

# Fracking chemicals tied to reduced sperm count in mice

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Credit: Martha Sexton/public domain

Prenatal exposure to a mixture of chemicals used in the oil and natural gas drilling technique known as hydraulic fracturing, or fracking, at levels found in the environment lowered sperm counts in male mice when they reached adulthood, according to a new study published in the Endocrine Society's journal *Endocrinology*.

The scientists tested 24 chemicals used in fracking and determined that 23 of them were endocrine-disrupting chemicals, or EDCs. EDCs mimic, block or otherwise interfere with hormones, the body's chemical messengers that act through receptors to regulate the activity of cells and biological processes such as metabolism, reproduction, growth, and digestion. Specifically, these 24 chemicals alone and in mixtures were tested for their ability to activate or inhibit action of the estrogen, androgen, progesterone, glucocorticoid and thyroid receptors using a human cell-based assay.

Among the 23 EDCs the scientists identified, more than 90 percent of the chemicals disrupted the functions of estrogens and androgens, [male sex hormones](#) such as testosterone. In addition, more than 40 percent could interfere with progestogens, another type of reproductive hormone, and glucocorticoids, which are involved in metabolism and stress. Thirty percent of the chemicals disrupted thyroid hormone signaling. In addition, some chemical combinations exhibited greater than anticipated disruption based on single chemical analysis.

EDC exposure has been linked to health problems including birth defects, reproductive disorders, cancer, diabetes, obesity and neurodevelopmental issues, according to the executive summary of the Endocrine Society's second [Scientific Statement](#) on endocrine-disrupting chemicals. An [economic analysis](#) published in *The Journal of Clinical Endocrinology and Metabolism* in March estimated that EDC exposure likely costs the European Union €157 billion (\$209 billion) a year in actual health care expenses and lost earning potential.

"This study is the first to demonstrate that EDCs commonly used in fracking, at levels realistic for human and animal exposure in these regions, can have an adverse effect on the reproductive health of mice," said the study's senior author, Susan C. Nagel, PhD, of the University of Missouri in Columbia, MO. "In addition to reduced sperm counts, the

male mice exposed to the mixture of chemicals had elevated levels of testosterone in their blood and larger testicles. These findings may have implications for the fertility of men living in regions with dense oil and/or [natural gas](#) production."

Oil and gas companies are not required to disclose all of the chemicals in the mixtures they use for fracking. The scientists tested wastewater samples from drilling sites in Garfield County, Colorado and identified 16 of the fracking chemicals they had previously tested in these samples. The scientists used this information, along with existing literature on fracking chemical concentrations, to create a mixture of 23 chemicals that spanned the likely range of human exposure from levels found in wastewater to those likely to be found in drinking water contaminated with fracturing fluids.

Researchers added four different concentrations of the chemical mixture to the [drinking water](#) given to pregnant mice in the laboratory. The mice were exposed to the mixtures from day 11 of pregnancy until they gave birth. Their male offspring were assessed for effects of EDC exposure. The male offspring were compared to male mice born to mothers in the [control group](#) that was not exposed to the [chemical mixture](#).

The scientists found mice that were exposed to the chemical mixtures prenatally had decreased sperm counts, increased testis weights and increased testosterone levels compared to the control group. In addition to exhibiting reproductive changes, the mice that were exposed to the highest concentration of the [chemical](#) mixture tended to weigh more and showed persistent effects on the structure of the heart compared to the [mice](#) in the control group.

"It is clear EDCs used in fracking can act alone or in combination with other chemicals to interfere with the body's hormone function," Nagel said. "These mixture interactions are complex and challenging to predict."

More research is needed to assess the many other chemicals used for fracking and to determine how they may be contributing to health outcomes."

**More information:** The study, "Endocrine Disrupting Activity of Hydraulic Fracturing Chemicals and Adverse Health Outcomes Following Prenatal Exposure in Male Mice," was published online at [press.endocrine.org/doi/10.1210/en.2015-1375](http://press.endocrine.org/doi/10.1210/en.2015-1375), ahead of print.

Provided by The Endocrine Society

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