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Exposure to endocrine disruptors during pregnancy affects the brain two generations later

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Prenatal exposure to low doses of the environmental contaminants polychlorinated biphenyls, or PCBs, change the developing brain in an area involved in metabolism, and some effects are apparent even two generations later, a new study finds. Performed in rats, the research will be presented Friday at the Endocrine Society's 97th annual meeting in San Diego.

Hereditary effects included increased body weight, but only in descendants of females—and not males—exposed to PCBs in the womb, said study co-author Andrea Gore, PhD, professor at the University of Texas at Austin.

"These endocrine-disrupting chemicals affect the developing brain differently in males and females," Gore said.

PCBs are known endocrine disruptors, chemicals in the environment that interfere with hormones and their actions in the body. PCBs are present in air, water, soil and many products manufactured before these chemicals were banned in the U.S. in 1979.

Brain development and function, and their regulation by hormones, are very similar between rats and humans, according to Gore.

"We believe," Gore said, "that results in our rat model may point to the

potential vulnerability of the developing human brain to environmental endocrine disruptors."

In this study, funded by the National Institutes of Health, the investigators gave a mixture of PCBs to pregnant rats at the beginning of their third trimester, thus directly exposing their offspring to the endocrine disruptors. Doses of PCBs were low to be comparable to that of human exposure, Gore said. Other pregnant rats received a low dose of estrogen to account for PCB's estrogenic effects, and control rats received a placebo instead of PCBs.

The researchers allowed the first-generation rats born to PCB-exposed and control rats to mature and then bred them (both males and females) through two additional generations, to see if the effects of PCBs were heritable.

Gore and her colleagues found that the first generation of PCB-exposed rats had changes to 9 genes in their brains, in the arcuate nucleus, a region involved in reproduction and metabolic function. The researchers saw few changes in the second-generation rodents, other than decreased levels of the hormone progesterone in females.

In the third generation, though, rats descended from animals exposed to the low-dose estrogen had changes to three genes in the arcuate nucleus that are involved in biological rhythms and metabolic function. These changes did not occur in descendants of control rats.

Because the third generation had no personal exposure to the treatment, the researchers concluded that the observed changes occurred through some form of inheritance. Gore said the reason why the second generation was less affected than the third generation is unclear but may have to do with the timing of the original exposure during development.

All three generations of rats descended from PCB-exposed females weighed significantly more than the other rats, the findings showed.

Provided by The Endocrine Society