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No fear

Woman lacking basic brain structure isn't scared of anything

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ENLARGE

SEAT OF FEAR
A rare genetic disease destroyed both sides of the amygdala (red) in a woman known as SM, preventing her from experiencing fear.
Wikimedia/Was a bee

A middle-aged woman known as SM blithely reaches for poisonous snakes, giggles in haunted houses and once, upon escaping the clutches of a knife-wielding man, didn't run but calmly walked away. A rare kind of brain damage precludes her from experiencing fear of any sort, finds a study published online December 16 in *Current Biology*.

SM has an unusual genetic disorder called Urbach-Wiethe disease. In late childhood, this disease destroyed both sides of her amygdala, which is composed of two structures the shape and size of almonds, one on each side of the brain. Because of this brain damage, the woman knows no fear, the researchers found.

Experiments have strongly implicated the amygdala in fear processing. Many of these were conducted on animals with amygdala damage. "But one thing we've never known for sure, because they're animals, is whether they can consciously feel fear," says study coauthor Justin Feinstein of the University of Iowa in Iowa City. "So we said, 'Let's take a human patient who has this same sort of damage, and for the first time, actually figure out how they're feeling.'"

Feinstein and his colleagues sifted through SM's past, looking for instances when she should have been scared. SM said she never felt fear, even when threatened with a knife or a gun. The researchers gave SM an electronic diary that she carried for three months to record her emotional state. Fear didn't make an appearance in the list of emotions. On a battery of questionnaires, SM wrote that she wasn't afraid of public speaking, death, her heart beating too fast or being judged negatively in a social setting.

Next, the researchers did their best to scare SM. They showed her clips from *The Blair Witch Project*, *The Shining* and *Silence of the Lambs*: She was interested, but not afraid. The Waverly Hills Sanatorium Haunted House in Kentucky didn't faze her. Instead of screaming, she laughed and poked one of the monsters in the head. The team took her to an exotic pet store with poisonous snakes and spiders. SM claimed to dislike the animals, but when she saw them she was overcome with curiosity, repeatedly asking to touch the snakes.

"What that suggests to us is that perhaps the amygdala is acting at a very instinctual, unconscious level," says Feinstein. "Without this area, instead of just losing your interest in things, you do the very thing that's opposite. She tends to approach the very things she should be avoiding."

Although the new study is based on a single patient, it is "a particularly clear example" of how the amygdala is important for fear, says neuroscientist Hans Markowitsch of the University of Bielefeld in Germany. "The woman indeed had almost no fear in quite divergent situations."

Markowitsch cautions that a study on a single person can't be extended to apply to other people, since many other factors influence how the brain and emotions work.

What's more, pinning a complex emotional state to a single brain structure isn't straightforward. "When you have to name a structure relevant for fear in the brain, everyone comes up with the amygdala," Markowitsch says. "But one could argue that the amygdala cannot act on its own — it's dependent on connections, on circuits, on other brain regions."

The study's authors can't dismiss other brain regions' roles in experiencing fear. Yet SM's complete inability to experience the emotion — in a wide variety of forms — highlights the amygdala's pivotal role in feeling afraid.

SUGGESTED READING :

B. Bower. Damage control: Brain injuries fight off PTSD in vets. Science News, Vol. 173, January 5, 2008, p. 5. Available online:

CITATIONS & REFERENCES :

J. Feinstein et al. The human amygdala and the induction and experience of fear. Current Biology. doi:10.1016/j.cub.2010.11.042