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Emotional memory

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Where were you on Sept. 11, 2001? Or when the shuttle Challenger exploded in 1986? Heightened emotions cause experiences to crystallize into lasting and vivid memories. This boost in memory formation is due in part to the stress hormone norepinephrine, but scientists haven't understood how the hormone causes this effect.

Now researchers have uncovered molecular changes triggered by norepinephrine that help nerve cells form new memories.

A team led by Roberto Malinow of Cold Spring Harbor Laboratory in New York traced the hormone's effects to a receptor molecule called glutamate receptor 1 (GluR1) on the surfaces of nerve cells. Through GluR1 and similar receptors, nerve cells can receive signals from their neighbors. Nerves store new memories by increasing the strength of those signals, according to a leading theory.

Norepinephrine, a form of adrenaline, triggers the attachment of a small molecule called a phosphate group to GluR1s before they reach a nerve cell's surface. Adding the phosphate group expedites the movement of GluR1 molecules to the surface, where they're thought to help cells form memories.

"There are likely to be a number of different mechanisms that underlie this effect, but this appears to be a major one," Malinow says.

The team engineered mice to have a mutation in GluR1 that prevents phosphate groups from attaching. Injecting norepinephrine into normal mice improved the animals' ability to learn from experience. But for the mice with impaired GluR1, the hormone made no measurable difference, the researchers report in the Oct. 5 *Cell*.

The research could lead to new drugs for emotion-related memory disorders, Malinow notes. "In post-traumatic stress disorder, where you have too much emotionally charged memory, this [receptor] could provide a molecular target for possible treatments."

References:

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Further Readings:

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Sources:

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