Researchers discover brain pathway that regulates fear responses

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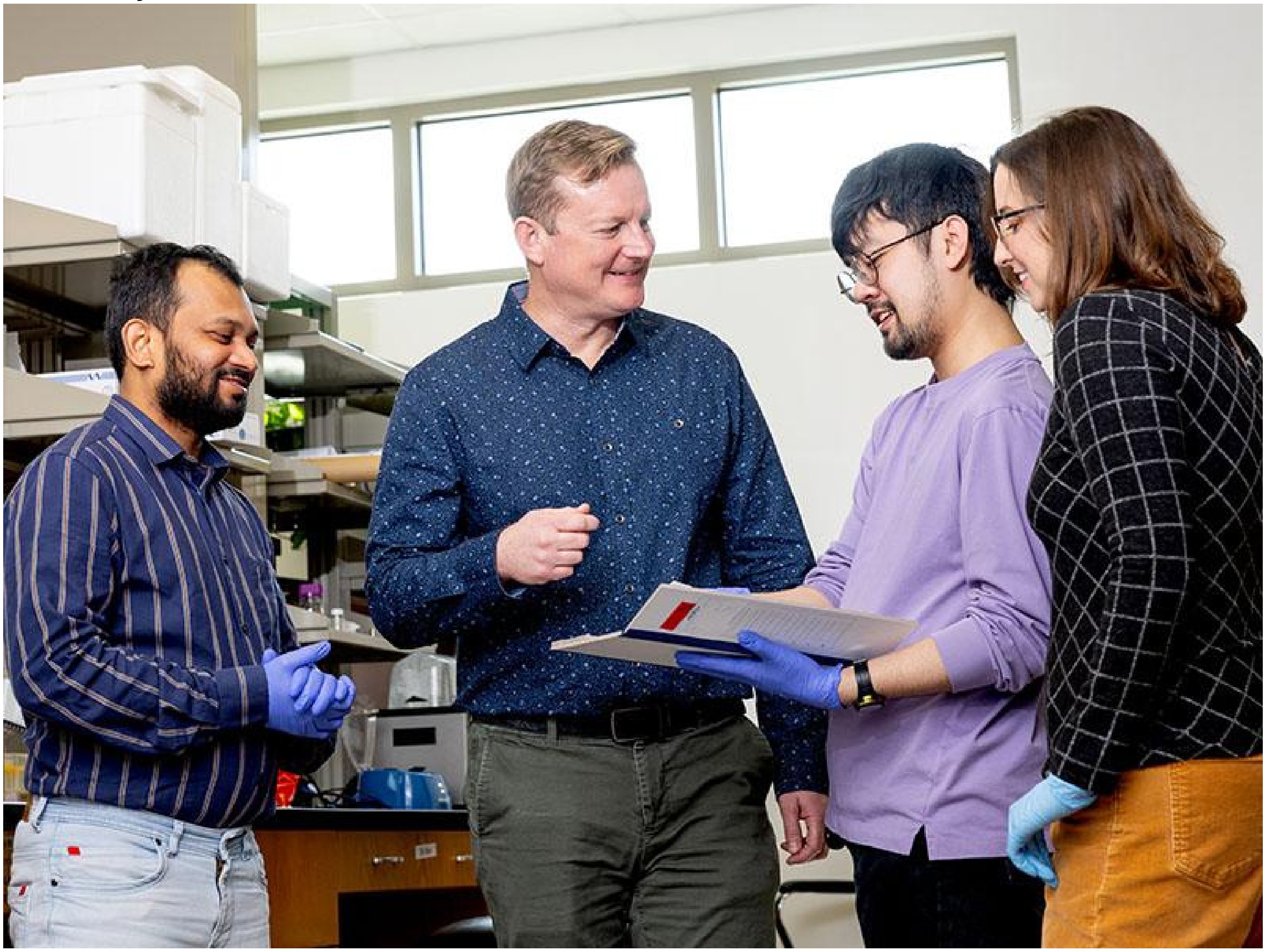

In a new study, researchers at Tulane describe a novel pathway in the brain that sheds light on the way the brain switches from a freezing response to a flight response. From left to right: Chandrashekhar Borkar, Jonathan Fadok, Eric Le and Claire Stelly. (Photo by Sabree Hill)

We have all had the experience of freezing in the face of fear and of wanting to escape, or actually running from, a threatening situation. It is a natural, automatic response that researchers are still trying to fully understand.

In a new study published in *Nature*, researchers at Tulane describe a novel pathway in the brain that sheds light on the way the brain switches from a freezing response to a flight response.

“Our research uncovered a previously unknown pathway, a discovery that paves the way for new understanding of how the brain produces fear behavior,” said Jonathan Fadok, an assistant professor in the Department of Psychology and the Tulane Brain Institute and corresponding author on the study. Fadok studies the medial prefrontal cortex and the amygdala, two parts of the brain associated with the response to fearful and threatening situations. This study came from his team’s interest in how the medial prefrontal cortex could control the shift from a freezing response to a flight response.

“In a freezing response, you can think of it as though, you’re walking alone at night, and you hear a twig snap behind you. That reaction that you have where your muscles tense up, and your heart might start to race and all of that, that is a freezing reaction,” said Fadok. “What it is serving to do is to help you assess what the threat is.”

The freezing response can also help prey animals, like mice, avoid detection by predators. If freezing doesn’t work and they are detected anyway, mice shift to a flight response, where they run and jump away from the threat.

Although many people know of the fight-or-flight response that humans have, there are other instinctive fear responses that humans exhibit, like freezing. This research was done on mice, which have similar fear responses but may respond differently to threatening situations than predators, such as humans. It is entirely likely that the pathways that control these same experiences in the human brain are more complicated.

“There are a lot of differences between the prefrontal cortex of a mouse and a human because, through evolution, our prefrontal cortex has gotten gigantic and much more complex,” said Fadok.

This research could lead to breakthroughs in treatment for disorders like PTSD or other anxiety disorders. These disorders are characterized by what is called a “maladaptive fear response,” a frightened reaction to something that would not, under normal circumstances, elicit such a fear response. Understanding the way the brain generates typical fear responses is the first step to understanding any abnormalities in the mechanism.

“By understanding the circuitry controlling fear reactions, we can perhaps move into something like a PTSD model and try to understand how the circuit operates differently there,” Fadok said.