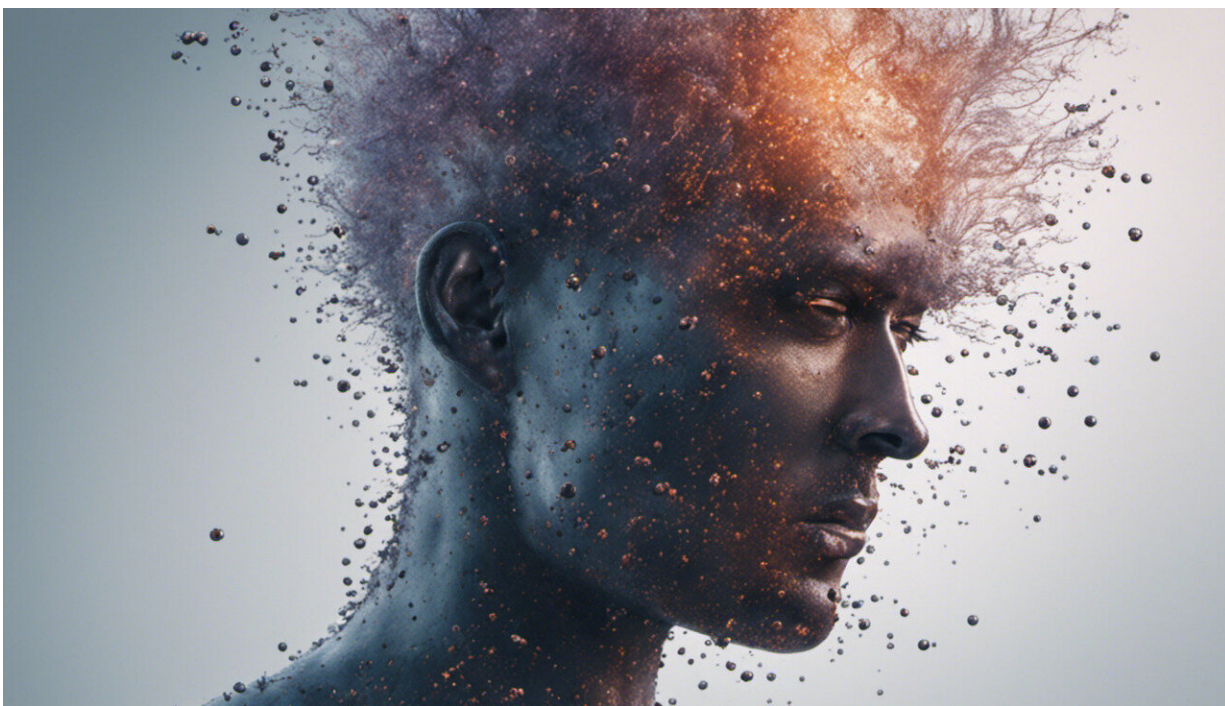


Researchers study polar bear poop to learn how chemicals are trapped in the body

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Credit: AI-generated image ([disclaimer](#))

A new University of Toronto study is using polar bear scat to reveal how certain chemical contaminants can become trapped—and build up—inside the body.

Polar bears are prone to storing certain contaminants in their bodies

because they are at the top of the food chain, have a very fatty diet and have evolved to absorb high amounts of fat.

"They're like a trap for these chemicals," says Frank Wania, a professor in department of physical and [environmental science](#) at U of T Scarborough who was one of the study's authors.

"Their contaminant intake is very high, but their ability to expel it is very low."

For the study, published in the journal *Environmental Science & Technology*, Wania and Ph.D. student Yuhao Chen developed a new method to study how certain chemicals, called polychlorinated biphenyls (PCBs), accumulate inside polar bears from contaminated food. They analyzed the diet and fecal samples of polar bears from the Toronto Zoo to see what quantity of PCBs get trapped compared to how much gets excreted.

Polar bears experience what's known as bio-magnification, where greater levels of toxins accumulate higher up in the food chain. Since polar bears are at the top, they've consumed the highest level of contaminants in their diet. (A [polar bear](#) has higher levels of contaminants than the seal it eats, the seal has more than a cod, the cod more than a small fish etc.)

Researchers also found that PCBs tend to bio-magnify at a higher rate in polar bears because of their high-fat diets and the capacity of their digestive system to absorb those lipids.

While animals and humans are generally good at expelling most chemicals that shouldn't be in the body, some contaminants are harder to get rid of due to their properties. Ones that are lipid-soluble and persistent, including the pesticide DDT and certain types of PCBs, can

build up in body tissue because they cannot be broken down or excreted easily in the digestive system.

Sarra Gourlie, supervisor of nutrition science at the Toronto Zoo who provided the dietary and fecal samples for the study, says polar bears have evolved to absorb nearly all the fat they eat—mostly from seal blubber.

"They're able to extract about 97% of fat from their diet, so very little of it actually gets excreted," she says.

The polar bears at the Toronto Zoo aren't fed wild seal blubber, which can contain high levels of PCBs. Chen says the that polar bears living in the wild have much higher levels of contaminants than ones at the zoo, which have a cleaner [diet](#).

He says it's important to monitor these contaminant levels because of the harm they can cause. Studies have linked high levels of PCBs in wild polar bears to lower levels of testosterone, which can impact reproduction. It's also been linked to disruptions of the immune and endocrine systems, which may lower survival rates.

"The levels of PCBs have been found to exceed levels of concern to the point where they are expected to have a negative impact on [polar bears](#) living in the wild," says Wania.

PCBs are a group of highly [toxic chemicals](#) that have been banned globally, but can last a long time in the environment. While the researchers only looked at PCBs in this study, they say the approach might also help in monitoring other chemicals trapped through bio-magnification.

Noninvasive method for top predators and humans

The traditional way of studying bio-magnification relies on analyzing tissue, which can only be done on dead animals or humans. As a result, there is virtually no research on bio-magnification in humans or endangered apex predators. The researchers hope the method they've developed can be used on other apex predators in the wild such as lions or tigers.

It might also be used on humans. Chen says he is currently looking into analyzing food and fecal samples from different people to see how contaminants can bio-magnify inside the body and whether there are differences between individuals.

"We know these contaminants are in humans, and we know how the body absorbs these contaminants," he says.

"What we don't know is how much of these [contaminants](#) are stored or expelled by our body when we eat a certain amount of food that is contaminated."

More information: Yuhao Chen et al, Probing the Thermodynamics of Biomagnification in Zoo-Housed Polar Bears by Equilibrium Sampling of Dietary and Fecal Samples, *Environmental Science & Technology* (2022). [DOI: 10.1021/acs.est.2c00310](https://doi.org/10.1021/acs.est.2c00310)

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