Environment

Has lead got your blood pressure up?

Exposure to lead can cause a range of problems — from miscarriages and developmental retardation to hearing loss and impaired vitamin D metabolism. The June issue of the bimonthly ENVIRONMENTAL HEALTH PERSPECTIVES focuses on one of the more recent additions to the growing list of lead hazards with 31 papers linking lead exposures to elevated blood pressure.

Joel Schwartz at the Harvard School of Public Health in Boston examined the relationship between blood pressure and lead based on measurements of each by the Public Health Service in its random sampling of U.S. males for the Second National Health and Nutrition Examination Survey completed in 1980. Schwartz found "a robust relationship between low-level lead exposure and blood pressure" even though the mean blood lead level in this group was 17 micrograms per deciliter (μ/dl) — well below the 25 μ/dl considered excessive for children, the group most vulnerable to lead's toxicity. J. Richard Landis at the University of Michigan School of Public Health in Ann Arbor—who also analyzed the survey data—says he saw a dose-response relationship in the lead/blood-pressure link down to 5 μ/dl.

While a 10 μ/dl increase in blood lead levels may correspond to no more than a 2-millimeter mercury increase in average systolic blood pressure, Schwartz notes, this small change could have important consequences. Herman A. Tyroler agrees. An epidemiologist at the University of North Carolina in Chapel Hill, Tyroler notes that data from the national Hypertension and Detection Follow-Up Program indicate that a 2-millimeter mercury decrease in blood pressure might be associated with as much as an 8 to 10 percent decrease in premature death — far from a trivial effect.

Roast those dioxins away

Dioxins, PCBs and other chlorinated hydrocarbons tend to settle into the sediment of the waterways they enter. That's why bottom-feeding fish, such as carp, can accumulate relatively high levels. In some Michigan rivers and streams, bottom feeders have accumulated up to 120 parts per trillion of TCDD, the most toxic of the dioxins. But a new Michigan State University study indicates that cooking can reduce that contamination dramatically.

Nancy C. Stachiw, Mary Zabik and their co-workers charbroiled and roasted restructured carp filets (chopped carp bits pressed into steaks) made from fish netted in Lake Huron's Saginaw Bay. Although the TCDD level of all filets was lower after cooking, certain methods proved more effective in eliminating the pollutant. For example, among filets cooked to an internal temperature of 60°C (medium rare), initial levels of TCDD contamination—about 40 parts per trillion—dropped 46 percent in those charbroiled, 37 percent in those roasted under covers, but just 24 percent in those roasted uncovered. Fish cooked to an internal temperature of 80°C (well done) lost even more TCDD — between 50 and 60 percent, depending on the cooking method.

These differences among cooking temperatures and techniques are impressive enough to justify advising consumers to cook fish they suspect of being contaminated at high heat and/or to a well-done stage, the East Lansing scientists write in the July/August JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY. Moreover, their work shows, a 12 percent increase in surface area (per unit weight) reduced cooked-filet TCDD contamination by 12 percent.

Where does the TCDD go? Although the scientists haven't measured its levels in the drippings, Zabik says it's reasonable to expect that that's where the fat-stored chemical ends up—so don't feed carp drippings to your cat.

Physical Sciences

Glass sponges with an ethanol thirst

Many aspects of liquid behavior, even after decades of study, remain poorly understood, and current research continues to produce surprises. David D. Awschalom and his colleagues at the IBM Thomas J. Watson Research Center in Yorktown Heights, N.Y., have been investigating the properties of liquids confined to networks of microscopic, cigar-shaped pores in glass blocks. Their results show that a confined liquid can be cooled as much as 30 percent below its normal bulk freezing point without freezing. At the same time, sound waves traveling through such a supercooled liquid behave as if the liquid were actually solid.

"That's what's so novel," says Awschalom. "It's a liquid that mimics all the acoustical properties of a solid yet clearly is still a liquid." The IBM team reports its findings in the Aug. 22 PHYSICAL REVIEW LETTERS.

By focusing on liquids confined to networks of cylindrical pores, Awschalom and his colleagues can study what is essentially a one-dimensional liquid — a long, thin, spaghetti-like tube of fluid. That geometry allows the researchers to investigate a situation in which the liquid has a vast surface area in relation to its volume. In a liquid-filled, porous glass block, much of the liquid has direct contact with the glass walls. In contrast, in a three-dimensional situation, such as water in an ordinary flask, the liquid has a much smaller surface area in relation to its volume. "There's a lot of interest in what kind of role the surface plays in liquid behavior," Awschalom says. Simplifying the geometry allows researchers to concentrate on surface effects.

In their experiments, Awschalom and his group allow a liquid such as ethanol or liquid oxygen to soak into glass samples containing uniform pores of a well-defined size and geometry. The pore radius ranges from 10 to 200 angstroms. By shining extremely short pulses of laser light into the transparent, liquid-filled glass sponges, the researchers generate ultrasonic waves within the material, allowing them to monitor the liquid's behavior.

The results show the geometry of the confining pores has a significant effect on the liquid's freezing point. As the pores get smaller, the freezing point declines. "Here we have a supercooled liquid for which you can predict exactly [at what temperature] it will freeze, based on the size of the pores," Awschalom says. That stability contrasts with the behavior of supercooled bulk liquids, which instantly freeze at no particular temperature when they are disturbed by a jolt or a dust particle.

The IBM findings suggest that researchers may be able to control the freezing point of a liquid by confining the liquid to pores of a certain size. In some cases, that would make it possible to study states of materials not otherwise readily accessible. Awschalom and his group, who term this effect "geometric supercooling," have already tried the technique on half a dozen liquids.

The solid-like acoustic behavior of a confined, supercooled liquid appears to stem from the spontaneous appearance and disappearance of tiny plugs of solidified liquid, which randomly grow and collapse, temporarily blocking the cylindrical pores. "Once these plugs exist, the acoustic properties are exactly like a solid," Awschalom says. As the liquid cools, the number of such fluctuating plugs increases, making the liquid more viscous. Finally, the temperature gets low enough that the plugs fill the pores and the liquid freezes.

The IBM group is now interested in seeing what happens when glassy sponges soak up mixtures of two liquids that, like oil and water, normally separate into two phases. The researchers also would like to obtain better evidence for the formation of solid plugs during supercooling.