

Discovery of novel brain fear mechanisms offers target for anxiety-reducing drugs

March 8 2022



Credit: Pixabay/CC0 Public Domain

A new target in the brain which underpins the eliciting of anxiety and fear behaviors such as "freezing" has been identified by neuroscientists. The University of Bristol researchers say the discovery of a key pathway in the brain, to be published in the journal *eLife*, offers a potential new drug target for treating anxiety and psychological disorders, which affect an estimated 264-million people worldwide.

Existing [anxiety](#)-reducing drugs are not always effective for all patients and often have unwanted side effects. Understanding the [brain networks](#) and mechanisms which underlie fear and anxiety may offer a new approach to developing better treatments for anxiety disorders.

Neuroscientists from Bristol's School of Physiology, Pharmacology and Neuroscience, sought to investigate how the brain's cerebellum, which is connected to many brain regions associated with survival networks, influences activity in another area of the brain called the periaqueductal gray (PAG). This PAG area lies at the hub of central networks that coordinate survival mechanisms including fear-evoked coping responses such as "freezing."

To investigate this, researchers fitted animal models with electrodes to record activity within the brain's PAG region and applied a conditioning task, whereby an auditory tone is paired with a small foot shock, eliciting the formation of a "fear memory" and freezing, a behavioral index of fear. The team showed that within the brain's PAG area, a subset of brain cells increased their responsiveness to the conditioned tone, consistent with encoding a fear memory.

However, when cerebellar output was altered during conditioning, the subsequent timing of fear-related neuronal activity in the PAG became less precise and the duration of fear-related freezing behavior was increased confirming that cerebellar-periaqueductal gray interactions contribute to fear conditioning processes. The team showed that the manipulation of a direct cerebellar-PAG pathway, also caused impairments in fear conditioned freezing and ultrasonic vocalizations.

The study's lead authors, Dr. Charlotte Lawrenson and Dr. Elena Paci, explain: "Until now, little was understood about how the cerebellum modulates neuronal activity in other brain regions, especially those related to fear and anxiety. Importantly, our results show that the

cerebellum is part of the brain's survival [network](#) that regulates fear memory processes at multiple timescales and in multiple ways; raising the possibility that dysfunctional interactions in the [brain](#)'s cerebellar-survival network may underlie fear-related disorders and comorbidities."

The study's findings provide new insights into the way the PAG encodes [fear memory](#) and also provides evidence that the cerebellum is an additional key structure in the list of [brain regions](#) that contribute to the fear/anxiety network and offers a novel target for treating psychological conditions including post-traumatic stress disorder.

"Cerebellar modulation of [fear](#) behavior and memory encoding in the PAG" is to be published in *eLife*.

More information: CL Lawrenson et al, Cerebellar modulation of fear behaviour and memory encoding in the PAG (2021). [DOI: 10.1101/2021.02.17.431584](#)

Provided by University of Bristol

Citation: Discovery of novel brain fear mechanisms offers target for anxiety-reducing drugs (2022, March 8) retrieved 27 April 2024 from <https://medicalxpress.com/news/2022-03-discovery-brain-mechanisms-anxiety-reducing-drugs.html>

<p>This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.</p>
--