

# What happens in the brain during fear learning?

August 19 2021, by Bob Yirka

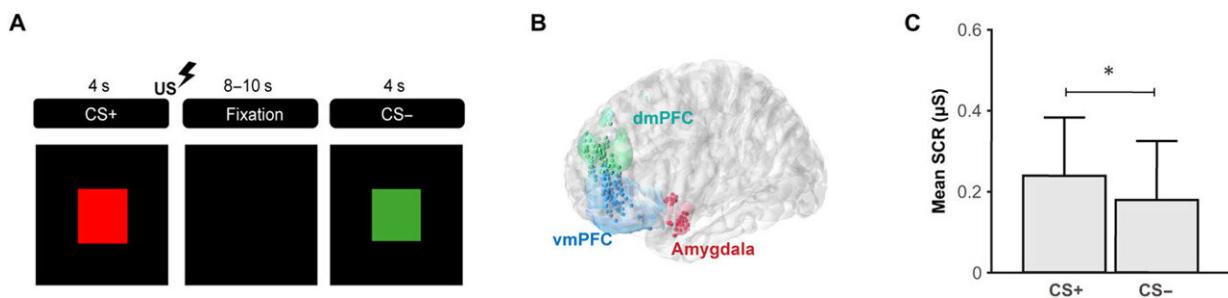


Fig. 1 Schematic depiction of the experimental paradigm and SCR results. (A) Trial structure and timeline for a single CS trial. The visual stimulus was presented for 4000 ms followed by an 8000- to 10,000-ms intertrial interval. A 15-ms electric stimulation (US) occurred at the end of 50% of all CS+ trials. (B) Depiction of electrode contact localizations in amygdala, vmPFC, and dmPFC for all 13 patients superimposed on a semitransparent MNI152 brain (as viewed from the left side). (C) Means ( $\pm$ SEM) CS-evoked SCRs during late acquisition over all patients (Wilcoxon signed-rank tests,  $P = 0.04$ ). \*P

A team of researchers affiliated with multiple institutions in China and one in Germany has learned more about what happens in the brain when a person experiences fear by studying data from probes placed deep in the brains of epileptic patients. The paper is published in *Science Advances*.

Much research has been conducted to learn more about what happens to the body when a person experiences **fear**—the **heart rate** picks up, for example, and quite often, people start to sweat. But much less is known about what goes on in the brain during such experiences. This is because the mechanisms involved lie deep

inside the brain, where it is difficult to get brain wave readings. In this new effort, the researchers overcame that difficulty by recruiting epileptic patients fitted with brain probes; the subjects completed a fear learning task.

Prior research has shown that in the brain, fear appears to originate in the amygdala and the [medial prefrontal cortex](#) (mPFC), so that was where the researchers focused. To learn more about what happens in those [brain regions](#), the researchers showed the volunteers a square on a computer screen. At random moments, a shock to the wrist would accompany the display of a colored square, teaching the volunteer to fear that color square. The same volunteers then looked at the square again after their probes were in place.

The researchers were able to see increases in brain activity when a volunteer was shown a square that they associated with receiving a shock to the wrist—a measure of fear response. In studying these responses, the researchers observed that the [brain activity](#) was a type of rhythm called a theta wave, and it happened in both the amygdala and mPFC. They were also able to see that the fear response began in the dorsal mPFC—a finding that has been seen in other primate studies. The work helps explain what happens in the [brain](#) when people feel fear, which could lead to the development of therapies to treat anxiety disorders.

**More information:** Si Chen et al, Theta oscillations synchronize human medial prefrontal cortex and amygdala during fear learning, *Science Advances* (2021).  
[DOI: 10.1126/sciadv.abf4198](https://doi.org/10.1126/sciadv.abf4198)

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