

Bringing Cancer to the Dinner Table: Breast Cancer Cells Grow Under Influence of Fish Flesh

Tests of river fish indicate their flesh carries enough estrogen-mimicking chemicals to cause breast cancer cells to grow.

Many streams, rivers and lakes already bear warning signs that the fish caught within them may contain dangerously high levels of mercury, which can cause brain damage. But, according to a new study, these fish may also be carrying enough chemicals that mimic the female hormone estrogen to cause breast cancer cells to grow. "Fish are really a sentinel, just like canaries in the coal mine 100 years ago," says Conrad Volz, co-director of exposure assessment at the University of Pittsburgh Cancer Institute's Center for Environmental Ecology. "We need to pay attention to chemicals that are estrogenic in nature, because they find their way back into the water we all use." Volz and colleagues, including biochemist Patricia Eagon, took samples from 21 catfish and six white bass donated by local anglers as part of a study presented at the American Association for Cancer Research meeting in Los Angeles this week. The fish were caught in five places: a relatively unpolluted site 36 miles upstream from Pittsburgh on the Allegheny River; an industrial site on the Monongahela River; an Allegheny site downstream from several industries that release toxic chemicals; and the confluence of the Allegheny and Monongahela rivers, where Pittsburgh dumps much of its treated sewage and sewer outflows. "This is the largest concentration of combined sewer outflows in the U.S.," Volz notes, about the confluence, known as the Point. The researchers also bought several fish at the store as controls.

Using an organic solvent, the researchers created an extract from the skin, flesh and fat of the various fish. They then bathed a breast cancer cell line—known as MCF-7—in the extract. "We used this cell line because it has estrogen receptors in it, meaning that if estrogens are present it causes this cell line to proliferate," Volz explains. "If you put something on it and it grows, then it must be stimulating the estrogen receptor." In addition to responding to pure estrogen applied as a positive control, the extract from two of the white bass and five of the catfish caused the breast cancer cells to thrive.

The highest response came from fish caught in the industrial section of the Monongahela River. "The Monongahela River area is the area in Pittsburgh that was the site of most of the steel production over the last 100 years," Volz says. "That area is still an industrial beehive." But the broadest response came from where the sewer outflows and sewage treatment plants flow into the rivers from Pittsburgh; three of the four catfish caught here caused the breast cancer cells to proliferate. "Sewage might be more responsible for putting estrogenic chemicals in the water than the industries alone," Volz adds. "All of the hormone replacement products that women use go down the drain, along with birth control pills, antibacterial soaps, and many of the plastics we use, like Bisphenol A, have such effects."

It remains unclear exactly what estrogen-mimicking chemicals were actually present in the fish and what kind of cancer-causing role they might have. But their effects on the

fish themselves were clear: the gender of nine of the fish could not be determined. "Increased estrogenic active substances in the water are changing males so that they are indistinguishable from females," Volz says. "There are eggs in male gonads as well as males are secreting a yolk sac protein. Males aren't supposed to be making egg stuff."

And this estrogen burden is widespread. The store-bought white bass caused breast cancer cells to grow like its river-caught counterparts (as well as containing higher levels of mercury, arsenic and other contaminants) after being trucked to Pittsburgh from Lake Erie. "These fish, again, were in waters that were seeing industrial waste as well as possible combined sewer outflows," Volz notes. "This isn't just happening in Pittsburgh, this is happening everywhere in the industrialized world."

Volz says he and his fellow researchers are launching a broader survey this summer that will entail sampling fish all along the Allegheny River. Efforts will be made to determine if it is industrial waste, sewage or agricultural runoff—or all three—that is responsible for the problem. In the meantime, cooking the fat out of fish may be the best defense. "If you broil fish and let the fats drip out that will take most of the contaminants out," Volz says, though that may not be enough given other exposures to potentially tainted water. "What our study does show us is that there is exposure potential to vast populations that use water from our rivers as their drinking water supply."