

The Scientist

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By Chris Tachibana

## Over a barrel

The glass-doored cooler in the Seattle University chemistry lab was filled with liters of half-fermented wine. Stacks of Petri dishes on the counters were fresh enough to have a pleasant, yeasty, fruity odor, but unless autoclaved soon, would smell of unwashed socks. This is how undergraduate students Cara Southworth and David Andrews remember their lab, after they spent 6 intense weeks of plating wine onto yeast growth medium to answer a challenge issued to chemistry professor Peter J. Alaimo. His girlfriend, wine consultant Erica Orr, asked him to figure out how to stop yeast from turning the sugar in grape juice into alcohol.



Alaimo, Southworth, and Andrews and their experiment.

This is the opposite of what winemakers usually want, but Alaimo explains that this is how to make a sweeter wine, like a Riesling. “Many white wines are fermented in stainless steel tanks, so after the yeast make some alcohol, but before they use up all the glucose, fermentation can be arrested by quickly cooling the tanks. Some high-end wines are fermented in wooden barrels, though. The wood doesn’t cool efficiently, so it’s prohibitively expensive to chill it.” Instead, fermentation is stopped by adding potassium metabisulfite (KMBS)—or “sulfites.” In solution, this generates SO<sub>2</sub> that kills the yeast, and is an antibacterial and an antioxidant.

“We have formulas for how much KMBS to use for a dry red wine, but not a sweet white wine,” explains Southworth. The KMBS calculation is complicated, because the amount of useful SO<sub>2</sub> depends on pH and the Brix, a measure of sugars and dissolved solids. Right now, makers of white wine add KMBS based on instinct, because they

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don't have much else.

“The literature on SO<sub>2</sub> in winemaking is voluminous,” says Alaimo, “but for simplicity, many studies use pH- and sugar-adjusted samples that only approximate wine. Other studies use real wine, but aren't very scientific, like they don't have good controls. We're trying to do scientific studies that are relevant to winemakers.” In the autumn of 2009, the students collected samples from 26 barrel-fermented wines, measured the pH and other variables, added KMBS, and serially diluted them, so that samples spread onto Petri dishes would give isolated, countable yeast colonies. The students were simulating winemaking conditions, so they couldn't freeze samples, but had to dilute and plate immediately, in a frenzy involving thousands of plates—and an overwhelming cleanup. “It was exactly like a winery,” says Southworth. “We had to work all through the harvest.”

Southworth and Andrews's goal is a spreadsheet that tells winemakers how much KMBS to add to arrest fermentation in white wine, depending on wine type, pH, and Brix. “This would definitely be a helpful tool,” says Graham Wehmeier, a winemaker in California's Napa Valley. “A small number of people are allergic to sulfites,” he adds, “and I think everyone would prefer less sulfite in their wines.”

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Usually, the Alaimo lab develops organic synthesis methods, and Alaimo's only previous yeast experience was rinsing it out of beer and wine bottles before recycling the glass. The students' experience with cells was limited to “a plant experiment in general biology,” says Andrews. Fortunately, the department biochemist works with yeast and gave them a crash course. “We didn't know what sterile technique was,” says Southworth. “We thought we would just control the cells with solvents.” But even with a little waste, it's an economical project.

Alaimo estimates the cost at about \$500, all provided by university undergraduate research funds.

The students may be a little young to be handling wine (Andrews was 21 and Southworth was 20 when the project started), but SU has no graduate chemistry program, so undergraduates do all the research. It's a Jesuit college, but not a dry campus. In any case, Southworth and Andrews are appalled at the idea of using the leftover samples for happy hour. On a sample-collecting trip, they tasted the product at this early stage, and "it's not good. It hasn't been aged, and it's just thick with yeast," says Southworth, "And they're samples. Just like we wouldn't drink the water in the chem lab, we wouldn't drink the wine out of the Falcon tubes."