

Neurobiology of dread gives scientists clues about human decision making

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In order to better understand how people make decisions when the outcomes are known to be unpleasant, a team of Emory neuroscientists led by Gregory Berns, MD, PhD, used functional magnetic resonance imaging (fMRI) to determine the areas of the brain that are activated when someone experiences dread. The study, which was supported by the National Institutes of Drug Abuse (NIDA), was published in the May 5, 2006 issue of the journal *Science*.

The study was part of a research program in the growing field of neuroeconomics, an area in which neuroscience methods are being applied to economic questions.

"Most people don't like waiting for an unpleasant outcome, and want to get it over with as soon as possible," explains Dr. Berns, an associate professor in the Department of Psychiatry and Behavioral Sciences at Emory University School of Medicine. "The only explanation for this is that the dread of having something hanging over your head is worse than the thing that you are dreading. It is a commonplace experience, but standard economic models of decision-making don't deal with this issue. So, we decided to take a biological approach and see what happens in the brain that might cause people to make such rash decisions."

The study was conducted using an fMRI scanner to look at the brains of the study participants while delivering a series of low voltage shocks to the foot of each participant, with different levels of intensity and different time delays up to the shock. Each of the participants in the

study was screened to determine their maximal pain threshold. While in the MRI scanner, participants underwent a series of 96 shocks. Before each shock, they were told how painful the shock would be (as a percent of their threshold) and how long they would have to wait for it. After the scanning procedure, they were then given the opportunity to choose between different intensity-delay combinations, the choice was always between more pain sooner or less pain later. The degree to which individuals chose more voltage sooner just to get a trial over was an indication of the dread they experienced from waiting.

A total of 32 participants took part in the trial. Most of the participants preferred to speed up the waiting period and were deemed "mild dreaders", but 28% dreaded so much that they were willing to take more pain just to avoid waiting. Berns called them "extreme dreaders."

The scans showed that brain activity related to dread was localized in the areas of the brain associated with pain. Dread was found in the parts of the pain network linked to attention. This is important because it suggests that dread is not as simple as fear or anxiety, which are emotions controlled by different brain regions.

The findings also showed that the mild and extreme dreaders had different patterns of brain activity. The extreme dreaders had more activity in the attentional parts of the pain matrix, and this activity was seen much earlier in each trial compared to the mild dreaders.

"Taken together, the anatomical locations of dread responses suggest that the subjective experience of dread that ultimately drives an individual's behavior comes from the attention devoted to the expected physical response, and not simply a fear or anxiety response," explains Dr. Berns. "The key factor seems to be that extreme dreaders devoted more attention toward the part of their body that was about to be shocked. This is important because it means that dread is not quite the same as

fear or anxiety. These findings underscore the very real nature of dread and the need to account for it in economics."

It also means that dread can be mitigated by diverting attention.

"The dread associated with things like medical procedures or public speaking, while real, can probably be alleviated by diverting one's attention during the waiting period," says Dr. Berns. "There may be many ways to do this, ranging from meditation to sports, or even a movie. The benefits could be substantial if it means that we act more rationally in terms of getting healthcare, or simply decreasing the psychological toll of dread and anxiety."

Source: Emory University

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