

Researchers discover how to erase memory

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(PhysOrg.com) -- Researchers working with mice have discovered that by removing a protein from the region of the brain responsible for recalling fear, they can permanently delete traumatic memories. Their report on a molecular means of erasing fear memories in rodents appears this week in *Science Express*.

“When a traumatic event occurs, it creates a fearful memory that can last a lifetime and have a debilitating effect on a person’s life,” says Richard L. Huganir, Ph.D., professor and director of neuroscience at the Johns Hopkins University School of Medicine and a Howard Hughes Medical Institute investigator. “Our finding describing these molecular and cellular mechanisms involved in that process raises the possibility of manipulating those mechanisms with drugs to enhance behavioral therapy for such conditions as post-traumatic stress disorder.”

Behavioral therapy built around “extinction training” in animal models has proven helpful in easing the depth of the emotional response to [traumatic memories](#), but not in completely removing the memory itself, making relapse common.

Huganir and postdoctoral fellow Roger Clem focused on the nerve circuits in the amygdala, the part of the [brain](#) known to underly so-called fear conditioning in people and animals. Using sound to cue fear in mice, they observed that certain cells in the amygdala conducted more current after the mouse was exposed to a loud, sudden tone.

In hopes of understanding the molecular underpinnings of [fear memory](#)

formation, the team further examined the proteins in the nerve cells of the amygdala before and after exposure to the loud tone. They found temporary increases in the amount of particular proteins — the calcium-permeable AMPARs — within a few hours of fear conditioning that peaked at 24 hours and disappeared 48 hours later.

Because these particular proteins are uniquely unstable and can be removed from nerve cells, the scientists proposed that they might permanently remove fear by combining behavior therapy and [protein](#) removal and provide a window of opportunity for treatment. “The idea was to remove these proteins and weaken the connections in the brain created by the trauma, thereby erasing the memory itself,” says Huganir.

In further experiments, they found that removal of these proteins depends on the chemical modification of the GluA1 protein. Mice lacking this chemical modification of GluA1 recovered fear memories induced by loud tones, whereas littermates that still had normal GluA1 protein did not recover the same [fear](#) memories. Huganir suggests that drugs designed to control and enhance the removal of calcium-permeable AMPARs may be used to improve memory erasure.

“This may sound like science fiction, the ability to selectively erase memories,” says Huganir. “But this may one day be applicable for the treatment of debilitating fearful memories in people, such as post-traumatic stress syndrome associated with war, rape or other traumatic events.”

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More information: Publication: *Science*, "Calcium-Permeable AMPA Receptor Dynamics Mediate Fear Memory Erasure," by R.L. Clem; R.L. Huganir at Howard Hughes Medical Institute in Baltimore, MD; R.L.

Clem; R.L. Huganir at Johns Hopkins University School of Medicine in Baltimore, MD. www.sciencemag.org/scienceexpress/recent.dtl

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