

## Study says Prescription Meds Polluting Waters

Findings presented at the first major American symposium on pharmaceuticals in water, held as part of the American Chemical Society's spring national meeting in San Francisco last week, said that water pollution by drugs "is a newly emerging issue," according to Christian G. Daughton, a symposium co-organizer and chief of environmental chemistry at the Environmental Protection Agency's National Exposure Research Laboratory in Las Vegas. EPA scientists examining the sludge from a U.S. sewage-treatment plant 20 years ago found that the incoming sewage contained excreted aspirin, caffeine, and nicotine. At about the same time, the cholesterol-lowering drug clofibric acid turned up in a groundwater reservoir being used by the Phoenix, AZ area. The drug had entered with treated sewage, which the city had been using to replenish the aquifer. Experts at that time didn't pay attention to the finding. It should have been a wake-up call, experts now argue, because if clofibric acid could pass through a sewage-treatment plant and percolate through soil unscathed, so could a host of other drugs.

Now new studies by Chris Metcalfe of Trent University in Peterborough, Ontario, reports finding a broad mix of drugs, including anticancer agents, psychiatric drugs, and anti-inflammatory compounds. "Levels of prescription drugs that we have leaving sewage-treatment plants in Canada are sometimes higher than what's being seen in Germany," he says.

He explains that many North American cities employ more rudimentary sewage treatment than those in Germany. Daughton observes also that some 1 million U.S. homes send their essentially untreated sewage directly into the environment.

Two years ago, the symposium's other co-organizer, Thomas A. Ternes, documented unexpectedly high concentrations of drugs "many measured in parts per billion (ppb)" both in raw sewage and in water leaving treatment plants in Germany. The chemist, who is at the Institute for Water Research and Water Technology in Wiesbaden, Germany, now finds that these drugs enter groundwater.

Sewage effluent can amount to at least half the water in many of Germany's smaller rivers, he notes. Groundwater fed by streams carrying relatively undiluted effluent can be tainted with 1 ppb carbamazepine, an anticonvulsive drug. Ternes has also detected similar amounts of the anti-inflammatory drug diclofenac and up to 2.4 ppb of iodine-based drugs used to improve contrast in X rays.

Because people discard their excess drugs, the town dump can also be a source of pharmaceutical pollution. Under one landfill, Ternes found groundwater tainted with 12 ppb clofibric acid and 1 ppb phenazone, an analgesic.

The latter medication also turned up in groundwater "but at far higher concentrations" under a leaking dump in Zagreb, Croatia, notes Marijan Ahel of the Rudjer Boskovic Institute in Zagreb. Some of his water samples had the drug at as much as 50 times the concentration detected by Ternes.

In the United States, federal scientists recently began probing another source of drug pollution's large feedlots for livestock. An estimated 40 percent of the antibiotics produced in the United States is fed to livestock as growth enhancers. Geochemist Mike Meyer of the U.S. Geological Survey in Raleigh, N.C., and his colleagues have begun looking for antibiotics in hog-waste lagoons.

Three drugs frequently show up, one in concentrations approaching 1 part per million. The same three antibiotics, which are also prescribed for people, often appear in local waters, though usually only at one-tenth to one-hundredth the concentrations in the lagoons, Meyer notes. "So, it

appears we're getting transport of these antibiotics into surface and groundwater's," he told Science News.

His colleagues at the Centers for Disease Control and Prevention in Atlanta have begun sampling bacteria from the tainted waters to investigate their responses to the antibiotics present, Meyer says. Their findings could begin to resolve a long-standing question: What is the contribution, if any, of livestock to potentially dangerous reservoirs of bacteria resistant to common antibiotics?

Traces of drugs are sometimes making it all the way into tap water. Thomas Heberer of the Technical University of Berlin reported finding traces of at least three pharmaceuticals in samples from his home tap. The concentrations, however, were near the limits of detection, a few parts per trillion. Moreover, he found that running this water through an activated-carbon filter removes all vestiges of the drugs.

Ternes' studies confirm that two disinfection agents "activated carbon and ozone" which are used in many European drinking-water plants, generally remove any traces of drugs. It's because these relatively costly technologies aren't employed for treating sewage, he notes, that a large share of the drugs flushed down toilets can reach open waters.

To date, the symposium's scientists noted, few if any toxicological studies have evaluated risks posed by chronic exposure to trace concentrations of drugs. Most of the participants suspect, however, that the biggest risks face aquatic life, which may be bathed from cradle to grave in a solution of drugs of increasing concentration and potency.

David Epel of Stanford University's Hopkins Marine Station in Pacific Grove, Calif., expressed special concern about new drugs called efflux-pump inhibitors. Designed to keep microbes from ejecting the antibiotics intended to slay them efflux-pump inhibitors also impede the cellular pumps that nearly all animals use to get rid of toxicants, he says. If pump-inhibiting drugs enter the aquatic environment, Epel worries that they might render wildlife vulnerable to concentrations of pollution that had previously been innocuous.