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Limb diformities caused in frogs by exposure to atrazine
Science

Common Weedkiller Causes Reproductive Issues in Humans

The effects of atrazine

Weedkiller was already known to cause reproductive issues in frogs and fish. Now it turns out that atrazine, the second most widely used weedkiller in the U.S., has also been connected to impaired hormonal signaling in human cells, as revealed by a new research made at the University of California San Francisco (UCSF) and published in the "PLoS ONE" journal.

This herbicide is employed on corn and sorghum fields, but also on suburban lawns and gardens. The E.U. banned this chemical after several studies revealed it was connected to endocrine disruptions in fish and amphibians.

The new research showed that in cultured human placental cells, a 24-hour exposure to atrazine boosted the activity of a gene whose over-expression can induce abnormal birth weight. Atrazine also boosted the activity of another gene that acts exactly like in the uterus of women with unexplained infertility.

Studies performed on zebrafish had previously shown that atrazine "feminized" the fish population, spurring the number of embryos that developed in females. Waters contaminated with atrazine levels similar to those from agricultural runoffs doubled the ratio of female fish. In frogs, atrazine causes limb deformities.

"These fish are very sensitive to endocrine disrupting chemicals, so one might think of them as 'sentinels' to potential developmental dangers in humans. These atrazine-sensitive genes are central to normal reproduction and are found in steroid producing tissues. You have to wonder about the long-term effects of exposing the rapidly developing fetus to atrazine or other endocrine disruptors," said senior author Dr. Holly Ingraham, a UCSF Professor of Cellular and Molecular Pharmacology.

The new study showed that atrazine turns on, preferentially, a type of receptors in the cell nucleus, including SF-1 and LRH-1. SF-1 is involved in the synthesis of enzymes controlling steroid production in the body and the growth of many endocrine tissues. One of these enzymes is Aromatase, which in lower vertebrates (fish and amphibians) induces the female development of the embryo, unbalancing the gender ratio.

The genes activated by atrazine in human placental cell cultures are involved in hormone signaling and steroid synthesis. "Endocrine-related cell types with a capacity for steroid generation appear to be especially sensitive [to atrazine], as demonstrated by the 'exquisite' cellular specificity of the atrazine response," wrote the authors.

"The finding that a pervasive and persistent environmental chemical appears to significantly change hormone networks means that scientists must take a broader look at this herbicide's potential effect on human health. Up to now, much of the focus has been on breast cancer, but since proper development of the endocrine system is important for normal reproduction, stress responses and metabolism, early exposure to this chemical in a fetus or infant might alter normal physiology later in life," said Ingraham.

