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The new 'epigenetics:' Poor nutrition in the womb causes permanent genetic changes in the offspring

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The new science of epigenetics explains how genes can be modified by the environment, and a prime result of epigenetic inquiry has just been published online in *The FASEB Journal*: You are what your mother did not eat during pregnancy. In the research report, scientists from the University of Utah show that rat fetuses receiving poor nutrition in the womb become genetically primed to be born into an environment lacking proper nutrition. As a result of this genetic adaptation, the rats were likely to grow to smaller sizes than their normal counterparts. At the same time, they were also at higher risk for a host of health problems throughout their lives, such as diabetes, growth retardation, cardiovascular disease, obesity, and neurodevelopmental delays, among others. Although the study involved rats, the genes and cellular mechanisms involved are the same as those in humans.

"Our study emphasizes that maternal-fetal health influences multiple healthcare issues across generations," said Robert Lane, professor of pediatric neonatology at the University of Utah, and one of the senior researchers involved in the study. "To reduce adult diseases such as diabetes, obesity, and cardiovascular disease, we need to understand how the maternal-fetal environment influences the health of offspring."

The scientists made this discovery through experiments involving two groups of rats. The first group was normal. The second group had the delivery of nutrients from their mothers' placentas restricted in a way

that is equivalent to preeclampsia. The rats were examined right after birth and again at 21 days (21 days is essentially a preadolescent rat) to measure the amount of a protein, called IGF-1, that promotes normal development and growth in rats and humans. They found that the lack of nutrients caused the gene responsible for IGF-1 to significantly reduce the amount of IGF-1 produced in the body before and after birth.

"The new 'epigenetics' has taught us how nature is changed by nurture," said Gerald Weissmann, M.D., Editor-in-Chief of *The* FASEB Journal. "The jury's in and, yes, expectant moms really are eating for two. This study shows not only that we need to address problems such as preeclampsia during pregnancy, but also that prenatal care is far more important than anyone could have imagined a decade ago."

More information: Qi Fu, Xing Yu, Christopher W. Callaway, Robert H. Lane, and Robert A. McKnight. Epigenetics: intrauterine growth retardation (IUGR) modifies the histone code along the rat hepatic IGF-1 gene. FASEB J. doi:10.1096/fj.08-124768 www.fasebj.org/cgi/content/abstract/fj.08-124768v1

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