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Fear: A justified response or faulty wiring?

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Fear is one of the most primal feelings known to man and beast. As we develop in society and learn, fear is hard coded into our neural circuitry through the amygdala, a small, almond-shaped nuclei of neurons within the medial temporal lobe of the brain. For psychologists and neurologists, the amygdala is a particularly interesting region of the brain because it plays a role in emotional learning and can have profound effects on human and animal behavior.

On June 3, 2013, a new article studying amygdala activity in human beings will be published as part of *JoVE Behavior*, a new section of the video journal that focuses on the behavioral sciences. The technique, developed by Dr. Fred Helmstetter and his research group at the University of Wisconsin-Milwaukee, studies how the brain responds to anticipated painful stimuli, in this case an electric shock, in volunteer test subjects.

"We're interested in how the brain reacts to stimuli in the environment and how it changes when we form a memory of what we experience." Dr. Helmstetter explains. "The amygdala is a part of the brain that's important for the way we determine what is dangerous and what is safe around us and how we react to threat. This experiment is novel in that we are able to look at activity in the amygdala on a very detailed time scale while it responds to human faces."

The technique takes advantage of two neuroimaging techniques: magnetic resonance imaging and magnetoencephalography. Magnetic resonance imaging (MRI) is a method where a test subject's brain can be

imaged in high resolution while the test subject is immobilized, creating a map of the brain. Once this map has been obtained, magnetoencephalography (MEG) is used to record the magnetic fields created by the electrical activity within the brain. When the test subject is shocked, or anticipates a shock, amygdala activity is picked up by the MEG and mapped to the MRI computer model.

As an emotional control center in the brain, the amygdala serves as a key component in a line of neurological structures that identify and respond to perceived threat. Dr. Helmstetter tells us, "There is good evidence to suggest that anxiety disorders and other psychopathology might be directly related to altered functioning of the amygdala. Prior work with other non-invasive imaging modalities supports this idea but has only been able to average the results of neural activity over several seconds which results in a poor picture of how neurons react to a stimulus over time. This work represents a significant improvement and will allow new questions to be answered."

More information: Helmstetter, F. J. et. al. How to Detect Amygdala Activity with Magnetoencephalography using Source Imaging. J. Vis. Exp. (76), e50212, doi:10.3791/50212 (2013). www.jove.com/video/50212/how-t … ncephalography-using

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