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NORTH COUNTY TIMES

**Monday, March 10, 2008**

# Around the world, research shows pharmaceuticals in water could impact human cells

Troubled by drugs discovered in European waters, poisons expert and biologist Francesco Pomati set up an experiment: He exposed developing human kidney cells to a mixture of 13 drugs at levels mimicking those found in Italian rivers.

There were drugs to fight high cholesterol and blood pressure, seizures and depression, pain and infection, and cancer, all in tiny amounts.

The result: The pharmaceutical blend slowed cell growth by up to a third - suggesting that scant amounts may exert powerful effects, said Pomati, who works at the University of New South Wales in Sydney, Australia.

Taken alone, this was a modest study. But in fact Pomati's work is part of a body of emerging scientific studies that indicate that over time, humans could be harmed by ingesting drinking water contaminated with tiny amounts of pharmaceuticals.

In another recently published study, Pomati discovered that some of those pharmaceuticals could amplify -- or reverse -- the effects of some others.

For example, the cholesterol drug bezafibrate and asthma drug salbutamol each seem to stimulate cell growth. Combined in the laboratory, they slowed it way down. The same cholesterol drug appeared to make cells more sensitive to harm from the antibiotic fluoroquinolone.

And Pomati's work indicates some drugs cause cellular effects at scant concentrations that -- strangely -- cannot be seen at higher levels.

Such findings are preliminary; they alone cannot demonstrate the same effects within the human body. But they provide scientific hints, just like cellular experiments that routinely guide discovery of new drugs.
They also heighten worry about the possible effects on especially vulnerable groups, like the very young, old or sick. "My wife is pregnant, and I don't let my wife drink the water ... where I know that there are pollutants like pharmaceuticals in concentrations that are detectable and in mixtures that are complex," Pomati said.

Elsewhere in the world, other researchers are finding results similar to Pomati's.

In research awaiting publication, human breast cancer cells grew twice as fast when

exposed to estrogens taken from catfish caught near untreated sewage overflows in Pennsylvania, compared with other fish.

The University of Pittsburgh researchers didn't calculate how much effect came from pharmaceuticals instead of natural hormones, but their earlier work points to birth-control pills and hormone treatments as important contributors, said lead researcher Conrad Volz.

"There is the potential for an increased risk for those people who are prone to estrogenic cancer," said Volz, who studies environmental hazards at the university's Cancer Institute.

He said people who regularly drink water containing low levels of hormones may be at higher risk, because they would presumably consume more of these drugs than those who only occasionally eat such fish.

Scientists at the Helmholtz research center in Leipzig, Germany, linked low levels of the pain reliever diclofenac to an inflammatory-like response in human blood cells, according to biologist Kristin Schirmer. Inflammation at the wrong time and place plays a role in conditions ranging from infections and arthritis to heart disease.

Sandra Steingraber, a biologist at New York's Ithaca College, adds that many efforts to determine how trace drugs affect humans don't fully consider the whole range of pharmaceuticals in the environment and whether someone has been exposed at more susceptible times, like during childhood or old age.

"The timing makes the poison as much as the dose," she said. "And the dose itself is not the dose from just any one thing -- it's from this whole kaleidoscope of chemicals."

Taking notice of accumulating evidence, the drug industry has backed studies of its own in recent years that have found very slight, if any, risk to humans.

But these studies haven't used water samples analyzed for drugs. Instead, the studies estimate danger from what's known about how much of a drug is sold and how toxic it is to animals. Then, safety margins are added for unknowns, such as possible effects of decades of exposure.

Those margins are just educated guesses. Also, the studies usually ignore what might happen to people exposed to the complex combinations of medicines that are often found in drinking water.

Then, there are the byproducts of the drugs. When medications are digested and processed through water treatment plants, they may take a new metabolic form.

"They miss some of the big issues. Our research shows mixtures are so prevalent," said Dana Kolpin, a U.S. Geological Survey water expert who launched a plethora of research in 2002 after finding pharmaceuticals in most samples taken from 139 streams in 30 states. "If there are any cumulative or additive issues, you can't just dismiss things so quickly."

Even if Kolpin is right, the industry may be focusing on the wrong pharmaceuticals, said chemist James Shine at the Harvard School of Public Health, who oversaw what's probably the broadest risk review yet, a yet-to-be-published study covering scores of the most common drugs sold in the United States.

As suspected, some chemotherapy drugs turn up high on that list. But blood-pressure diuretics, though rarely considered, appear to pose more risk than many drugs more often evaluated.

Even when researchers downplay risk, that may not be the final word.

People "are going to be concerned about being medicated by mandate when you turn on the tap," said Dr. Stevan Gressitt, a psychiatrist who's led a push for a program in Maine that allows consumers to turn in unused pharmaceuticals for secure disposal or destruction. "And that's going to be seen if the level is (only) one molecule in 100 taps."