Experience and instinct: Both count when recognizing infant cries

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Caregivers learn to decipher differences in newborn cries through a combination of hard-wired instincts and on-the-job experience, a new study in rodents shows.

Understanding the specific meaning of a baby's vocal expressions is critical in childcare for humans and other animals, experts say. However, every infant has its own unique set of cries, so the most successful parents must quickly learn to recognize subtle variations of distress and other kinds of calls.

Led by researchers at NYU Grossman School of Medicine, the study showed that female mice instinctively hurried to fetch crying infants, even if they'd never had pups of their own before. In addition, certain nerve cells in the auditory cortex, the part of the brain that processes sound, became active when the mice heard the wails.

The study, published online Oct. 7 in *Nature*, also showed that experienced "babysitter" mice recognized more variations of cries that were calls for attention than mice with little caregiving experience. The latter group only responded to a narrow range of cries.

As the unexperienced animals spent more time living with a veteran caregiver, however, they were able to recognize a wider variety of cries and would quickly retrieve the babies.

"Our findings show that while some parenting skills are innate, there is a significant learning curve," says study lead author Jennifer Schiavo, a predoctoral fellow in the Skirball Institute of Biomolecular Medicine at NYU Langone Health. "For mother mice, and possibly for humans too, hard-earned experience matters."

The investigation also affirmed the role of the hormone oxytocin in learning parenting behavior. Extra amounts of the chemical, best known for its role in breastfeeding and parent-infant bonding, was previously shown by the team to improve recognition of barely audible pup distress calls. In the new study, when the researchers instead blocked oxytocin, experienced babysitters only retrieved crying pups as little as 40 percent

of the time, compared with well over 80 percent when the hormone levels were left alone.

Similarly, without oxytocin, cells in the auditory cortex did not respond to a broader range of distress calls, even after the mice observed more experienced mothers parenting. According to Schiavo, this suggests that oxytocin helps rewire the brain and prepare it to learn new skills more easily.

For the study, the investigators measured the average number of syllables in the "come get me" cries of dozens of mouse pups to determine the standard version of the call. Then, the team sped up or slowed down recordings of the cries to create alterations that fell outside the typical range. These modified audio clips were dubbed over the pups' natural cries.

The study authors only compared expert and inexperienced caregivers, neither groups having had their own pups, in order to tease apart instinctive versus learned elements of parenting, without pregnancy complicating the matter.

They found that seasoned babysitters' brain cells became active in response to normal calls, and those mice accordingly retrieved the pups over 80 percent of the time. Meanwhile, the new babysitters' brain cells did not respond to normal calls, and these mice only picked up the pups about 33 percent of the time.

The study also showed that novices could learn to recognize altered calls over time, with pup retrieval rates as much as 75 percent. By comparison, experienced babysitters who heard the altered calls for the first time had a retrieval rate of just 14 percent.

"Our study provides new insight into how the brain learns new skills,"

says senior study author Robert Froemke, Ph.D., an associate professor in the Skirball Institute of Biomolecular Medicine at NYU Langone. "There is a built-in understanding that serves as a foundation for developing more complex behaviors in rodents."

He adds that next, the research team plans to investigate whether the inexperienced mice learn by passively observing mothers or if they are actively trained to respond to unusual calls. Froemke also serves as an associate professor in the departments of Otolaryngology-Head and Neck Surgery, and Neuroscience and Physiology at NYU Langone.

More information: Innate and plastic mechanisms for maternal behaviour in auditory cortex, *Nature* (2020). DOI: 10.1038/s41586-020-2807-6 , www.nature.com/articles/s41586-020-2807-6

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