LETTERS

Days of Wine and Lasers

The proliferation rate of small, independent wineries in California and throughout the world is exceeded only by activity in the publication of books and periodical articles on wine and wine tasting. A mystique has thereby evolved which renders the consumer frustrated in the selection and judgment of wines that he might buy. Is a knowledge of the myriad qualitative wine parameters really needed and, furthermore, is there any means by which the consumer may determine that a particular analysis by an expert is more hype than fact? Since the qualities of a wine (taste, aroma, color, and clarity) exist only by virtue of particle types present, be they molecules, bacteria, or even grapes, it is reasonable to expect that an answer to these questions might be achieved by looking at wine particles by means of laser light scattering (*1*). Described here are the results of a very limited experiment in which the light-scattering properties of carefully decanted and diluted wines were compared with the opinions of a nonprofessional consumer panel. The results clearly show that, had the wines been judged initially by the quality of their differential light-scattering (DLS) patterns, the entire panel would have concurred.

All measurements were performed with seven different West Coast varietal Pinot Noir wines using a Differential III light-scattering photometer (2) equipped with a nominal 3-milliwatt, vertically polarized, helium-neon laser. The wine samples, diluted 10 to 1, are placed individually in special cuvettes at the center of the beam. The logarithm of the scattered intensity is recorded as a function of scattering angle, and the data are presented as shown in Figs. 1 and 2. The wines, labeled A through G, cover a

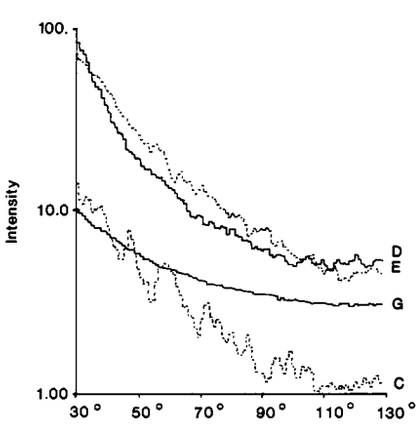

Fig. 1. DLS patterns of wines C, D, E, and G.

Table 1. Wine qualities (Pinot Noir).

Identification	Cost* ($)	Panel† rank	Comments‡
A	3.75	4	NR
B	3.75	5	NR
C	5.00	3	Y, T
D	3.15	7	SP, T, H
E	6.50	6	T, V, H
F	7.00	2	P, N
G	12.00	1	G, N, Y

*Cost varies from store to store. These were prices at one store on date of purchase. †Physicist, mathematician, electrical engineer, office manager, x-ray technician, coin dealer, electromechanical assembler, and attorney. ‡G, good; SP, soda pop aftertaste; T, thin; P, pleasant; N, nice flavor; NR, no resemblance to a Pinot; V, vegetable taste; H, horrible; and Y, young.

retail price range from $3.15 to $12 per standard three-quarter liter bottle (Table 1). Because the natural "pigmentation" of all these wines is red, the use of a red laser wavelength (λ = 632.8 nanometers) ensures that virtually no light is absorbed and all recorded patterns characterize the scattering properties of the ensemble of molecules and particles present.

As may be seen from Figs. 1 and 2, the degree of unpleasant taste as determined by the panel of nonprofessionals (Table 1) correlates well with the degree of noise and relative amplitude in the recorded signals. The smoother and flatter curves correspond to better-tasting wines, a predominance of large particles tending to affect simultaneously both taste and light-scattering properties.

The total material present within each sample is manifest from the vertical position of the DLS pattern. Thus if two samples contained identical types and distributions of molecules and other particulates, the sample containing the greatest concentration would yield the pattern of greatest intensity. The relative height of the pattern, however, is *not* necessarily proportional to the *number* of particles present. Indeed, in the molecular regime (*3*), the scattered intensity

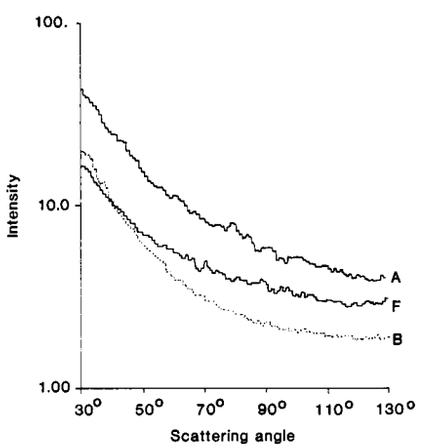

Fig. 2. DLS patterns of wines A, B, and F.

from a particle is proportional to the square of its volume (Rayleigh region). Thus a particle 50 nanometers in diameter will generally scatter four times as much light as one with half that diameter. The slope of the DLS pattern near forward scattering (small scattering angles) generally becomes steeper as the average particle size increases.

Wines F and G have the smoothest DLS patterns and also the shallowest slopes. At large scattering angles the patterns are nearly horizontal. These wines thus seem to consist predominantly of molecular contributions with most of the precipitable, large particles having been removed (say, above 500 nanometers). These two wines were judged to have superior relative taste, and their manufacturers had obviously devoted considerable effort to "polishing" them. Although wine B, for example, produced about as much total light scattering as wines F and G, its DLS pattern is irregular and considerably steeper than the patterns of the other two. Its relative taste quality did turn out to be rather poor.

The DLS pattern of wine C was also quite noisy (large particulates present, although at substantially lower concentrations than A, B, D, and E), yet its overall pattern was depressed—even relative to F and G. It contains, therefore, smaller molecules than either F or G, probably smaller than needed to produce a good body. Had its manufacturer devoted more attention to the removal of the larger particulates, wine C could well have had a taste quality exceeding those of both F and G, since these large particulate residues seem to correlate with poor quality.

As is evident from Table 1, most of the wines would never have been purchased by any of the panel at any price had they known a priori how they tasted. The two wines producing good-quality DLS patterns (F and G) pleased everyone. I do not propose that every wine consumer go out and purchase an expensive laser light-scattering photometer to help select wine, but I am firmly convinced that, were a copy of the wine's DLS pattern or a quantitative parameterization thereof available, the selection process would be greatly simplified and certainly far easier to understand than most media hype on the subject. The consumer might be able then to buy wines according to a rating system similar to the Environmental Protection Agency's mileage ratings comparing automobiles.

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References

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2. V. R. Stull, *Clin. Chem.* **19**, 833 (1973).
3. M. Kerker, *Ind. Eng. Chem.* **60**, 30 (1968).

Koop's Candidacy

The controversy surrounding the candidacy of C. Everett Koop for the Office of Surgeon General, as reported by Marjorie Sun (News and Comment, 24 Apr., p. 422) is as frightening as the McCarthy or Nixon eras, and for similar reasons. In those times many honest persons who lived and acted according to their consciences and within the law were either denied their rights to work as they chose and to serve their government, or they lived in realistic fear of loss of these rights. It seems to me that Koop is being subjected to similar extralegal pressures.

It is altogether appropriate to scrutinize Koop to ensure that he is a capable administrator and that he will administer the law as written, as was done with Joseph Califano when he was proposed as Secretary of the Department of Health, Education, and Welfare in the Carter Administration. The forces opposed to Koop do not, however, recommend this. They have prejudged him on these issues, found him guilty, and therefore proclaim him unqualified.

It is understandable that those whose livelihood involves counseling abortion or performing abortions, and those who feel abortion is every woman's right, would object to an ardent pro-lifer as Surgeon General, but the principle of applying a moral or philosophical litmus test of any sort to candidates for public office is far more dangerous than temporary occupancy of an office by an individual whose ideas differ from one's own.

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Owl Monkey Cell Line

I would like to amplify a statement which appears in the article "A diversion of the quest for truth" (News and Comment, 6 Mar., p. 1022). This article deals with the unfortunate contamination of purported human Hodgkin's disease cells with a cell line from owl monkey kidney in John Long's laboratory at Massachusetts General Hospital. I refer to the quotation (p. 1023), "O'Brien had studied the lines [sent by Long] with a panel of six enzyme tests, and assured [Nancy] Harris that they were of human origin."

Actually, we typed the lines in the summer of 1979 and found certain enzyme phenotypes that were consistent with a human origin and two others that were unusual. We reported this to Long. These enzyme systems were not diagnostic with respect to species identification; rather they were selected to discriminate between different individuals within a group of human cells [S. J. O'Brien *et al.*, *In Vitro* **16**, 119 (1980)], as had been requested by Long. An expanded series of species-specific isozyme systems were examined in January 1980 at the request of Harris in order to clarify the question of their identity. Results of these tests confirmed the conclusion (also derived by Walter Nelson-Rees using karyology) that the origin of the cell lines was nonhuman. Our conclusions at this time were the first considered opinions of species origin that we gave.

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Meeting Requirements

In connection with Eliot Marshall's Briefing (News and Comment, 1 May, p. 525) that education majors scored lowest as a group on a test of "global awareness," readers might bear in mind that education majors are the only group whose curriculum is more than one-third prescribed by some agency of government.

Education majors are so busy meeting requirements for certification—requirements of no demonstrated validity—that they have no time to learn about the globe.

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Erratum. In the letter from Bailus Walker, Jr. (22 May, p. 875), option (ii) in the second paragraph should have read: "general laboratory guidelines which would be mandatory only for *work with those substances regulated by OSHA health standards for* general industry. . . ."

Erratum: In the Meeting Highlight "Caffeine's stimulatory effects explained" (Research News, 27 Mar., p. 1408), the adenosine molecule should have been represented as follows: