Endocrine disruptors alter thyroid levels in pregnancy, may affect fetal brain development

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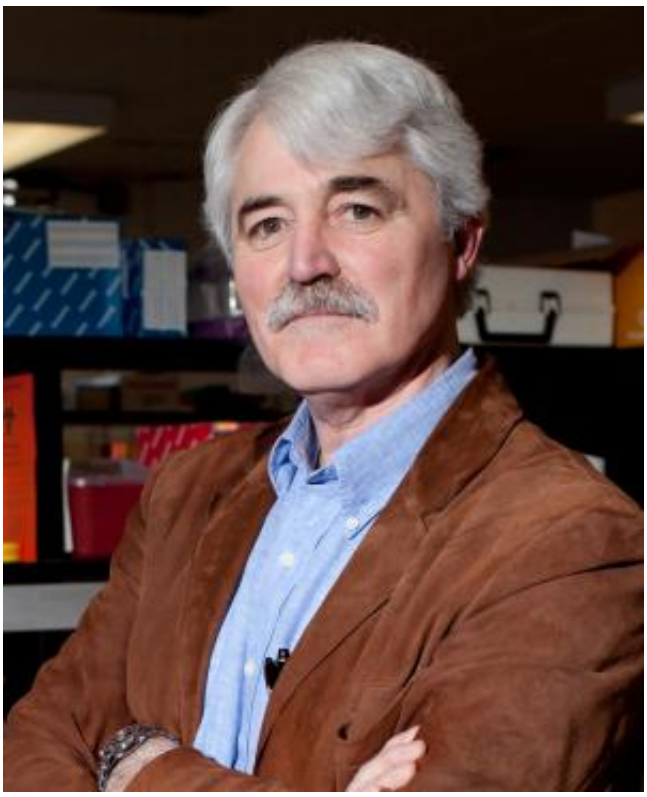

Zoeller and colleagues' study provides the strongest evidence to date that endocrine-disrupting chemicals can travel across the placenta and affect a fetus. Credit: UMass Amherst

A new study led by biologist R. Thomas Zoeller of the University of Massachusetts Amherst provides "the strongest evidence to date" that

endocrine disrupting chemicals such as polychlorinated biphenyls (PCB) found in flame retardant cloth, paint, adhesives and electrical transformers, can interfere with thyroid hormone action in pregnant women and may travel across the placenta to affect the fetus.

Results appeared in an early online edition and in the December print edition of the Endocrine Society's *Journal of Clinical Endocrinology & Metabolism*. The paper was also honored this week as an "extramural paper of the month" by the National Institute of Environmental Health Sciences.

Zoeller says, "As endocrine-disrupting chemicals, PCBs interfere with the way the thyroid hormone functions, but they don't actually change the amount of the hormone found in the body. Although these effects are largely invisible in scientific studies that only judge thyroid activity by measuring hormone levels, they may be having a real impact on infants' brain development."

Although endocrine-disrupting PCBs were banned in the United States in 1979, they are still released into the environment from disposal sites or products manufactured before the ban. Most people have been exposed to low levels of PCBs, Zoeller points out.

In this prospective birth cohort study, he and colleagues looked at the effects of low-dose chemical exposure in 164 pregnant women. Tissue from their placentas, the uterine structure that provides oxygen and nutrients to the fetus, was analyzed for a specific enzyme, CYP1A1, which changes endocrine-disrupting chemicals into a form that can interfere directly with the body's thyroid hormone receptors.

This work was a collaboration between scientists in the biology department at UMass Amherst and physician scientists led by Larissa Takser at the University of Sherbrooke, Québec, who collected placental

tissue from a large epidemiological study. Biochemistry and experimental work conducted at Zoeller's UMass Amherst laboratory over the past decade provided the framework for the analyses. "This led us to predict specific molecular events that might be occurring in the placenta," he notes, "and as best as we can tell right now, we were correct."

Zoeller and colleagues found that in pregnancies where the placenta contained higher levels of CYP1A1, it also showed signs of thyroid disruption. Levels of two thyroid-regulated genes tended to be higher in these pregnancies, although the mother's overall thyroid hormone levels did not change.

"Whatever is happening in the placenta likely reflects what is happening in the fetus," says Zoeller. "To truly understand how endocrine-disrupting chemicals may be affecting pregnancies, the findings show we need to study not only hormone levels, but hormone activity at the cellular level."

The effects of endocrine-disrupting chemicals may be particularly insidious in people who smoke, Zoeller said. The enzyme CYP1A1 is supposed to clean the blood, and the body produces more of this enzyme when it is exposed to cigarette smoke. The researchers found pregnant women who smoked tended to have higher levels of the enzyme in the placental tissue.

More information: Wadzinski TL, Geromini K, McKinley Brewer J, Bansal R, Abdelouahab N, Langlois MF, Takser L, Zoeller RT. 2014. Endocrine disruption in human placenta: expression of the dioxin-inducible enzyme, Cyp1a1, is correlated with that of thyroid hormone-regulated genes. J Clin Endocrinol Metab; dx.doi.org/10.1210/jc.2014-2629 [Online 9 October 2014].