

Forget about it: Inducible and selective erasure of memories in mice

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Targeted memory erasure is no longer limited to the realm of science fiction. A new study describes a method through which a selected set of memories can be rapidly and specifically erased from the mouse brain in a controlled and inducible manner. The research, published by Cell Press in the October 23 issue of the journal *Neuron*, may eventually lead to development of strategies amenable to the human brain that would permit selective erasure of traumatic memories or unwanted fear while leaving other memories intact.

Memory is generally separated into four different stages: acquisition, consolidation, storage, and retrieval. Previous research has identified specific molecules and events that appear to play a role in the various phases of the memory process. One such "memory molecule," calcium/calmodulin-dependent protein kinase II (CaMKII), is an enzyme that has been linked to multiple aspects of learning and memory.

A research team led by Dr. Joe Z. Tsien, from the Brain and Behavior Discovery Institute at the Medical College of Georgia, developed a method for rapidly manipulating CaMKII activity in the brains of transgenic mice. "We recently developed a chemical genetic strategy that combines the molecular specificity of genetics with the high time-resolution of pharmacological inhibition. Using this technique, we examined the manipulation of transgenic γ CaMKII activity on the retrieval of short-term and long-term fear memories and novel object recognition memory," explains Dr. Tsien, who is also renowned for his 1999 creation of Doogie, the smart transgenic mouse with enhanced learning and memory abilities.

Dr. Tsien and colleagues found that transient overexpression of γ CaMKII at the time of recall impaired retrieval of newly formed 1 hr novel object recognition memory and fear memories, as well as 1-month-old fear memories. The researchers went

on to show that recall deficits linked to excessive γ CaMKII activity were not caused by a blockade of the recall process but instead seemed to be due to rapid erasure of the stored memories. Further, the erased memories were limited to those being retrieved while others remained intact.

The results demonstrate a successful genetic method for rapidly and specifically erasing specific memories, such as new and old fear memories, in a controlled and inducible manner without doing harm to the brain cells. "Given the fact that so many war veterans often suffer from reoccurring traumatic memory replays after returning home, our report of selective erasure of fear memories in an inducible and rapid way suggests the existence of molecular paradigm(s) under which traumatic memories can be erased or degraded while preserving other memories in the brain," says Dr. Tsien. However, he goes on to caution, "No one should expect to have a pill do the same in humans any time soon, we are barely at the foot of a very tall mountain."

Source: Cell Press

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