Father's genes can impact motherly love

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A father's genes can influence the quality of care a newborn receives from its mother. Credit: Kapa65 on Pixabay

A father's genes are no longer thought to just provide a blueprint for the

growth and development of their offspring. Research publishing 31 July in the open access journal *PLOS Biology* by scientists led by Professors Rosalind John and Anthony Isles from Cardiff University's School of Biosciences finds that paternal genes can affect the type of care the offspring receives both before and after they are born.

The research team has been investigating the hormonal signals given off from the placenta during pregnancy. The placenta transports nutrients to the growing fetus during pregnancy and gives off hormonal signals in the mother's bloodstream to establish and maintain a successful pregnancy. As well as being involved in nurturing the baby throughout the pregnancy, the placental signals are thought to be important for programming a mother's behavior, preparing them for their new role as a parent.

These hormones are produced by placental cells called spongiotrophoblasts, whose proliferation (and therefore whose hormone output) is held in check by a gene called Phlda2. But here's the twist; like most genes, the developing fetus has two copies of the Phlda2 gene, but unlike most genes, only one copy of Phlda2 is active. This is due to an evolutionarily intriguing phenomenon called genomic imprinting, whereby only the gene copy from one parent is switched on. In the case of Phlda2 it's the father's copy that's silent.

Using genetically altered mice, the researchers asked what happened if both copies of the fetus' Phlda2 gene were active (a "maternalized" condition) or if both were silent (a "paternalized" condition). They found that mothers exposed to pups with the highest Phlda2 activity (and therefore presumably reduced placental hormones) nursed and groomed their pups less and instead focused on nest building. Conversely, "paternalized" mothers, exposed to the lowest Phlda2 dose (and therefore higher hormone levels), spent more time nurturing their pups, and less on housekeeping tasks. The authors also showed corresponding

changes in two regions of the mother's brain—the hypothalamus and hippocampus.

Why is this important? Parenthood can be seen as a conflict between the interests of the two parents, with the father (and his genes) favoring maximum investment in the offspring, potentially at the expense of the mother's best interests. The results of this study suggest that the father, by causing his Phlda2 gene to be silent in the fetus, can even affect the nurturing behavior of the mother after his offspring have been born.

The authors speculate that this may have relevance to humans, as levels of Phlda2 gene activity vary between human pregnancies and inversely correlate with placental hormones. Changes in the mother's priorities during gestation and after birth are critically important for the wellbeing of the new baby and their lifelong mental health.

"Our previous work has reported that a similar placental gene is linked to prenatal depression, and we are currently asking whether similar gene changes are associated with poor quality maternal care in the Grown in Wales Study" said Professor John, lead author of the study. "More work must be done to further our understanding in how this works in humans."

More information: Creeth HDJ, McNamara GI, Tunster SJ, Boque-Sastre R, Allen B, Sumption L, et al. (2018) Maternal care boosted by paternal imprinting in mammals. *PLoS Biol* 16(7): e2006599. doi.org/10.1371/journal.pbio.2006599

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