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Study suggests great-grandparents' chemical exposure could affect your disease risk

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The bad characteristics you thought you inherited from your grandparents or even great-grandparents may not be the fault of bad genes. When it comes to obesity, ovarian disease or kidney disease, it may have been the fault of the pesticides your ancestors were exposed to during early pregnancy or before conception, new research suggests.

A **study** published today in *PLOS ONE* and funded by the National Institutes of Health found that exposing lab rats to methoxychlor caused an increased incidence of these diseases in the third generation, or the great-grandchildren of the animals first exposed to the chemical.

"What your great-grandmother was exposed to during pregnancy could be passed on to you," Michael Skinner said in a phone interview. Skinner is a professor of environmental epigenetics and reproduction at Washington State University and lead author of the study.

Skinner has been on the cutting edge of research on epigenetics, or the molecular factors that regulate the way DNA functions and are independent of the genetic sequence itself.

"If these things are altered, then they can alter what genes are on and off," he said, adding that these changes are often passed through the germline -- where information is transferred from one generation to the next in sperm or eggs. Skinner has conducted a number of **studies** that show factors like stress, diet and exposure to pesticides such as DDT can all be passed via this route.

"The epigenetics can't really cause the disease, per se; what it does is increase susceptibility," Skinner said.

In today's study, the researchers found that the great-grandchildren of rats exposed to methoxychlor displayed high rates of obesity, adult-onset kidney disease and ovarian disease.

The chemical, also known as Chemform, Methoxo, Metox or Moxie, was introduced in 1948 and was used as a replacement for DDT on crops, livestock, pets and ornamental plants. It was banned in 2003 in the United States because it affects human reproduction and the glands that control hormone circulation in organs like ovaries, testes, the pancreas and the thyroid.

The results suggest that the exposure of the great-grandmother was a major criterion in an individual rat's susceptibility to a disease.

That could have troubling implications for people. "It's like human society is doomed eventually," Skinner said. "There is a negative connotation to this."

But, he said, just because people are born with these epigenetic changes doesn't mean they will necessarily get sick. He suggested people could have epigenome mapping done early in their lives to see whether they have these epigenetic mutations that make them more susceptible to disease.

"We may not be able to fix the epigenetic changes, but we can come up with some preventable measures to combat these diseases," he said.

Skinner noted that previous epigenetic tests showed that descendants of rats exposed to DDT were more likely to develop obesity than the descendants of rats exposed to methoxychlor. But the levels of kidney problems displayed by the rats were similar with both pesticides.

Emily Marquez, a staff scientist at Pesticide Action Network, found the study results troubling. "This [animal test] is the best that we have, and if we see these subtle effects on animals, we have to ask ourselves whether or not these effects can be observed in the human population," she said in a phone interview.

Marquez would like U.S. EPA to update its pesticide screening standards to look at epigenetic effects and multigenerational problems.

In a statement, EPA said it previously canceled all methoxychlor products because it had “significant concerns about the effects of methoxychlor on human health and the environment, including concerns about its endocrine disruption effects and persistent, bioaccumulative toxicity.”

Nevertheless, the agency said it will “consider the study and its implications.”

Skinner said methoxychlor is just one of the factors that can affect these transgenerational epigenetics.

"The environment is far more important than we previously conceived in where we develop disease and in general biology," he said.

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