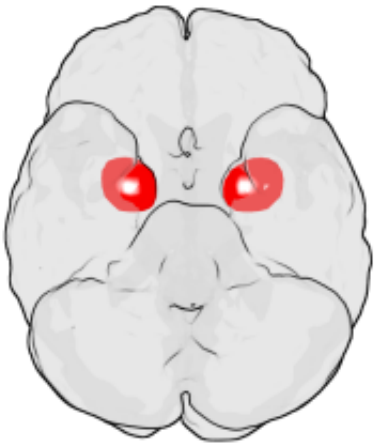
Researchers find amygdala not always necessary for fear

February 4 2013, by Bob Yirka



Location of the amygdala in the human brain. Image: Wikipedia.

(Medical Xpress)—Researchers at the University of Iowa have found that three volunteer women with defective amygdalas were able to experience internal fear. In their paper published in the journal *Nature Neuroscience*, the team describes how they were able to induce fear in the volunteers despite all three suffering from a degenerative disease that made them immune to fear in the "normal" sense.

After many years of research by a wide range of scientists, a consensus had been reached regarding the way the human brain controls the sensation of fear. Most agreed that the primary brain region involved

was the amygdala – without it, people would lead fear-free lives. This new research suggests such a conclusion may have been at least partially flawed, as the three women in the study all suffered from a genetic disease that leads over time to degeneration of the amygdala. They'd all been living without feeling fear for many years.

The three women, listed as SM, AM and BG, all have Urbach-Wiethe disease – a genetic condition that causes the degeneration of a tiny part of the brain known as the amygdala. AM and BG are identical twins, and SM has volunteered for extensive testing over many years and has demonstrated a near immunity to fear from not just lab tests (being shown spiders, snakes, scary movies, etc.) but real life threats such as being held at knifepoint. All such fear inducing threats however, have had one thing in common, they are what are known as external threats. This new research set out to test internal threats – those that come from within, such as heart attacks, and in this case, the possibility of suffocating.

The volunteers weren't suffocated of course, instead, suffocation was simulated by putting a mask on the volunteers' faces forcing them to breathe air with high amounts of carbon dioxide in it. This leads, of course to abnormal amounts of carbon dioxide in the blood, which for some, can lead to panic. For the three volunteers, that's exactly what happened. Each reported feeling extreme amounts of fear – a sensation they had not experienced in many years. Thus, despite a non-functioning amygdala, the women were still able to feel fear, just not the kind associated with external threats.

While the researchers can't say for sure why the women were able to experience internal, but not external fear, they suggest other parts of the brain must play a role in fear generation overall, and that perhaps the amygdala doesn't generate the feeling of fear, but instead is involved in the processing of external threats that lead to a fearful response.

More information: Fear and panic in humans with bilateral amygdala damage, *Nature Neuroscience* (2013) doi:10.1038/nn.3323 . www.nature.com/neuro/journal/v … nt/full/nn.3323.html

Abstract

Decades of research have highlighted the amygdala's influential role in fear. We found that inhalation of 35% CO2 evoked not only fear, but also panic attacks, in three rare patients with bilateral amygdala damage. These results indicate that the amygdala is not required for fear and panic, and make an important distinction between fear triggered by external threats from the environment versus fear triggered internally by CO2.

Press release