Puget Sound Mussels Contain Opioids, Antidepressants, and Chemotherapy Drugs

The biannual Puget Sound mussel monitoring study found that three of eighteen samples of native bay mussels contained trace amounts of oxycodone, the chemotherapy drug Melphalan, and antidepressants. Scientists from the Washington Department of Fish and Wildlife (WDFW) transplant uncontaminated mussels to various locations in the Seattle and Bremerton harbors and check them two to three months later. It is not unusual for pharmaceuticals and illegal drugs like cocaine to be found during these surveys, but this is the first time scientists have found opioids. Jennifer Lanksbury is a biologist at the WDWW.

> *What we eat and what we excrete goes into the Puget Sound…It's telling me there's a lot of people taking oxycodone in the Puget Sound area."*

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How Do They Get There?

Opioid use in the U.S. has spiraled out of control, with deaths from pharmaceutical versions, heroin, and fentanyl nearly tripling since 2002. Finding evidence of that crisis in our waterways is a when, not an if. But how does that happen?

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The biggest culprits are wastewater plants discharging into the bay. Opioids enter the waste stream through human excrement and improperly disposed of pharmaceuticals (flushing

them). An earlier study in the Great Lakes found that wastewater treatment facilities were only able to remove half of the prescription drugs that enter the plant. A quarter of chemicals had low removal rates, where there was less than 25 percent chance of removing 75 percent or more of the drug. Runoff from agricultural sources is also a contributor to the presence of harmful chemicals in aquatic environments.

What Do the Fish Think?

The bay mussels are not likely to metabolize these opioids, especially in the trace amounts found, but what about other fish? Zebrafish, although not a resident of the Puget Sound, learn how to dose themselves with opioids, and scientists surmise that salmon and other native species will have similar reactions. The effects of these drugs on the aquatic population will likely be more clear as the opioid crisis continues to gain momentum.

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The opioids were found in trace amounts, but the chemotherapy drug Melphalan was found in doses that correspond to a recommended dose in humans. This drug interacts with DNA and is a carcinogen. The National Institutes of Health notes that

> *…There is sufficient evidence for the carcinogenicity of melphalan from studies in experimental animals. When administered by intraperitoneal injection, melphalan caused cancer of lymphatic tissue (lymphosarcoma) in male mice, lung tumors in mice of both sexes, and cancer of the abdominal cavity (sarcoma of the peritoneum) in rats of both sexes…”*

Water At Risk

Water is our most precious resource, and we have not been good stewards of it. The ecosystem that keeps our bodies of water

and our very planet healthy is constantly being changed and manipulated without a way to correct for the changes. This is the first evidence of opioids in the water, but other drugs have become commonplace as we see with the Melphalan. There are no procedures in place to keep the same thing from happening with opioids.

Sources:

- *Bay Mussels in Puget Sound Show Traces of* Oxycodone – Puget Sound Institute
- *Mussels off the coast of Seattle test positive for opioids* – CBS News
- *Overdose Death Rates* – National Institute on Drug Abuse
- *Melphalan* – National Institutes of Health Report on Carcinogen
- *Only Half of Drugs Removed by Sewage Treatment* – Scientific American