A Solution to Pharmaceutical Pollution?

Today, pollution is shifting so that it is not merely something out there (smog, tons of plastic suspended in the ocean) but also something inside each and every one of us, spread by our shared experience of air, water, and food. The term "body burden" refers to the hundreds of chemicals now found in the average citizen around the world, chemicals that did not exist in our bodies before World War II. Some of these chemicals have been shown to cause organ damage as well as cancer in various studies. There is no escape from pollution, but there may be possible solutions if we pay attention.

Last year, four engineering students at Ryerson University won an award for their final year project—designing a process to remove residual pharmaceuticals from wastewater. As someone concerned about residual drugs in our sewage, I was very excited to learn of their work. So, I tracked down Reuben Fernandes, Kirill Cheiko, Charles Gilmour and Pawel Kita, and asked them a few questions about their project.

They've all graduated. Fernandes will study public policy next year, and Gilmour has gone on to graduate studies, where he is investigating mutagens that form in wastewater. Cheiko is working for a consulting engineering company designing water treatment systems for industrial and municipal sectors, while Kita is working at an automotive company. All of them want a chance to build a laboratory prototype to test their design, and they recently shared their work at the Northeast Water Science Forum in Portland, Maine, this April.

The three-stage process they developed uses commercially available technologies—such as advanced screening, a Canadian hollow-fiber membrane system, and a UV light/hydrogen peroxide reactor—but what is unique is that this particular combination removes traces of pharmaceuticals. Conventional wastewater treatment plants were not designed to handle everything from antibiotics to cancer drugs, pain relievers, and endocrine disruptors.

They chose seven representative compounds from five pharmaceutical/EDC families that are the most toxic and/or concentrated in wastewater, and methodically set out to remove them. Given the hundreds, possibly thousands of different drugs in the water, this is no mean challenge. Cheiko would like their system to target hospital wastewater, where such drugs are particularly concentrated. Having seen my own hospitalized family members ingest strong anti-cancer drugs that should not even be touched, and then flush their toxic wastes into municipal waters, I appreciate their focus on hospitals.

Gilmour explains, "With enough time or energy, organic compounds (which these drugs are) will keep breaking down until they reach the base level of becoming water and carbon dioxide, which is ideally the goal." While the process they've designed takes a bit longer than conventional treatment, it can remove more than 90% of pharmaceuticals and endocrine disruptors.

I asked them if they'd had any surprises in doing their team project. Cheiko says, "I was

surprised that the effects of the residual pharmaceuticals on wildlife are pretty well known, yet little is being done to remediate the situation." Deformed, intersex fish affected by this pollution have been found from the Potomac watershed (Washington DC, 2003) to Puget Sound (Seattle) to Lake Mead (Las Vegas), as well as high rates of dead fish in some cases.

Given these effects, it's logical to ask what's in store for humans too. Gilmour argues persuasively for a precautionary principle—it being more cost-effective to reduce these chemicals as quickly as possible, rather than to wait to find out the costs to our health and environment. This happened with ozone and the Montreal Protocol in 1989, which is estimated to have saved billions of dollars in economic and environmental disruption. In light of all the malformed fish, it is also surprising that there doesn't seem to be more urgency among our leaders to address this very real problem.

Some of these drugs, such as endocrine disruptors, can have effects at very low concentrations. What's more, the cumulative effect of all these chemicals mixing and interacting remains anyone's guess. "This is a serious problem, one that will only get worse in the foreseeable future if action is not taken soon," says Fernandes. Perhaps more municipalities should be talking to these guys, who are working on real solutions. While preventing these chemicals from entering the wastewater is one real step more people can take, I don't see our meds disappearing from hospitals anytime soon, so this project deserves more public support.