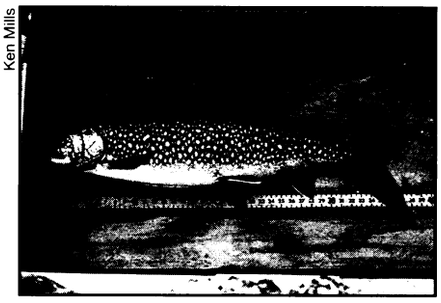
Ken Mills



The fat that allows this lake trout to survive long winters also fosters the buildup of toxicants such as toxaphene.

and into the water, observes Terry F. Bidleman, an environmental chemist with Canada's Atmospheric Environment Service in Downsview, Ontario. "But Karen Kidd's paper is showing clearly this is not the case—there's a strong food-chain factor which is likely to be quite different from lake to lake."

Her findings also explain the differential contamination of fish in remote, neighboring lakes in Ontario, notes David R.S. Lean with Environment Canada's National Water Research Institute in Apsley, Ontario. "The only difference [between the lakes] is in the food chain."

Lean says these recent findings of toxaphene throughout the Arctic and subarctic are scary because they "beg the question: If this was banned for so long and we're just finding it, how many things just as bad may be here that we haven't looked for?" *— J. Raloff*

Nicotine plays deadly role in infant death

As a result of studies associating smoking with miscarriage and sudden infant death syndrome (SIDS), pregnant women are usually advised by their doctors to kick the habit (SN: 3/11/95, p.151). A new study adds weight to that advice and explains how smoking may lead to SIDS.

A group of North Carolina researchers found that rats exposed to nicotine as fetuses were born without the ability to adjust to periods of oxygen deprivation, resulting in a rodent syndrome resembling SIDS. That finding could result in pregnant women being advised to forgo the nicotine patch as well as smoking.

"Perhaps pregnant women should be advised to go cold turkey," says study leader Theodore A. Slotkin of Duke University Medical Center in Durham, N.C.

The researchers gave pregnant rats nicotine in dosages representative of either moderate smoking (the equivalent of 10 cigarettes per day) or heavy smoking (40 cigarettes per day). Control animals received only water. The researchers then exposed the newborn pups to low oxygen concentrations similar to what they would experience if they suffered from sleep apnea, the transient cessation of breathing during sleep. One-third of the pups exposed to nicotine before birth died, while all of the control pups survived.

As the team reports in the July BRAIN RESEARCH BULLETIN, the nicotine-exposed pups that died failed to produce the stress hormones adrenaline and noradrenaline when faced with oxygen deprivation. Without this response, they couldn't maintain a normal heartbeat.

The results of prenatal exposure to nicotine continue after birth, says Slotkin. In humans, the nervous system develops throughout the first year of life. During that time, the adrenal glands, which produce the stress hormones, aren't fully integrated into the nervous system. In infancy, immature cells in those glands respond to low oxygen by producing a surge of stress hormones. Later, after nerve cells reach the adrenal glands and cause the cells to mature, the nervous system takes over control of hormone output.

Nicotine, by mimicking nervous system chemicals, forces the adrenal cells to mature prematurely, so they cannot secrete stress hormones without the go-ahead from the nervous system. The result, says Slotkin, is a child with "no defenses against low oxygen until nerves innervate his adrenal glands around his first birthday."

Slotkin's results may allow researchers to check adrenal function and identify infants likely to suffer from SIDS, says Marian Willinger of the National Institute of Child Health and Human Development in Bethesda, Md. *— L. Seachrist*

Feeding microbes to get rid of nitrates

Many sources of drinking water, polluted by fertilizers and other contaminants, contain high concentrations of nitrate, which studies have shown to cause cancer in humans. No simple method exists for removing nitrates, and groundwater rich in this contaminant has little use except on crops.

Now, researchers at the Department of Agriculture's Agricultural Research Service (ARS) in Fort Collins, Colo., say they may have a technique for reducing nitrate concentrations by supplying corn or soybean oil to microbes living in aquifers.

To survive, the microorganisms require carbon and either nitrate or oxygen to oxidize the carbon. Adding oil to nitrate-rich water provides a source of extra carbon that enables the microbes to make use of the abundant nitrogen, report William J. Hunter and Ronald F. Follett in the July AGRICULTURAL RESEARCH. Microbes convert most of their nitrate supply into harmless nitrogen gas.

Follett and Hunter tested their idea for groundwater cleanup by injecting oil into glass tubes containing sand and water from a polluted aquifer. The researchers then pumped the water slowly through the tubes. The water had 14 to 19 milligrams of nitrate-nitrogen (the nitrogen present in nitrates) per liter, which exceeds the safe concentration of 10 milligrams per liter, says Follett.

The oil became embedded in the sand, where it and the microbes formed an organic filter in the tube. Within 1 to 2 days of the oil infusion, the microbes began removing nitrates from the water that passed through the tube. As long as they had enough oil, the microbes kept nitrate concentrations to almost zero for the year-long experiment.

One gram of oil enabled the microbes to remove 260 milligrams of nitrate-nitrogen from 26 liters of water, the ARS team calculates.

An oil-based approach to removing nitrogen could have pitfalls, the scientists acknowledge. The microbe-oil filter could plug up pores in aquifers; make water taste or smell bad or be totally undrinkable; or pollute water with nitrites, a dangerous by-product of denitrification, they note.

The researchers hope to conduct field tests, in which they will either inject a mixture of oil and water near the base of a well or force oil down a well, says Hunter. They may also devise an above-ground water filter that uses oil.

"Overall, I think it's an intriguing concept," says Ralph S. Baker of ENSR Consulting, Engineering, and Remediation in Acton, Mass. However, "there's a lot of work to do to make something like this effective," he warns, citing particularly the concerns about clogging and nitrite production.

Battelle Memorial Institute, a research group in Richland, Wash., has a patent on a similar oil-based system for removing nitrates from water. A Battelle scientist, formerly with ARS, came up with the idea for the technology, but the institute has not formally tested it, says Glendon W. Gee of Battelle. The institute is looking for a commercial partner to help develop the system.

Other researchers have used bacteria to remove heavy metals and organic chemicals from damp soil. One group grows bacteria on blankets of coconut hull fibers that it then lays on contaminated areas (SN: 3/4/95, p.138).

— T. Adler