

Scientists selectively erase fear memories and gain insight into how the memory works

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(PhysOrg.com) -- It may sound like something out of a science fiction movie - but bad memories can be erased in mice and this finding sheds light into how memories are normally encoded and stored in the brain. In a study published in the March 13 issue of the journal *Science*, researchers at the University of Toronto and The Hospital for Sick Children (SickKids) have established a link between specific neurons and a given memory.

The human brain contains over 100 billion neurons (there are over 100 million in the mouse brain), yet memories are thought to be stored in only small groups of them. Identifying the precise neurons encoding a given memory has been a longstanding challenge. In the past, scientists had deleted an entire brain region in mice to try and erase a memory in the hopes of finding out about how memories are normally stored, but in this study led by Sheena Josselyn, Assistant Professor of Physiology, Canada Research Chair in Molecular and Cellular Cognition and a SickKids scientist, researchers took a more targeted approach and removed only the small portion of neurons thought to be involved in a specific memory.

"Though previous studies have provided important evidence suggesting that specific neurons are involved in a memory, we believe this paper is the first to establish causal links," said Josselyn.

In a previous paper, the research team showed evidence suggesting that in mice, fear memories are stored in specific neurons within a <u>brain</u>



structure known as the lateral amygdala (LA) that have a high amount of a specific protein (CREB). This means that CREB levels helps dictate which neurons are involved in storing a memory. In the latest study, the scientists went on to destroy only these LA neurons with high levels of CREB and found that mice no longer remembered the fearful event. More importantly, they illustrated that random removal of a similar number of LA neurons does not impact the fear memory. These findings are the first to definitively show which specific set of neurons store a memory.

"Our experiences, both good and bad, teach us things," said Josselyn. "If we didn't remember that the last time we touched a hot stove we got burned, we would be more likely to do it again. So in this sense, even memories of bad or frightening experiences are useful. However, there are some cases in which fearful memories become maladaptive, such as with post-traumatic stress disorder or severe phobia. Selectively erasing these intrusive memories may improve the lives of afflicted individuals," she said.

"Do our results suggest that someday this might be possible? Our studies suggest that one strategy would be to target interventions to that small subset of neurons actually involved in storing a memory, rather than the entire brain. It sounds like a futuristic film, but our results in mice do provide proof-of-principle that this may one day be possible in humans," added Paul Frankland, SickKids Scientist, Assistant Professor of Physiology, Canada Research Chair in <u>Cognitive</u> Neurobiology and co-investigator of the study.

"Our memories are an essential part of who we are, in fact some believe it is the ongoing connection between our thoughts and memories that constitutes our identity," said Christine Harrison, SickKids Director of Bioethics. "As the research in this area continues to evolve, so do the ethical considerations related to potential future therapies."



Provided by University of Toronto (<u>news</u> : <u>web</u>)

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