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Study On Fear Responses Suggests New Understanding Of Anxiety Disorders

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A new study on rats has identified a part of the brain's cortex that controls learned but not innate fear responses.

The results suggest that hyperactivity in a region of the prefrontal cortex might contribute to disorders of learned fear in humans, such as post-traumatic stress disorder and other anxiety disorders, say authors Kevin A. Corcoran, PhD, and Gregory Quirk, PhD, of the Ponce School of Medicine in Puerto Rico. Their report appears in the January 24 issue of *The Journal of Neuroscience.*

While building on previous findings, this study contradicts prior thinking that the amygdala, which plays a central role in emotional learning, is sufficient for processing and expressing fear, and it opens the potential for new avenues of treatment, the researchers say.

"This is the first paper demonstrating that a region of the cortex is involved in learned fear but not in innate fear," says Markus Fendt, PhD, of the Novartis Institutes for Biomedical Research in Basel, Switzerland, who is not connected with the study.

In their study, Corcoran and Quirk taught rats to associate a 30-second tone with a shock to the foot at the end of the tone. Upon hearing the same tone the next day, rats spent nearly 70 percent of the time of the tone frozen, a typical fear response.

In another group of rats, the researchers chemically blocked activity in the prelimbic cortex, which is located near the front of the brain and close to the midline between the two hemispheres. These rats spent only 14 percent of the time freezing to the sound of the tone.

Yet the rats' innate, or natural, fears seemed unaffected by blocking the prelimbic cortex; they froze as much in response to seeing a cat or being placed in a large open area as they did to hearing the tone. Furthermore, when the team trained rats with the tone after chemically inactivating the prelimbic cortex, and then tested them drug-free the next day, the rats showed a normal fear response, indicating that inactivating the prelimbic cortex did not prevent them from learning to fear the tone.

The prelimbic cortex is connected to the amygdala, and, based on their findings, Corcoran and Quirk speculate that "by modulating amygdala activity, the prelimbic cortex is important for determining the circumstances in which it is appropriate to convey learned fears." In contrast, they propose that fear responses to innate threats are automatic and do not require cortical involvement.

"Corcoran and Quirk's work raises the question of whether learned fear is more controllable--for example, by higher brain functions--than innate fear," says Fendt.

The Journal of Neuroscience is published by the Society for Neuroscience, an organization of more than 36,500 basic scientists and clinicians who study the brain and nervous system.

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