ENVIRONMENT

How amphetamine use may be affecting our waterways

Chelsea Harvey
Of The Washington Post

New research has added to the growing body of evidence that chemicals we put in our bodies end up in our waterways — with noticeable consequences.

A new study, published in the journal Environmental Science & Technology, explores what happens when amphetamine enters the ecosystems encompassing streams and finds the drug can have significant effects on the bacteria, algae and insects who call them home.

The fact that drugs are turning up in our waterways isn't news. Numerous studies through the years have revealed all kinds of substances in our water supplies, from caffeine to cocaine. The chemicals are most likely being transported via sewage systems after they're excreted in urine or when people decide to flush unwanted drugs away.

And scientists are starting to pay attention to the kinds of effects these chemicals can have when they turn up in streams and other aquatic ecosystems. Studies have suggested that birth control pills, for instance, can hurt the ability of fish to reproduce.

The effects of various drugs in the waterways is an area of special interest for Emma Rosi-Marshall, an aquatic ecologist at the Cary Institute of Ecosystem Studies and a co-author of the new amphetamine study. She's been involved in research on the effects of everything from antihistamines to antidepressants on stream ecosystems.

Several recent studies on waterways around the world have detected the presence of amphetamine, a potent stimulant used in a variety of pharmaceutical compounds to treat ADHD, as well as in a number of illicit drugs.

So she and her team decided to test six stream sites around Baltimore to see what chemicals might show up. Sure enough, amphetamine was present, along with caffeine, acetaminophen, at least one type of antihistamine and an agent for combating parasites. The amount of amphetamine in the water varied from one site to the next — the site with the lowest concentration contained just 0.003 micrograms per liter of water, while the site with the highest contained 0.63 micrograms per liter.

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Next, the researchers set up a series of eight artificial stream environments to investigate effects of amphetamine on aquatic organisms. They added 1 microgram per liter to four of the environments and left the other four alone. The amount of amphetamine used in the experiments was higher than researchers observed in the Baltimore streams, but it's a concentration Rosi-Marshall said is considered "environmentally relevant," meaning it could show up in real-life ecosystems.

The researchers monitored the artificial streams for three weeks to investigate amphetamine's effects on organisms including bacteria, algae and insects. By the end of three weeks, they found significant differences between the treated and untreated streams.

For instance, microorganisms in the amphetamine-treated streams produced less chlorophyll — a chemical essential to photosynthesis — and seemed to produce and use less energy overall. Many tiny organisms in bodies of water, such as phytoplankton and algae, get their energy through photosynthesis. These organisms are vital to the health of natural ecosystems, serving as primary food sources to larger animals.

Algae and bacteria communities in the amphetamine-treated streams also had significant differences in the types or numbers of species present. The researchers also observed that aquatic insects in the amphetamine-treated streams tended to emerge from the water more frequently, especially in the first and third weeks of the experiment.

The researchers did not continue to add amphetamine to the experimental streams after they initially put it in — and, in fact, they observed that the amount of amphetamine in the water declined over the course of the experiment. It's unclear what happened to it, but one theory is that it was absorbed by the living organisms in the stream.

The showed amphetamine has an effect — but whether that means negative consequences for the stream remains to be seen.

Rosi-Marshall said that in real-life situations, it's unlikely that amphetamine would be the only chemical in the water.

"We know, as humans, that if you take one drug and add another drug, these drugs can interact," she said. "Out there in the environment, we don't really understand how these drugs (interact) with one another to influence the ecology of fresh water."