

'Experienced' mouse mothers tutor other females to parent, helped by hormone oxytocin

August 11 2021



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Watching a mother mouse gather her pups into the family's nest trains other female mice without pups to perform the same parenting task, a

new study shows. Furthermore, these observations lead to the production of oxytocin in the brains of virgin female mice, biochemically shaping their maternal behaviors even before they have pups of their own.

Led by researchers at NYU Grossman School of Medicine, the new set of experiments involved round-the-clock filming of female mice interacting with their newborns as well as with virgin mice. Simultaneous electrical readings were made in several [brain regions](#) known to produce oxytocin or thought to be responding to the hormone. The research team built on its earlier studies of the so-called pleasure hormone showing that the release of oxytocin is essential not only for the onset of nursing but also for the initiating of other maternal behaviors.

Publishing in the journal *Nature* online Aug. 11, researchers describe what they called a never-before-seen behavior in which new mouse mothers would without prompting shepherd virgin [female mice](#) into the family's nest along with their pups. Within 24 hours, the virgins began mimicking the maternal behavior of gathering the mom's pups into the nest even if the mother was not there. Almost as quickly, virgin mice would also start to perform the pup-retrieving task without any direct contact with an experienced mouse mother and after having only "viewed" the mother through a clear plastic window.

The research team also measured brain [electrical activity](#) in virgin mice during shepherding and later when they became mothers on their own. They found that both the sight and sound of crying pups moved outside of their nest stimulated oxytocin production in a specific region of the brain, the hypothalamic paraventricular nucleus (PVN). By contrast, chemically blocking any of the visual, auditory, or oxytocin-producing PVN nerve pathways prevented virgin mice from learning to take care of pups.

"Our study shows that in mice the best way to be a mom is to watch and

learn from an experienced mom," says study senior investigator Robert Froemke, Ph.D., a professor in the Skirball Institute of Biomolecular Medicine at NYU Langone Health. "Given the evidence, we propose that similar mechanisms operate in human [mothers](#)."

Froemke says the study findings in rodents add scientific evidence to the benefits observed from parenting classes in humans. He says the team next plans to examine if the same tutoring relationship exists among dad mice and virgin males.

"This work redefines oxytocin's role in brain function, broadening its impact to include formidable and complex social networking activities that force the [brain](#) to pay attention and adapt to its surroundings at the time, whether it's reacting to the sound of a pup's cries or feelings of happiness," says Froemke, who also serves as a professor in the departments of Otolaryngology-Head and Neck Surgery, and Neuroscience and Physiology at NYU Langone.

As part of the ongoing study, researchers analyzed nearly 5,000 hours (over six months) of video footage of several dozen mother mice interacting with their pups and with virgin [mice](#).

More information: Oxytocin neurons enable social transmission of maternal behaviour, *Nature* (2021). [DOI: 10.1038/s41586-021-03814-7](https://doi.org/10.1038/s41586-021-03814-7) , www.nature.com/articles/s41586-021-03814-7

Provided by NYU Langone Health

Citation: 'Experienced' mouse mothers tutor other females to parent, helped by hormone oxytocin (2021, August 11) retrieved 25 April 2024 from <https://phys.org/news/2021-08-experienced-mouse-mothers-females-parent.html>

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