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Two women hold each other as they watch the World Trade Center burn following the Sept. 11 attacks. New research may help find ways to replace such traumatic memories. (Ernesto Mora/AP Photo)

## Fear Stops Here Scientists Finding Answers to How the Brain Handles Fear

By Amanda Onion  
[abcNEWS.com](#)

Nov. 7 — In a time when the national terror alert rating lingers at yellow and communities around Washington, D.C., are recovering from a series of sniper shootings, fear has become a prominent part of Americans' lives.

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But what, exactly, is fear, and how can people shrug off its often paralyzing effects?

A study on rats is shedding light on the sensation that isn't just an emotion, but a biological instinct designed to help us survive. By zeroing in on how the brain processes fear — and quells it — scientists hope to develop treatments for people with runaway fear responses.

"What was clinically interesting was we could reduce fear in rats by stimulating a particular area of the brain," says Gregory Quirk, a physiologist at the Ponce School of Medicine in Puerto Rico who authored the study in this week's issue of *Nature*. "Someday we hope to use what we learn to help people with anxiety disorders."

### The Fear Center

For years scientists have believed that the so-called "hub" of fear lies in a peanut-sized part of the brain called the amygdala. The amygdala assesses whether a situation is dangerous, then fires signals to other

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parts of the brain. This triggers the release of hormones, including cortisol, which causes reactions like sweating and a tensing of the muscles.

Now Quirk and others have taken a closer look at another region of the brain — the prefrontal cortex — where they believe one's sense of safety is generated.

To analyze this region, Quirk and his student Mohammed Milad trained rats to fear a tone by following the sound with an electric shock to their feet. Rats conditioned to fear the tone froze at the sound in anticipation of pain.

Next the team reconditioned some of the rats using the same tone followed by no electric shocks. Over time most of these rats no longer froze when they heard the tone. In another set of rats, Quirk and Milad did not retrain the animals so they would no longer fear the tone, but instead electrically stimulated neurons in the prefrontal cortex of the rats' brains.

Quirk says the rats whose brains had been stimulated "acted like they had never been conditioned to fear the tone at all," — even when the tone was repeatedly followed by shocks.

"We know that fear is not erased — it's always there," says Quirk. "Instead there seems to be a system that actively inhibits the response. That's what we've discovered."

Sending the 'All Clear'

What happens, Quirk believes, is when the brain senses conditions similar to ones that previously produced fear, the prefrontal cortex assesses the situation and if all seems OK, sends what he calls an "all clear" signal to the brain's fear center. This signal reins in the fear response that would otherwise emanate from the amygdala. The 'all clear' signal is likely based on the context of the situation.

"If I yell 'Fire!' in a movie theater, people may run, but if I yell 'Fire!' in an outside county fair, people are a lot less likely to feel afraid and react," explains Michael Bouton, a psychologist at the University of Vermont.

It's this soothing signal that people with anxiety disorders may have trouble accessing. And just as Quirk was able to electrically stimulate the "all clear" signal in rats, he hopes the same can be done in people using magnetic pulses.

Rats and people are a big leap apart, he admits, but those working with human anxiety disorders say the research is promising.

"We're very interested in animal studies," says Thomas Neylan, medical director of the Post Traumatic Stress Program at the San Francisco Veterans Affairs Medical Center in California.

Neylan adds that current research is revealing that neurons in the prefrontal cortexes of people with post-traumatic stress disorder are not as active as in normal patients.

"If you can enhance frontal lobe function, it may have therapeutic effects," Neylan says. "But it is all speculative at this point."

#### Traumatic Times

Today about 5.2 million Americans suffer from PTSD and recent traumatic events may well have caused that number to spike.

A post-Sept. 11 study done for the New York City Board of Education found that 10.5 percent of schoolchildren in the city show multiple symptoms consistent with post-traumatic stress disorder. Among adults, a New York Academy of Medicine survey in January found that 40 percent to 45 percent of New Yorkers have at least one symptom of post-traumatic stress. Nearly 6 percent of Americans outside of New York City reported post-traumatic stress symptoms six months after the attacks according to a University of California at Irvine study.

A common method of treatment for post-traumatic stress is to have patients repeatedly experience the conditions of a traumatic event through psychotherapy in an effort to reprogram their associations. Neylan says that while the treatment is often effective, it's usually not long lasting.

A treatment using magnetic stimulation of the brain might offer more long-term cures, says Quirk. Still, he adds, nothing can completely erase the memory of fear.

"It's not about erasing fear from memory, but replacing it with a memory of safety," he says, adding, "It's good we can't erase fear, we need it. Fear keeps you alive." ■

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