced by extraction conditions during winemaking. Anthocyanins are water-soluble vacuolar flavonoid pigments that appear red to blue, according to pH. They have been observed to occur in all tissues, mainly in grape skins. Present as glycosides and occurring as single sugar residues attached to multiple hydroxyls, the grape pigments are usually bound with acetic, caffeic, or *p*-coumaric acids (Zoecklein et al. 1995). The term for the simple parent flavonoid ring system is *anthocyanidin*. However, anthocyanidins are never found in grapes or wine, except in trace quantities, because they are unstable. The major form of pigment is the modified or conjugate anthocyanidins, the anthocyanins or aglycones. There are five basic anthocyanins in wine: cyanidin-, peonidin-, delphindin-, petunidin- and malvidin-, the most abundant in red wines. The color of these pigments and their stability is a function of pH, making them completely pH dependent; for a pH >3.0, less than 50% of the potential red color is visible. Increased wine storage and temperature results in increased color because of accelerated polymerization; however, too much polymerization can cause wine instability.

Tannins are astringent, bitter-tasting grape polyphenols that bind and precipitate proteins. *Tannin* is a functional term that describes substances used to tan hide to leather; in wine the term refers to any large polyphenolic compound containing sufficient hydroxyls and other suitable groups, such as carboxyls, to form strong complexes with proteins and other macromolecules. Tannins have molecular weights from 500 to >20,000 and are usually divided into hydrolyzable tannins and condensed tannins. Hydrolized tannins are based on the nonflavonoid phenols and exist as esters which can be degraded or hydrolyzed. Condensed tannins, also known as procyanidins, cannot be decomposed by hydrolysis. Wine tannin is largely composed of polymers of condensed tannins. These tannins exhibit blue-color complexes upon reactions of Fe^+ with protein and are then described as astringent. Tannins are found in the seeds (58.5%) and to a lesser extent in stems (21%) and skins (4%). Skin tannins are of greatest concern because of the ease of extraction, and therefore winemakers take extra care in minimizing undesirable tannins. Tannins play an important role in preventing oxidation in aging wine and appear to polymerize and comprise a major portion of the sediment in wine; therefore the tannin level must remain <3 g/hL (Zoecklein et al. 1995).

Our experiment was designed to analyze the relative impact of mechanical disruption of skins alone or of seeds and skins on the amount of anthocyanins and tannins in the wine. A standard Osterizer household blender set on liquefy was used to macerate skins and seeds for 15 seconds, after which extensive skin and seed damage had occurred. Replicate fermentations were conducted of musts comprised of 20% macerated skins and seeds and 80% untreated must and of 40% macerated skins and seeds and 60% must. In a second trial, seeds were removed from the must by hand, and the skins only were blended using the same settings. The macerated skins and untouched seeds were then blended back with untreated must at the same 20% and 40% ratios. A control of untreated must was also run in parallel. The Harbertson-Adams tannin assay was used to measure tannin, with values expressed in terms of catechin equivalents (CE). Relative anthocyanin content was measured spectrophotometrically at 520 nm of diluted samples, and expressed as mg/L of malvidin-3-glucoside equivalents (M3GE).

Table 1 Anthocyanin and tannin content of wines.

Treatment	Anthocyanins (M3GE)	Tannins (CE)
Control	381.75 ± 51.26	838.25 ± 34.34
20% blended seeds and skins	385.47 ± 20.79	1164.5 ± 143.80
40% blended seeds and skins	369.19 ± 43.05	1233.25 ± 154.41
20% blended skins	332.16 ± 14.76	839.812 ± 122.03
40% blended skins	332.25 ± 31.37	802 ± 178.32

Mean anthocyanin concentrations ranged from 332 to 385 mg/L M3GE (Table 1). Maceration of skins with or without the presence of seeds had no significant effect on wine color. The maceration of skins only had no effect on the tannin content of the wines. In contrast, the maceration of seeds along with the skins significantly increased tannin levels. However, the increase in tannin level did not show a linear response with the percentage of seeds blended, suggesting that other wine components play an important role in tannin development.

Physically breaking a percentage of the must before fermentation by blending appeared to increase tannin concentration of the resulting wine. The tannin level increased when either 20% or 40% of the must (skins and seeds) was blended, but there was no difference between the tannin concentrations in the treatments. The increase was presumably due to increased seed exposure and seed breakage. Wines made in the same manner but with the seeds removed before blending did not show any tannin increase. However, since there was no difference between the 20% and 40% treatments, the extraction of tannins from seeds did not seem proportionate with the percent of must blended.

No effect was seen on the anthocyanin concentration of the wine by blending the seeded or deseeded must regardless of the percent blended (up to 40%). The extraction of anthocyanins from the skin did not appear to be related to the amount of surface area or breakage of the skin cells. However, a secondary effect of, or compound released by, blending the must may have inhibited extraction of anthocyanins past the level of the control. To tailor a program specifically targeting the extraction of anthocyanins, variables other than surface area, such as temperature and matrix chemistry, should be examined.

Zoecklein, B.W., K. Fugelsang, B.H. Gump, and F.S. Nury. 1995. Wine Analysis and Production. Chapman & Hall, New York.