Medical Xpress

Researchers unlock mechanisms in the brain that separate food consumption from cravings

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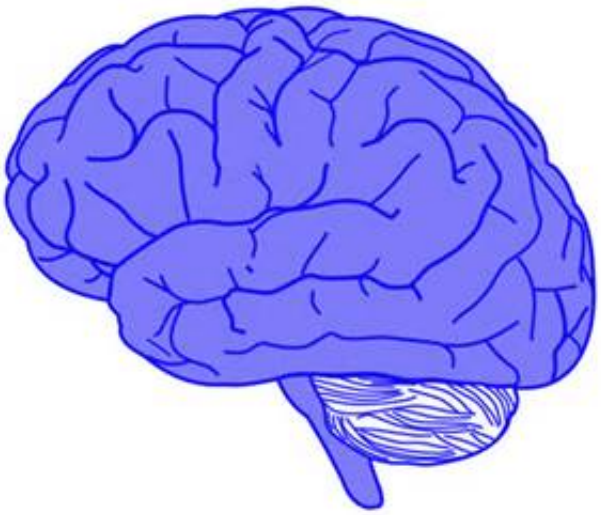

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Researchers investigating eating disorders often study chemical and neurological functions in the brain to discover clues to overeating. Understanding non-homeostatic eating—or eating that is driven more by palatability, habit and food cues—and how it works in the brain may help neuroscientists determine how to control cravings, maintain healthier weights and promote healthier lifestyles. Scientists at the

University of Missouri recently discovered the chemical circuits and mechanisms in the brain that separate food consumption from cravings. Knowing more about these mechanisms could help researchers develop drugs that reduce overeating.

"Non-homeostatic eating can be thought of as eating dessert after you've eaten an entire meal," said Kyle Parker, a former grad student and investigator in the MU Bond Life Sciences Center. "I may know that I'm not hungry, but this dessert is delicious so I'm going to eat it anyway. We're looking at what neural circuitry is involved in driving that behavior."

Matthew J. Will, an associate professor of psychological sciences in the MU College of Arts and Science, a research investigator in the Bond Life Sciences Center and Parker's adviser, says for behavior scientists, eating is described as a two-step process called the appetitive and consummatory phases.

"I think of the neon sign for a donut shop—the logo and the aroma of warm glazed donuts are the environmental cues that kick start the craving, or appetitive, phase," Will said. "The consummatory phase is after you have that donut in hand and eat it."

Parker studied the behavior patterns of laboratory rats by activating the brain's pleasure center, a hotspot in the brain that processes and reinforces messages related to reward and pleasure. He then fed the rats a cookie dough-like diet to exaggerate their feeding behaviors and found that the rats ate twice as much as usual. When he simultaneously inactivated another part of the brain called the basolateral amygdala, the rats stopped binge eating. They kept returning to their food baskets in search of more, but only consumed a normal amount.

"It seemed as if the rats still craved the dough," Will said. "They kept

going back for food but simply didn't eat. We found that we had interrupted the part of the brain that's specific to feeding—the circuit attached to actual eating—but not the craving. In essence, we left that craving intact."

To find out what was happening in the brain during cravings, Parker set up a spin-off experiment. Like before, he switched on the region of the brain associated with reward and pleasure and inactivated the basolateral amygdala in one group of rats but not the other. This time, however, he limited the amount of the high fat diet the rats had access to so that both groups ate the same amount.

Outwardly, both groups of rats displayed the same feeding behaviors. They ate a portion of food, but kept going back and forth to their food baskets. However, inside the brain, Parker saw clear differences. Rats with activated nucleus accumbens showed increased dopamine neuron activity, which is associated with motivated approach behavior.

The team also found that the state of the basolateral amygdala had no effect on dopamine signaling levels. However, in a region of the brain called the hypothalamus, Parker saw elevated levels of orexin-A, a molecule associated with appetite, only in rats with activated basolateral amygdala.

"We showed that what could be blocking the consumption behavior is this block of the orexin behavior," Parker said.

"The results reinforced the idea that dopamine is involved in the approach—or the craving phase—and orexin-A in the consumption," Will said.

The team believes that these findings could lead to a better understanding of the different aspects of overeating and drug addiction.

By revealing the independent circuitry of craving vs. the actual consumption or drug taking, this could lead to potential drug treatments that are more specific and have less unwanted side effects.

Parker and Will's study, "Neural activation patterns underlying basolateral amygdala influence on intra-accumbens opioid-driven consummatory versus appetitive high-fat feeding behaviors in the rat," recently was published in *Behavioral Neuroscience*. Research was funded in part by the National Institute of Drug Abuse (DA024829). The content is solely the responsibility of the authors and does not necessarily represent the official views of the funding agency.

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