

Mothers' behavior influences bonding hormone oxytocin in babies

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In the study, the scientists observed a free play interaction between mothers and their five-month-old children. Credit: MPI CBS

Oxytocin is an extremely important hormone involved in social interaction and bonding in mammals, including humans. It helps us relate

to others, strengthens trust and closeness in relationships, and can be triggered by eye contact, empathy or pleasant touch. It's well known that a new mother's behavior is influenced by her oxytocin levels, and as a result, the bond she makes with her baby. A new epigenetic study by Kathleen Krol and Jessica Connelly from the University of Virginia and Tobias Grossmann from the Max Planck Institute for Human Cognitive and Brain Sciences now suggests that mothers' behavior can also have a substantial impact on their children's developing oxytocin systems.

Childhood marks a dynamic and malleable phase of postnatal development. Many bodily systems are coming online, maturing, or getting tweaked, often setting our psychological and behavioral trajectories well into adulthood. Nature plays an obvious role, shaping people through [genes](#). But humans are also heavily influenced by interactions with other people and with their environment.

"It is well known that oxytocin is actively involved in early social, perceptual and [cognitive processes](#), and that it influences complex social behaviors," says Tobias Grossmann. "However, in this study, we asked whether the mother's behavior might also have a decisive influence on the development of the baby's oxytocin system itself. Advances in [molecular biology](#), epigenetics in particular, have recently made it possible to investigate the interaction of nature and nurture, in this case, infant care, in fine detail. That is exactly what we've done here."

The scientists observed a free play interaction between mothers and their five-month-old children. "We collected saliva samples from both the mother and the infant during the visit and then a year later, when the child was 18 months old. We were interested in exploring whether the involvement of the mother, in the original play session, would have an influence on the oxytocin receptor gene of the child a year later. The oxytocin receptor is essential for the hormone oxytocin to exert its effects, and the gene can determine how many are produced," explains

Kathleen Krol, a Hartwell postdoctoral fellow in Connelly's Lab at the University of Virginia who conducted the study together with Tobias Grossmann at MPI CBS in Leipzig.

"We found that epigenetic changes had occurred in the infant's DNA, and that this change was predicted by the quality of the mother's involvement in the play session. If mothers were particularly involved in the game with their children, there was a greater reduction in DNA methylation of the oxytocin receptor gene one year later. Decreased DNA methylation in this region has previously been associated with increased expression of the oxytocin receptor gene. Thus, greater maternal involvement seems to have the potential to upregulate the oxytocin system in human offspring," explains the scientist.

"Importantly, we also found that the DNA methylation levels reflected infant temperament, which was reported to us by the parents. The children with higher methylation levels at 18 months, and presumably lower levels of oxytocin receptor, were also more temperamental and less well balanced."

The results of this study provide a striking example that people are not simply bound by genes, but are the products of a delicate interplay between genetics and experiences. Early [social interaction](#) with caregivers, certainly not excluding fathers, can influence biological and psychological development through epigenetic changes to the [oxytocin](#) system. These and related findings highlight the importance of parenting in promoting cross-generational health.

The study is published in *Science Advances*.

More information: "Epigenetic dynamics in infancy and the impact of maternal engagement," *Science Advances*, [DOI: 10.1126/sciadv.aay0680](https://doi.org/10.1126/sciadv.aay0680), advances.sciencemag.org/content/5/10/eaay0680

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