# Wine-Tasting in Vitro

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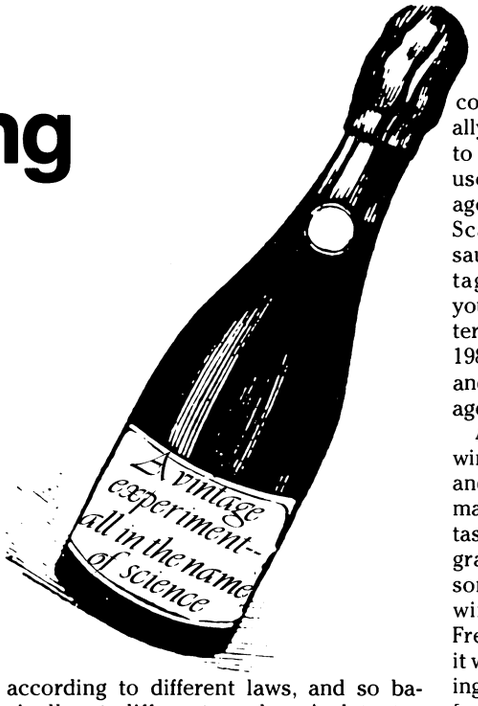


It was a Saturday afternoon in Santa Barbara about two years ago. Being in California, says Philip J. Wyatt of Wyatt Technologies in Santa Barbara, it's the sort of place where on a Saturday afternoon, someone naturally produces a bottle of wine—even in a scientific laboratory. Being scientists, however, the people assembled around the bottle of wine decided to do something scientific with it: to taste it and see whether scientific analysis would reveal any basis for their judgment of its taste.

Then someone pointed out that if they were going to make physical measurements on the wine, they needed a basis for statistics. So they went out and assembled 10 bottles of the same variety of wine, pinot noir, ranging from a $12.00 California vintage to a $1.99 bottle from Romania. "As soon as you open 10 bottles of wine in California," Wyatt told the recent meeting in New Orleans of the Optical Society of America, "people you haven't seen in years come to the door." In fact 10 or 12 people assembled, including scientists, engineers, X-ray technicians, a used car dealer and a couple of lawyers. There were no professional wine judges among them. They decided to taste the wines, rate them, and then see if scientific analysis could provide some justification for the ratings.

*De gustibus non est disputandum,* said Cicero—there's no accounting for tastes. Wyatt and associates set out to prove Cicero wrong. They seem to think they have done so.

Every experiment begins with theoretical physics, Wyatt says. In this case, theory began with the axiom that if wine contained nothing but water molecules, it would taste like water. The taste therefore must depend on the molecules and solid particles that are not water. The experiment looked for differences in the amounts and sizes of such natants (objects floating in the water) and sought to relate those differences to perceived differences in taste.

The apparatus used is a light-scattering instrument used in studies of how bacteria interact with antibiotics. The sample, wine diluted ten to one with deionized water, is placed in a cuvette and irradiated with a laser. The dilution is necessary, Wyatt says, because laser light does not penetrate full strength red wine very well "even when it's out of the green bottle." Natants of different sizes, from molecules to large flakes of sediment, scatter the laser light according to different laws, and so basically at different angles. A detector swings in an arc around the cuvette, recording the brightness of scattered light at each angle. The graph of scattered intensity versus angle gives a measure of the mix of natants of various sizes in the sample.

These cuvettes were little cups that are used to serve cream on Delta Airlines. A microbiologist in the group had brought some back from a trip, reasoning that the great clarity of the plastic would make them particularly useful. The cuvettes have beveled sides, and the physicists reasoned that the bevels would play hob with the light scattering. *Ne sutor ultra crepidam,* runs another Latin proverb—cobbler stick to your last. Somebody tried the beveled cuvettes anyhow, and the results were clearer than anything before. *Post facto* the physicists reasoned that the bevels had actually thrown internal reflections by the vessel out of the plane in which scattering took place. Straight-sided cuvettes throw their internal reflections in the same plane and so confuse the measurements a little.

The amateur wine tasters had characterized the wines with "words you would never read in a wine column," Wyatt says; terms such as: wow, excellent, good, bad, awful, thin and vegetable. Professional tasters use qualities like aroma, color, clarity, body, nose...and try to rate each wine on a scale of 1 to 20. Wyatt quotes Benjamin Thompson, Lord Kelvin: "If you really want to measure something, do it with numbers."

The numbers from these measurements do seem to correlate with the judgments of the amateur wine tasters. The wines they thought particularly good gave flat scattering curves. Wines characterized as thin had low levels of scattering, while those that tasted vegetable had generally high levels.

One of the major concerns is the effect of aging. As a wine ages, protein polymers condense into large particles that eventually fall out as sediment. Aging also tends to change the taste. Red wines only were used in these tests, as white wines don't age and are best consumed quite young. Scattering curves from two cabernet sauvignons from the same vineyard, vintages 1980 and 1981, show that the younger wine produces a scattering pattern steeper than that of the older one. The 1981 vintage has more tannin, says Wyatt, and will taste bitter. It will mellow as it ages.

American vintners sometimes chill the wine to increase the sedimentation rate and so speed up the aging process. Wine makers do other things as well to alter the taste. "There's a lot in wine that's not from grapes," Wyatt says. He cites the case some years ago of a very delicious Italian wine that was selling well in France. French laboratories analyzed it to see why it was so good. They found there was nothing in it from grapes. "One can chemically [synthetically] achieve many of the characteristics of wine without going through all winemaking activity," Wyatt points out.

Beer is perhaps a more plebeian tipple than wine, but it ages too, and not to its advantage. A person pouring a beer and finding it cloudy with sediment is likely to consider it unpalatable. It is important, Wyatt says, to monitor this process to determine the best shelf life for the beer. Four beers were surveyed, two regulars and their associated lights. Light beer has a different scattering pattern than the corresponding regular beer, but this didn't seem to correlate with taste. Large particles were found in beers made with mountain stream waters, Wyatt says, the brewers apparently unaware that folks were camping upstream.

Soft drinks were also surveyed. Diet drinks are found to have more floating material and steeper scattering curves than nondiet drinks. A lot of things are added to cover the taste of saccharine, Wyatt says.

Finally the researchers brought in a solid contender: breakfast food. "Does anyone in this room remember how Rice Krispies tasted in 1938?" Wyatt asked. "Is there any way you can fingerprint the taste of a food? Can you tell the high priced brand from the generic variety?" In this case some of the molecules of interest are too small to show up directly in light scattering, so the investigators introduced bacteria that eat those molecules. After a certain time, the increase in the bacteria, which do scatter light, gives a measure of how much of that particular substance was present. "There's a great difference in cornflakes," Wyatt says.

Getting back to wine, he states his final conclusion: "If a set of judges selects a certain ordering of wines, you can measure them by means of their light-scattering patterns and put them in the same order by an algorithm that is easy to develop, and then you should be able to always reproduce that same judgment." □