

Very young found to process fear memories in unique way

Very young brains process memories of fear differently than more mature ones, new research indicates. The findings appear in the Feb. 6 issue of *The Journal of Neuroscience*. The work significantly advances scientific understanding of when and how fear is stored and unlearned, and introduces new thinking on the implications of fear experience early in life.

“This important paper raises questions that are the ‘tip of the iceberg’ related to the very complex series of events that occur as we learn to fear something. In the real world, we become fearful, extinguish that fear, reacquire it at another time, and then conquer it yet again,” says John Krystal, MD, of Yale University and director of the clinical neuroscience division of the VA National Center for Post-Traumatic Stress Disorder. “Typically, we think about long-term, negative impact of fear learning, such as lifelong problems with anxiety. But this work highlights an avenue for adapting to early stresses that apparently can occur only early in life: to erase a learned fear from memory.” Krystal was not affiliated with the research.

Study co-authors Jee Hyun Kim and Rick Richardson, PhD, of the University of New South Wales in Sydney, homed in on the amygdala, using anesthesia to temporarily inactivate it and therefore isolate its role. The amygdala is critical for emotional learning and plays a central role in dulling the memory of a fear.

Kim and Richardson trained rats that were 16 and 23 days old—the human equivalent of children and budding adolescents—to associate a specific sound with a mild shock to the foot. After subsequent training, when the sound was not followed by a shock, the animals’ fearful reaction to hearing the sound faded. Technically, this is known as “extinction,” and depended on the function of the amygdala.

In a second round of training, the researchers reintroduced the fear and tried to re-extinguish it. This time around, they found, only the older rats were able to do so without the amygdala.

The researchers concluded that the age at which the initial extinction training occurred was critical to whether or not the rats’ fear faded the second time independently of the amygdala. The authors suggest that in the very young, it is primarily the amygdala that extinguishes fearful memories, but that mechanisms independent of the amygdala develop later.

This raises the possibility that fears unlearned at an early enough age are, in fact, erased. As brains develop, however, and related structures near the amygdala mature, these structures take on a greater role. Thus, fear in adolescence and later in life may not be erased, but instead be, for example, inhibited by a process of overlaying neutral memories on top of the initial fear reaction. The initial memory could still exist and be called on again.

“Extinction in the young brain might forever erase early traumatic learning—but accepting this hypothesis will have to wait for more research,” says Mark Bouton, PhD, of the University of Vermont, who did not participate in the research. “What might change as the brain develops is where and how fear learning and extinction are stored and how they can be retrieved.”

Source: Society for Neuroscience

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