# Heavy lead found in some French red wine

Wine drinkers know that the sulfites used as preservatives in wine can cause headaches in some people—even death in some asthmatics (SN: 6/27/87, p.409). But new research shows that an even greater danger may exist in some French red wines: heavy-lead pollution.

Researchers report in the July 7 NATURE that atmospheric pollution caused by the use of leaded gasoline has led to contamination of some Chateauneuf-du-Pape wine. Richard Lobinski at the University of Antwerp in Belgium and colleagues in France examined 19 vintages from the region and discovered organolead concentrations 10 to 100 times higher than those found in drinking water. This particular wine was made from grapes that grew in vineyards bordering French autoroutes A7 and A9.

This isn't the first time lead has leached its way into wine. Lead crystal (SN: 1/26/91, p.54) and lead-foil bottle wrappers (SN: 9/21/91, p.189) have already been named toxic culprits. But Lobinski sees the contamination found in the new study as far more serious because of its organic nature. Organolead differs in composition and toxicity from what Lobinski calls "normal lead, $Pb^{2+}$." Organolead compounds, he says, are more volatile and soluble in fats and lipids—and consequently more dangerous.

"Organolead can be easily absorbed, especially by [the] brain," Lobinski adds. In addition, organolead is not easily eliminated from the body and can accumulate in the liver and kidneys.

These heavy-lead compounds are absorbed by wine (and not by water) because they bind to the ethanol produced naturally during the fermentation process. The risk of long-term pollution is "not so bad," according to Lobinski, "because there's a certain lifetime for organolead in the environment. Normally, these compounds disappear in sunlight."

Commenting on this new research, Andrew L. Waterhouse, a chemist at the University of California, Davis, noted that "government regulators should consider making a distinction between inorganic lead and organolead compounds."

Lobinski believes that "wine can be used as archives of past environmental pollution." The concentrations of organolead in the wines studied reflect the use of leaded gasoline in western Europe. For instance, the availability of leaded gas dropped off in France in the late 1970s, and vintages since then have shown a sharp decrease in contamination. "The only recommendation I'd like to make is don't drink the vintages between '75 and '80," Lobinski says.

The age of the ills of leaded gasoline has passed quietly away in the United States (thanks to the Clean Air Act of 1972), and Lobinski says there isn't much to fear from California wines. But he isn't as optimistic about other climes. "Twenty-five percent of the market is still leaded gasoline in Europe. In Central Europe, 80 percent of gasoline is leaded. In the Soviet Union, 100 percent of gasoline is leaded. We haven't analyzed Crimea wines because they were not available here, but I think they can be really dangerous."

—*G. Marino*

# Greenery filters PAH-lution from skies

Five years ago, a NASA scientist reported that English ivy, potted mums, and other houseplants can remove significant quantities of several noxious pollutants from indoor air (SN: 9/30/89, p.212). Now, two academic researchers observe that grasses, shrubbery, and trees may provide much the same function for the outdoor environment.

Traffic, residential heating, industrial processes, and other human activities together spew some 7.5 million kilograms of polycyclic aromatic hydrocarbons (PAHs) into U.S. skies. These combustion by-products include a number of known or suspected carcinogens.

Staci L. Simonich and Ronald A. Hites of Indiana University in Bloomington suspected that because these compounds can accumulate in waxes, the outer tissues of many plants might serve as storage depots for them. So they began studying concentrations of 10 representative PAHs in the vegetation and soil at a suburban Indiana site.

Their data confirmed that waxiness tends to control a plant's PAH uptake. But even within a particular tissue type, plants vary their PAH acquisition by season—and by temperature.

The Indiana scientists used these data to model plants' PAH removal in the industrialized region running from Kansas, Missouri, Kentucky, and Virginia north to Canada. Some 52 percent of the U.S. population makes its home there. Coupling these figures with previously published data for soil, air, and water, the researchers developed what Hites describes as the first "unified" picture of the fate of PAHs.

The pair now reports in the July 7 NATURE that plants appear to pick up a large fraction of this pollution—perhaps 43.5 percent in the northeast quarter of the United States. Eventually these PAHs enter the soil as leaf litter and other decaying plant matter. The researchers' analysis indicates that another 10 percent of the pollution falls directly onto the soil and 5 percent into water, where it eventually settles into sediment. The remaining roughly 41 percent either becomes chemically transformed in the atmosphere or wafts across U.S. borders.

If anything surprised him, Hites says, it was that plants didn't have a bigger role. "Almost everything's covered with vegetation, which has about 10 times the surface area of [the land] on which it grows," he says. "And a very waxy material—some of it quite rough—covers vegetation's entire surface. You just can't imagine a better [PAH] scavenger."

—*J. Raloff*

# $CO_2$ increase boosts methane emissions

Plants around the world can slow the buildup of carbon dioxide pollution by absorbing tons of this greenhouse gas. But this apparent blessing comes at a price. The fertilizing effects of carbon dioxide on plants can cause some regions to increase emissions of methane, an even more potent heat-trapping gas.

These conclusions emerge from a study of wetland plants performed at the Smithsonian Institution's Environmental Research Center in Edgewater, Md. It suggests that wetlands and similar environments could be amplifying the greenhouse power of carbon dioxide gas, says John W.H. Dacey of the Woods Hole (Mass.) Oceanographic Institution. Dacey, Bert G. Drake of the Smithsonian, and Michael J. Klug of Michigan State University report their results in the July 7 NATURE.

For the last 8 years, Drake has studied how increasing carbon dioxide alters the growth of plant species in specially designed enclosures at the Smithsonian center near the Chesapeake Bay. Half the chambers have carbon dioxide concentrations of 690 parts per million, almost twice the atmosphere's current amount. The other enclosures have regular air and serve as controls.

During July 1991, Dacey measured the amount of methane escaping from the plots of land in the enclosures. He found that chambers enriched with carbon dioxide produced 80 percent more methane gas on average than the control chambers.

Methane in wetlands comes from soil bacteria that consume organic plant matter. Because carbon dioxide stimulates plant growth, wetland sedges in the experimental enclosures produced more organic matter for the methane-producing bacteria than did the plants in the control chambers.

"This study confirms that elevated

carbon dioxide concentrations are likely to have quite complex and far-reaching effects on ecosystems," Drake says.

L. Hartwell Allen, a crop physiologist with the U.S. Department of Agriculture in Gainesville, Fla., finds similar methane enhancements in studies of rice. Plots growing in double the current concentration of carbon dioxide emitted roughly twice as much methane as did those subjected to lower carbon dioxide amounts, he told SCIENCE NEWS.

Although they cover only a limited part of the globe, wetlands and rice paddies account for 30 to 40 percent of methane emissions into the atmosphere. By enhancing methane production in these environments, the buildup of carbon dioxide could significantly boost atmospheric concentrations of methane, Dacey says.

Indeed, methane amounts are rising, having more than doubled since preindustrial times. Researchers blame most of this increase on coal mining, use of natural gas, rice cultivation, raising of cattle and sheep, and burning of vegetation. But the new study suggests that the buildup of carbon dioxide may have caused roughly 15 percent of the methane increase by stimulating growth in wetlands and rice paddies, says Dacey.

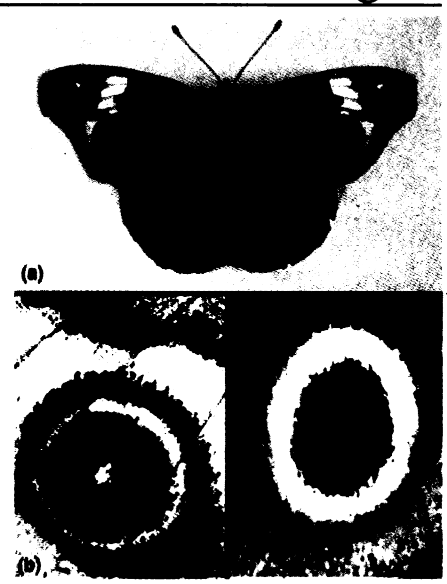
Climate experts are concerned about methane because each molecule can trap about 20 times more heat than carbon dioxide can. —*R. Monastersky*

# Gene patterns decorate butterflies' wings

Nature photographer Kjell B. Sandved made his reputation exploring the diversity of the world's approximately 200,000 moths and butterflies. Over the years he has found the alphabet, numbers, and many other human symbols inscribed in their wings (SN: 6/16/90, p.376).

But it took the plain fruit fly *(Drosophila melanogaster)* to help scientists understand how nature can be so creative.

In fruit flies, and presumably all insects, the activation, or expression, of certain genes in particular cells for short periods helps define body parts. Just before an insect larva changes into a flying adult, it develops white globs of cells called imaginal disks that later become its wings, explains Sean B. Carroll, a geneticist at the Howard Hughes Medical Institute at the University of Wisconsin-Madison.




Carroll and Stephen W. Paddock/HHMI-Univ. Wisconsin

*Buckeye (a) eyespots (b, c) up close.*

Carroll's group used fruit fly genes to study these disks in the buckeye butterfly, *Precis coenia*, which is common throughout the United States. They found six genes very similar to the fruit fly's. In fruit flies, these genes specify the top and bottom, back and front, and inner and outer margins of the developing wings.

The same holds for butterflies, the Wisconsin group now reports in the July 1 SCIENCE. For example, in butterflies, as in fruit flies, the cells that make up the top wing surface contain an activated apterous gene, while those destined to frame the wing perimeter express one called Distal-less. "The same genes are expressed in the same relative coordinates that we know operate in the fruit fly wing," says Carroll.

Fruit flies began evolving separately from butterflies about 200 million years ago. "So it looks like that program was very much conserved," he adds.

But then the butterfly goes one step further, reactivating those genes to generate colorful wing designs. "Distal-less is expressed in a new and unexpected pattern," comments H. Frederik Nijhout of Duke University in Durham, N.C.

Carroll and his colleagues observed that within each section of developing wing, a wedge of cells activates Distal-less genes. Over time, that wedge narrows and finally shrinks to a small spot, just as Nijhout had predicted years earlier when he was theorizing about how patterns should arise.

"It confirms that all butterfly color patterns are derived from a common ground plan," says Nijhout. On each wing, several small groups of cells act as organizing centers that guide the patterning of the entire wing. "Different parts of the color pattern are uncoupled. You can think of it as a mosaic system," he adds. This uncoupling leads to great variety.

Thus, while all wing sections can generate eyespots, only certain ones do. Carroll and Nijhout think the expression of other genes helps define other types of butterfly wing patterns and that natural selection guides the final outcome. For example, showy colors on the upper surface help attract mates, while duller bottom surfaces help the insect blend in with its background to avoid predators, they note. — *E. Pennisi*

# Future for artificial photosynthesis shines

Is artificial photosynthesis possible? Might scientists someday mimic nature's sunlight-capturing molecular machinery in order to use solar energy for human purposes?

Based on recent work revealing the structure of key membrane proteins that enable plants and bacteria to harness the sun's energy, photosynthesis may become "the first complex biological system to have its structure, function, and regulation described in rigorous physical-chemical terms at the atomic level," say James Barber, a biochemist at the Imperial College of Science, Technology, and Medicine in London, and B. Andersson, a chemist at Stockholm University.

"Such knowledge could provide a blueprint for new technologies for the production of energy," they write in the July 7 NATURE.

Specifically, the scientists herald recent work showing the structure of a "light-harvesting pigment protein," an advance that they say could eventually make possible artificial photosynthesis. This light-harvesting pigment protein lets photosynthetic organisms take advantage of the entire solar spectrum and grow where little light shines. By means of a new technique called electron crystallography, scientists can view the structure of the light-harvesting chlorophyll a/b-protein complex, also known as LHCII.

The most abundant membrane protein in chloroplasts, where photosynthesis occurs, LHCII binds about half of all chlorophyll, the researchers say. Organisms able to harvest light in this way can survive continual and unpredictable fluctuations in sunlight. Within seconds of a slight shift in clouds, sunlight can vary by up to 100 times in intensity. Thus, chemical mechanisms are crucial in regulating light absorption and restoring interrupted photosynthesis.

In recent months, an artificial photochemical system has generated for the first time a "spin-polarized triplet state"—a charge-transfer reaction previously seen only in live photosynthetic organisms. In another key advance, a group has synthesized self-assembling proteins genetically engineered to incorporate specialized pigments.

The "secrets of the molecular electronics" of photosynthesis will soon become available for solar energy conversion, Barber and Andersson predict. "The challenge now is to devise an artificial system based on this knowledge."

—*R. Lipkin*