

What happens when minnows take a chill pill?

By TOM MEERSMAN, Star Tribune

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That dose of Prozac, Effexor, Wellbutrin, Zoloft or Zyban doesn't disappear once you swallow it.

Some of it flows through your body into toilets, sewer lines, wastewater treatment plants and eventually into lakes and rivers.

Multiply that by millions of people, and tons of diluted but biologically active drug residues end up in the drink.

"We don't have a clue about how these drugs really behave together," said Melissa Schultz, assistant chemistry professor at Wooster College in Ohio.

Scientists at St. Cloud State University want to answer some of those questions by studying what happens to fathead minnows when they're exposed to antidepressants. The results have been surprising.

They've found that fish eggs and hatchlings doused with drugs are more laid back than those raised in cleaner water. That may be a death sentence in nature; they could be gobbled up by larger fish before they can escape, said Meghan McGee, a graduate student in cellular and molecular biology.

At St. Cloud State's aquatic toxicology lab, McGee works with lab director Heiko Schoenfuss, an anatomy professor who has been studying pharmaceuticals and fathead minnows for several years.

In the latest experiment they raised hundreds of eggs and hatchlings under different concentrations and combinations of anti-depressants. One by one, McGee placed a 12-day-old minnow, a quarter-inch sliver of silver, into a petri dish. She then activated a microvibrator at the bottom of the dish to create waves to simulate an approaching predator and counted how many milliseconds the minnow took to react.

"We literally mounted a little vibrator chip that came out of my wife's cell phone," said Schoenfuss. "She wasn't too happy about that, but it worked like a charm."

Science in super slo-mo

The minnows' response to water movement is so rapid that the researchers used a camera that records 1,000 frames per second. McGee analyzed frames of each minimovie to determine precisely when each hatchling responded to the vibration, which involves curling its body into a C-shape before shooting away like a spring in the opposite direction. She found that those exposed to antidepressants for five days as eggs or

during 12 days after hatching were almost twice as slow to react as those raised in clean water.

"If you're a fish living downstream of a wastewater treatment plant, you're not just getting a single dose of Prozac, you're getting several antidepressants, antibiotics, estrogen, birth control pills and other compounds," said Schultz, who developed the analytical techniques being used in St. Cloud.

Schultz's techniques allow antidepressants to be detected in parts per billion and parts per trillion, said Schoenfuss. That's far different from traditional aquatic toxicology, which takes a "kill 'em and count 'em" approach to determining lethal doses and extrapolates what concentrations are safe to use in pollution permits, he said.

In the latest experiment, presented at a scientific conference last month and soon to be published, each group of fathead minnows was exposed to one of four antidepressants at one of three concentration levels. Another group of hatchlings was exposed to a combination of all four drugs. The concentrations of antidepressants were based on values found in the Mississippi River downstream of the metro wastewater plant in St. Paul, and in other rivers.

Other surprises surfaced

Some other noteworthy findings: A couple antidepressants apparently caused hatchlings to grow 25 percent larger than average. Some of his other research has shown that males exposed to some antidepressants were "feminized" and developed proteins normally made only by egg-laying females.

What all of this means is unclear, said Schoenfuss, except that pharmaceuticals even at extremely low concentrations can affect growth and development of very young and adult fish.

To test whether the hatchlings with slower response rates are truly at greater risk, the next phase of research will put the hatchlings into tanks with predator bluegills and measure which minnows are the better escape artists. Schultz will also analyze some St. Cloud specimens to learn whether antidepressants change fish brains.

Schoenfuss said the science of emerging contaminants in water is so new that each study seems to produce more questions than answers. It's impossible to know yet whether pharmaceuticals affect the genetics of fish and their long-term health, he said, or whether they get into the food chain or drinking water supplies at levels of concern, and what the minute concentrations will mean for wildlife or human populations in the long run.

"I see it less as a reason to panic and more of a cautionary tale," said Schoenfuss. "Whatever we put into the water usually comes back to haunt us."

Tom Meersman • 612-673-7388