

# Parents' stress leaves lasting marks on children's genes

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Researchers at the University of British Columbia and the Child & Family Research Institute have shown that parental stress during their children's early years can leave an imprint on their sons' or daughters' genes – an imprint that lasts into adolescence and may affect how these genes are expressed later in life.

The study, published online today in the journal *Child Development*, focused on epigenetics – the expression of genes as opposed to the underlying sequence of DNA. A central component of epigenetics is methylation, in which a chemical group attaches to parts of the DNA – a process that acts like a dimmer on gene function in response to social and physical environments.

Michael S. Kobor, a UBC associate professor of medical genetics, measured methylation patterns in cheek cell DNA collected recently by University of Wisconsin researchers from more than 100 adolescents. These patterns were compared to data obtained by the University of Wisconsin in 1990 and 1991, when these same [children](#) were infants and toddlers, and their parents were asked to report on their [stress](#) levels – including depression, family-expressed anger, parenting stress and financial stress.

Comparing DNA methylation to stress, Kobor's team found that higher stress levels reported by mothers during their child's first year correlated with methylation levels on 139 DNA sites in adolescents. They also discovered 31 sites that correlated with fathers' higher reported stress

during their child's pre-school years (three-and-a-half to four-and-a-half years old).

"To our knowledge, this is the first demonstration, using carefully collected longitudinal data, that parental adversity during a child's first years leads to discernible changes in his or her 'epigenome,' measurable more than a decade later," says Kobor, a scientist at the Centre for Molecular Medicine and Therapeutics at the Child and Family Research Institute (CFRI), and a Mowafaghian Scholar at the Human Early Learning Partnership (HELP). "This literally illustrates a mechanism by which experiences 'get under the skin' to stay with us for a long time."

The team also found that fathers' stress level is more strongly associated with DNA methylation in daughters, while mothers' stress level has an effect with both boys and girls. This reinforces other research showing that the absence of fathers or their lack of participation in parenting is associated with an earlier onset of puberty and difficult temperamental traits in girls, but not in boys.

In general, none of the genes whose methylation level correlated with stress were among those best known to play a role in controlling a person's behaviour or reaction to environmental stress. But they did find some genes that had a consistent change in methylation levels at more than one site on the DNA, including one involved in the production of insulin, the hormone that regulates blood sugar levels, and three other [genes](#) possibly involved in brain development.

"What is particularly intriguing is that a mother's higher stress levels during infancy, but not during the preschool years, leads to epigenetic changes," says co-author Clyde Hertzman, a professor in UBC's School of Population and Public Health and director of HELP. "And the opposite is true for fathers – it's their higher stress during a child's preschool years, but not during their infancy, that counts."

"These results confirm what early childhood experts have long known – those first few years are a crucial period that sets the stage for much of what happens to the individual later in life," said co-author Thomas Boyce, a professor at UBC's Human Early Learning Partnership and a scientist at CFRI. "It helps explain why a child's socioeconomic status is the single most powerful predictor of childhood health and that individual's lifelong health."

Provided by University of British Columbia

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