

Toxins may affect genes

Study finds link during pregnancy

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New research by Washington State University scientists suggests that a single exposure to environmental toxins during pregnancy can cause cancer, kidney disease and other illnesses for future generations.

The research, led by WSU professor Michael Skinner, suggests that environmental pollution could permanently reprogram genetic traits in a family line, creating a legacy of sickness. It follows previous studies in Skinner's lab that showed similar long-term effects from toxins on the reproductive systems of successive generations.

"It's a new way to think about disease," Skinner said in a WSU news release. "If this pans out, it gives us a host of new diagnostic and therapeutic tools."

It also provides possible explanations for increases in some diseases, as well as spikes in illness that are tied to a geographical region. And it highlights the potential long-term dangers from environmental pollution, said Skinner, the director of WSU's Center for Reproductive Biology.

In the research, pregnant rats were exposed to high levels of a fungicide commonly used in vineyards. In male offspring and three subsequent male generations of the rats, 85 percent of the animals developed cancer, prostate disease, kidney disease, premature aging or other problems. Most of the rats developed more than one illness.

The research was published in two papers Thursday in the journal *Endocrinology*.

Skinner's lab has been working on the question of "epigenetic inheritance" for years, and published research last year that showed toxic exposure during embryonic development could hurt fertility over several generations. Epigenetic inheritance involves chemical modifications in the operation of genes from parent to offspring – changes in which the DNA itself isn't modified, but the way the genes "turn off" and "turn on" is affected, WSU said.

Cancer research

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The new research suggests an environmental toxin can permanently reprogram an inheritable trait.

Skinner and a team of WSU researchers exposed pregnant rats to the fungicide vinclozolin during a period when the sex of the rats' offspring was being determined. It's a state of development when embryos are susceptible to genetic reprogramming, WSU said in its news release.

The rats were exposed to higher levels of the toxin than are normally present in the environment, and more research is needed to see if lower levels show the same effects.

Pregnant rats exposed to the toxin produced male offspring with low sperm counts and high rates of disease. When those rats mated with females that weren't exposed to the fungicide, their male offspring had the same problems – a situation that persisted through four generations.

"A human analogy would be if your grandmother was exposed to an environmental toxicant during mid-gestation, you may develop a disease state even though you never had direct exposure, and you may pass it on to your great-grandchildren," Skinner said.

Skinner said the findings might be applicable to the study of breast cancer and prostate disease, which are increasing faster than would be expected from genetic changes alone.