

## How dads bond with toddlers: Brain scans link oxytocin to paternal nurturing

February 17 2017

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Credit: George Hodan/public domain

Fathers given boosts of the hormone oxytocin show increased activity in brain regions associated with reward and empathy when viewing photos of their toddlers, an Emory University study finds.

"Our findings add to the evidence that [fathers](#), and not just mothers, undergo hormonal changes that are likely to facilitate increased empathy

and motivation to care for their children," says lead author James Rilling, an Emory anthropologist and director of the Laboratory for Darwinian Neuroscience. "They also suggest that [oxytocin](#), known to play a role in social bonding, might someday be used to normalize deficits in paternal motivation, such as in men suffering from post-partum depression."

The journal *Hormones and Behavior* published the results of the study, the first to look at the influence of both oxytocin and vasopressin - another hormone linked to [social bonding](#) - on brain function in human fathers.

A growing body of literature shows that paternal involvement plays a role in reducing child mortality and morbidity, and improving social, psychological and educational outcomes. But not every father takes a "hands-on" approach to caring for his children.

"I'm interested in understanding why some fathers are more involved in caregiving than others," Rilling says. "In order to fully understand variation in caregiving behavior, we need a clear picture of the neurobiology and neural mechanisms that support the behavior."

Researchers have long known that when women go through pregnancy they experience dramatic hormonal changes that prepare them for child rearing. Oxytocin, in particular, was traditionally considered a maternal hormone since it is released into the bloodstream during labor and nursing and facilitates the processes of birth, bonding with the baby and milk production.

More recently, however, it became clear that men can also undergo [hormonal changes](#) when they become fathers, including increases in oxytocin. Evidence shows that, in fathers, oxytocin facilitates physical stimulation of infants during play as well as the ability to synchronize their emotions with their children.

In order to investigate the [neural mechanisms](#) involved in oxytocin and paternal behavior, the Rilling lab used functional Magnetic Resonance Imaging (fMRI) to compare neural activity in men with and without doses of oxytocin, administered through a nasal spray. The participants in the experiment were all healthy fathers of toddlers, between the ages of one and two. While undergoing fMRI brain scans, each participant was shown a photo of his child, a photo of a child he did not know and a photo of an adult he did not know.

When viewing an image of their offspring, participants dosed with oxytocin showed significantly increased neural activity in brain systems associated with reward and empathy, compared to placebo. This heightened activity (in the caudate nucleus, dorsal anterior cingulate and visual cortex) suggests that doses of oxytocin may augment feelings of reward and empathy in fathers, as well as their motivation to pay attention to their children.

Surprisingly, the study results did not show a significant effect of vasopressin on the [neural activity](#) of fathers, contrary to the findings of some previous studies on animals.

Research in prairie voles, which bond for life, for instance, has shown that vasopressin promotes both pair-bonding and paternal caregiving.

"It could be that evolution has arrived at different strategies for motivating paternal caregiving in different species," Rilling says.

Provided by Emory University

Citation: How dads bond with toddlers: Brain scans link oxytocin to paternal nurturing (2017, February 17) retrieved 24 April 2024 from <https://medicalxpress.com/news/2017-02-dads-bond-toddlers-brain-scans.html>

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