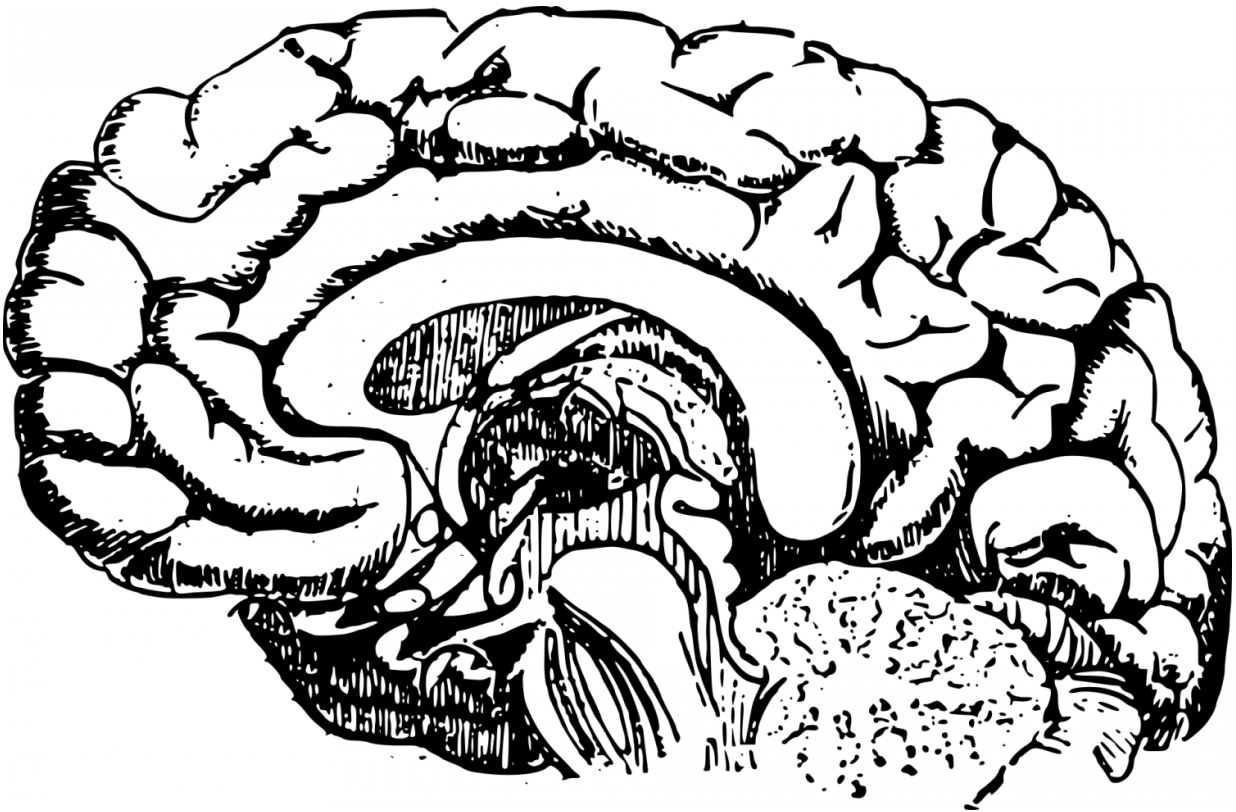


How the brain helps us make good decisions—and bad ones

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A prevailing theory in neuroscience holds that people make decisions based on integrated global calculations that occur within the frontal cortex of the brain.

However, Yale researchers have found that three distinct circuits connecting to different brain regions are involved in making good decisions, bad ones and determining which of those past choices to store in memory, they report June 25 in the journal *Neuron*.

The study of decision-making in rats may help scientists find the roots of flawed decision-making common to mental health disorders such as addiction, the authors say.

"Specific decision-making computations are altered in individuals with mental illness," said Jane Taylor, professor of psychiatry and senior author of the study. "Our results suggest that these impairments may be linked to dysfunction within distinct neural circuits."

Researchers used a new tool to manipulate brain circuits in rats while they were making choices between actions that led to them receiving rewards or no rewards. The authors found decision-making is not confined to the orbital frontal cortex, seat of higher order thinking. Instead, brain circuits from the orbital frontal cortex connecting to deeper brain regions performed three different decision-making calculations.

"There are at least three individual processes that combine in unique ways to help us to make good decisions," said Stephanie Groman, associate research scientist of psychiatry and lead author of the research.

Groman says an analogy would be deciding on a restaurant for dinner. If restaurant A has good food, one brain circuit is activated. If the food is bad, a different circuit is activated. A third circuit records the memories of the experience, good or bad. All three are crucial to [decision-making](#), Groman says.

For instance, without the "good [choice](#)" circuit you may not return to the

restaurant with good food and without the "bad choice" circuit you might not avoid the restaurant with bad food. The third "memory" circuit is crucial in making decisions such as whether to return to the [restaurant](#) after receiving one bad meal after several good ones.

Alterations to these circuits may help explain a hallmark of addiction—why people continue to make harmful choices even after repeated negative experiences, researchers say.

The Yale researchers previously showed that some of the same [brain](#) computations were disrupted in animals that had taken methamphetamine.

"Because we used a test that is equivalent to those used in studies of human decision- making, our findings have direct relevance to humans and could aid in the search for novel treatments for substance abuse in humans," Groman said.

Provided by Yale University

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