

# Study: Diabetes drug affecting fish in Lake Michigan

January 16 2015, by Keith Matheny, Detroit Free Press

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Researchers have found that pharmaceuticals and personal-care byproducts persist at low levels miles from sewage discharge pipes in Lake Michigan. And a study from the University of Wisconsin-Milwaukee shows that the most prevalent drug in the lake - the Type 2 diabetes medication Metformin - changes the hormonal system of fish exposed to it.

But what long-term effects it may have on fish and their ability to reproduce are unknown.

In the research group's latest study, fathead minnows were exposed to Metformin at the levels found in Lake Michigan for four weeks. Male minnows showed disruption of their endocrine systems, producing a chemical messenger usually associated with females' egg production, said Rebecca Klaper, a professor and research scientist at the university's School of Freshwater Sciences.

She co-authored a 2013 paper that found that Metformin and other products persist in Lake Michigan, including the birth control pill hormone progesterone and sulfamethoxazole, an antibiotic used to treat urinary tract and ear infections.

The drugs are not completely broken down by people's bodies after ingestion, are excreted and then are not fully removed by [wastewater treatment](#) processes. The flushing of old pharmaceuticals down the toilet contributes to the problem.

"It's enough to raise an alarm bell that this might be something that causes changes in reproduction of fish," she said. "It's something that definitely warrants further study."

The levels of the products are relatively minuscule - micrograms and nanograms per liter of water, Klaper said. A microgram is one-millionth of a gram; a nanogram is one-billionth of a gram. What, if any, effects they have - individually or mixed together in the [lake](#) - are not well understood, she said.

Of all the drugs researchers tested for in Lake Michigan, Metformin is found at the highest concentrations, at up to 40 parts per billion. More than 60 million Metformin prescriptions were dispensed in the U.S. in 2013, according to drug market research firm IMS Health.

"It wasn't something we had really thought about before," Klaper said. "But there are a lot of people with Type 2 diabetes, and it's a very common medication to be prescribed."

The Metformin enters wastewater treatment plants at 40 parts per billion and is found at levels between 100 and 200 parts per trillion two miles out in Lake Michigan, Klaper said.

"The [sewage treatment plant](#) is taking out a significant amount of the medication, but it's just that it's coming in at such a high concentration, it doesn't remove it all," she said. "A sewage treatment plant wasn't designed to take these medications out."

Doing something about that would be a monumental task. Metformin is the most prescribed treatment for the millions of Americans with Type 2 diabetes. And providing sophisticated-enough filtration systems for wastewater treatment plants to remove the drug and other personal-care products is impractical.

"It's very difficult - wastewater [treatment plants](#) aren't designed to treat nanoparticles," said Timothy Lynch, manager of the Benton Harbor-St. Joseph Wastewater Treatment Plant on the shores of Lake Michigan. The plant serves about 60,000 homes and treats about 9 million gallons of waste per day.

"To retrofit with that type of technology would be very expensive, and are the paybacks for what you are accomplishing worth the cost? For most facilities and most governmental units, just maintaining the existing infrastructure is a challenge."

Klaper said future study will look at how fish are affected over a longer term of exposure.

"We also need to explore other compounds," she said. "This was just one of many. What happens when these are in a mixture? Which ones are the ones to focus on and get rid of? Then we've got a starting point."

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