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Brain pathway contributes to restraining from food temptation triggered by environmental cues

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It is often difficult to resist the presentation of a dessert tray or a display of candy bars near a cashier. Eating those excess calories can contribute to overweight and obesity and is often driven by environmental cues - the sight of beautiful dessert or the colorful wrapper of a candy bar - rather than metabolic need. Researchers at the University of Illinois at Chicago have identified a pathway in the brain responsible for the ability to control this impulsive behavior. The findings will be presented this week at the Annual Meeting of the Society for the Study of Ingestive Behavior (SSIB), the society for research into all aspects of eating and drinking behavior.

"We have found that stopping a behavior that typically leads to reward is an active process," says Jamie Roitman, PhD, the principal investigator of the study. "While it is intuitive to think that we have to actively initiate an action, putting on the brake is also an active process to stop these kinds of behaviors".

To test how the brain exercises this inhibitory control over behavior, the authors trained rats to press a lever to obtain sugar pellets. Then the rats had to learn to hold the press in check when presented with a "stop" signal. The researchers discovered that the ability to stop depended on the activity of the medial prefrontal cortex (mPFC), a region of the brain implicated in executive control over behavior. They found that individual neurons in mPFC became activated in response to both 'go'

and 'stop' environmental cues, suggesting that it may play a role in both types of control. When mPFC activity was temporarily suppressed with a drug infusion, rats' ability to stop their behavior was strongly diminished. In addition, the researchers found they could improve rats' stopping ability by applying a chemogenetic treatment that enhanced neural activity in that region. These results suggest that mPFC activity plays a critical role in exercising control over behavior when a stop signal is presented.

To examine how mPFC may exert this control, the researchers turned their attention to another brain area which receives commands from the mPFC, the nucleus accumbens (NAc). The NAc plays an important role in processing rewards and has been implicated in a wide range of motivated behaviors, such as feeding, sex, and drug abuse. When the communication between the mPFC and NAc was blocked, rats were again unable to hold their behavior in check when encountering a stop cue.

"Taken together, the results suggest that medial prefrontal cortex actively puts a hold on behavior in the moment that an environmental cue may trigger it. If we can boost this hold signal - perhaps with another cue to remind us at the right time why we should forego the tasty treat - we could gain better control over this kind of impulsive eating. We need an app for that," suggests Roitman.

More information: Response of medial prefrontal neurons to cues for behavioral restraint, Annual Meeting of the Society for the Study of Ingestive Behavior (SSIB), 2016.

Provided by Society for the Study of Ingestive Behavior