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# New Study Indicates That Sense of Smell Could Play Major Role in New Approaches to Treating PTSD

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For those who live with post-traumatic stress disorder (PTSD), the sense of smell could one day play a prominent role in treatment, according to researchers at McLean Hospital in Belmont, Massachusetts, who co-authored a paper published this week in the journal *Proceedings of the National Academy of Sciences*.

The new paper “Extinction Reverses Olfactory Fear Conditioned Increases in Neuron Number and Glomerular Size” highlights the results of a first of its kind study in which researchers reveal that the olfactory system in the brain is biologically and structurally more sensitive to trauma cues than previously thought, and that it’s possible for fear behaviors associated with emotional learning to be reversed through exposure-based talk therapy.

“The olfactory system is often an underappreciated sensory system in humans, even though we’ve all experienced the feeling of smelling a particular odor and having an almost instant flashback or emotional experience of an old memory,” said Filomene G. Morrison, BA, a neuroscience PhD candidate at Emory University and McLean Hospital, and the lead author of the paper. “An emotional memory, like the smell of home cooking, can trigger feelings of comfort, while for those with PTSD, an odor associated with a traumatic experience can trigger a negative response and PTSD symptoms.”

The outcomes of the study help explain why the olfactory system is so important from a molecular, genetic, and neurobiology perspective, according to paper co-author **Kerry J. Ressler, MD, PhD**, chief scientific officer and chief of the **Center of Excellence in Depression and Anxiety Disorders** at McLean.

“It’s the only sensory system where we have the specific genetic tools that allow us to dissect how different odors in the environment activate different neural pathways. There’s a gene for receptor A versus a gene for receptor B, and we don’t have that level of specificity in any other sensory system.”

Ressler added, “In the olfactory system, the fact that there are these genes that encode the different receptor specificities gives us a powerful tool for using genetic approaches to understanding how the brain codes for the environment. One of the ways that the brain codes trauma is by increasing sensitivity to the trauma cues in the environment. And these tools make it tractable to understand how trauma is encoded.”

While other studies have been done on extinction, Ressler said, “Nothing has been done in this particular realm—one that looks at the structural changes of the brain—particularly of the specific sensory representations associated with fear or trauma and how they change with regard to extinction or recovery from fear.”

“This is exciting because we can now understand that there’s a biological, structural representation in the brain of this trauma-related sensitivity that can be normalized with treatment. The study helps to provide a neurological explanation for the sensitivity that people with PTSD tend to have to environmental triggers. It also provides hope in suggesting that the brain changes that occur with trauma are, in fact, reversible with treatment,” he explained.

“Getting a better understanding of the exact mechanisms that are underlying these changes, will be critical,” said Morrison. She added that while investigators are not sure yet how therapeutic approaches would be implemented, having the understanding of how to identify olfactory cues and use the information as part of exposure-based therapy sessions is extremely promising.

“This is the first study to examine olfactory systems in adult mice with regard to the potential to reverse the behavioral and neuroanatomical effects of emotional learning using extinction,” said Morrison. “Much of extinction training—the process of learning that a fearful cue is no longer fearful—in adult rodents closely parallels aspects of exposure-based psychotherapy for humans, where an exposure to a stimulus that was associated with trauma shares many aspects of the initial traumatic memories.”

## Topics

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