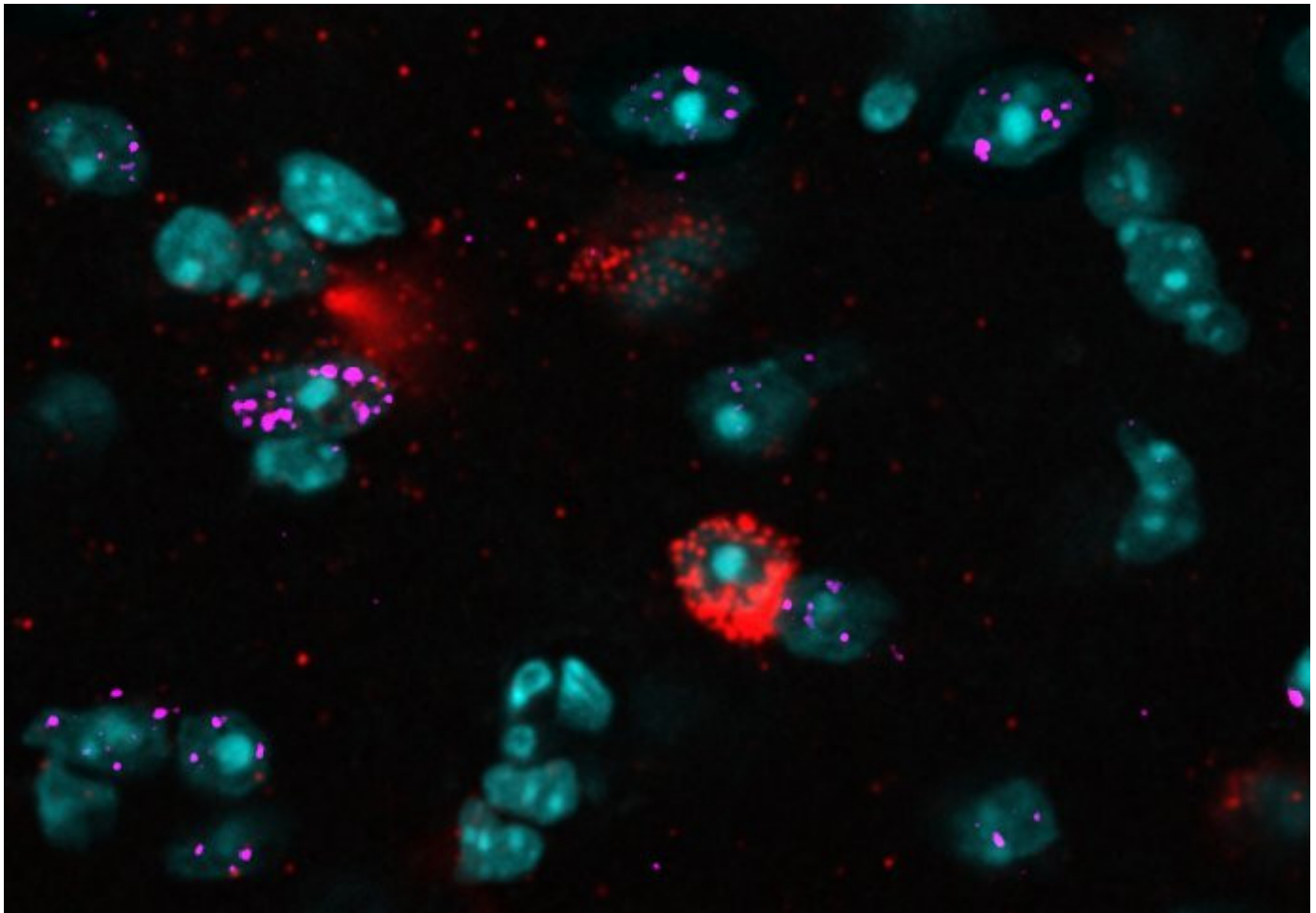


[Tulane University study reveals how the brain fine-tunes fear as threats fade](#)

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Microscope image shows two types of neurons in the central amygdala: somatostatin-expressing cells (red) and corticotropin-releasing hormone (CRH)-expressing cells (purple), which play distinct roles in how the brain regulates fear and stress responses. (Image by Emma Lardant)

Researchers at Tulane University have identified brain circuits that help determine how fear responses change as perceived threats diminish, offering new insight into how the brain regulates defensive behavior and why those processes may break down in conditions such as post-traumatic stress disorder (PTSD).

The [study](#), led by neuroscientist [Jonathan Fadok](#) at the [Tulane Brain Institute](#), examines how different populations of neurons deep in the brain shape a range of fear responses — from freezing to active escape behaviors.

The research, supported by the National Institutes of Health and the U.S. Department of Veterans Affairs, examines how the brain adjusts fear responses as perceived threats fade.

“For decades, most fear research has focused on freezing,” said Fadok, associate professor of psychology in Tulane University’s [School of Science and Engineering](#). “That has been incredibly useful, but it captures only part of the picture. In real-world situations, fear can also produce more active responses like darting or trying to escape.”

Using a modified conditioning paradigm in mice, the researchers were able to observe multiple defensive behaviors within the same experiment, including freezing, escape jumping and darting. This approach allowed them to track how those behaviors shift during fear extinction — the process through which repeated exposure to a previously threatening cue reduces the fear response.

The team found that fear does not simply disappear during extinction. Instead, the brain appears to gradually recalibrate how it responds to a perceived threat.

“At the neural level, extinction looks less like erasing fear and more like reshaping it,” Fadok said. “Different circuits help determine whether an animal responds with intense escape behavior, freezing or a lower-intensity defensive state.”

Specifically, the researchers identified distinct roles for two types of neurons in the central amygdala, an area of the brain responsible for emotional processing. Activity in corticotropin-releasing factor (CRF) neurons supported higher-intensity, escape-like responses, such as jumping. In contrast, somatostatin (SOM) neurons promoted freezing and helped regulate lower-intensity behaviors like darting.

Manipulating these circuits altered how animals responded to threats. Inhibiting CRF neurons reduced escape jumping, while activating SOM neurons shifted behavior away from flight and toward freezing.

The findings suggest that the brain organizes fear along a continuum, adjusting behavior based on perceived threat level rather than switching fear “on” or “off.”

This more nuanced view of fear regulation may have implications for understanding psychiatric conditions such as PTSD, in which fear responses can be persistent and difficult to control.

“PTSD is often described as a disorder of persistent fear, but that persistence can look very different from person to person,” Fadok said. “Some individuals remain hypervigilant, while others experience more intense, panic-like reactions. Our work points to brain mechanisms that may contribute to those different expressions.”

Although the research does not immediately translate into new treatments, it identifies biological pathways that could serve as targets for future therapies aimed at improving fear extinction.

“If extinction depends on shifting responses away from high-intensity states, then disruptions in these circuits could help explain why fear remains so hard to regulate,” Fadok said.

The study also revealed that the central amygdala plays a more active role in selecting specific defensive behaviors than previously understood.

“It’s not just generating fear,” Fadok said. “It’s helping decide what that fear looks like.”



Jonathan Fadok, neuroscientist at Tulane Brain Institute and associate professor of psychology in Tulane University's School of Science and Engineering