

Scientists show how memories are linked in the brain

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Credit: The Hospital for Sick Children

Some memories just seem to go together. Think about an important experience in your life. You may also closely remember another experience that happened around that time too, like exchanging vows at your wedding, and then your friend's epic dance moves later that same night. Somehow these two memories seem to be linked in your mind.

A new study led by The Hospital for Sick Children (SickKids), looks at this connection between memories and illustrates how certain memories



become linked in the <u>brain</u>. The study is published in the July 22 online edition of *Science*.

Dr. Sheena Josselyn, principal investigator of this study, and her lab have been working on how the brain forms, stores and organizes memories for many years. Previous work from her lab identified collections of <u>neurons</u> (engram) in the amygdala that store specific memories in mice. The amygdala is a brain region that is important in encoding important memories.

There are many thousands of neurons in the amygdala, but how does the brain "decide" which collection of neurons encode a particular <u>memory</u>? "We found that the activity, or excitability, of neurons in the amygdala fluctuates, and the neurons that are most excitable when an event occurs are most likely to 'grab' the memory," says Josselyn, Senior Scientist in Neurosciences & Mental Health at SickKids.

The study found that after encoding a memory, these 'engram' cells remain active for a few hours before their excitability levels drop. The researchers showed that if a second event occurs within this window (less than six hours), then the memory for that event is encoded in the same collection of neurons. Because these two memories are encoded in the same population of cells they become linked.

If a second event occurs outside of the window when the initial 'engram' cells are active and excited (like a day later for example) then the memory for that second event is encoded in a different population of cells. These two memories are not linked and are remembered as entirely separate events.

This paper shows that a neuron's excitability is the key factor determining whether two memories were linked or not. By artificially manipulating neuron excitability, the research team showed it was



possible to link two memories that would normally be encoded in separate populations of <u>amygdala</u> neurons. Conversely, they showed it was possible to separate two memories that would normally be encoded in the same population of neurons.

"Our data begins to uncover the principles of how we organize our memories—how remembering one event conjures up memories of closely related episodes," says Josselyn who is also Associate Professor in the Departments of Physiology and Psychology at the University of Toronto.

Paul Frankland, co-principal investigator on the study adds, "These results may have relevance to various psychiatric conditions. For example, understanding how memories are linked may provide hints as to how they become inappropriately connected in conditions such as schizophrenia."

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More information: Competition between engrams influences fear memory formation and recall, *Science*, <u>science.sciencemag.org/cgi/doi</u> ... <u>1126/science.aaf0594</u>

Provided by The Hospital for Sick Children

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