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Brain Regions Activated By Food Craving Overlap With Areas Implicated In Drug Craving

Images of desire...

Philadelphia, PA -- Researchers at the Monell Chemical Senses Center and the University of Pennsylvania School of Medicine used functional magnetic resonance imaging (fMRI) to reveal that food cravings activate brain areas related to emotion, memory and reward – areas also activated during drug-craving studies. Study lead author Marcia Levin Pelchat, PhD, a Monell Center sensory psychologist, comments, “This is consistent with the idea that cravings of all kinds, whether for food, drugs, or designer shoes, have common mechanisms.”

Studies of food craving – possibly the evolutionary basis of all craving behavior - may provide insight into drug craving and how it contributes to maintenance and relapse of drug addiction. Pelchat notes, “Identifying the brain regions involved can tell us a great deal about the normal and pathological neurochemistry of craving, and in turn, lead us to better pharmacological treatments for obesity and drug addiction.”

During food craving episodes, craving-specific activation was seen in three regions of the brain: the hippocampus, insula, and caudate. These same three areas have also been reported to be involved in drug craving.

J. Daniel Ragland, PhD of the Department of Psychiatry, University of Pennsylvania School of Medicine, was responsible for the imaging part of the study. Ragland comments, “The pattern of fMRI results suggests that memory areas of the brain responsible for associating a food with a reward are more important to food craving than are the actual reward centers.” He goes on to say, “This result fits nicely with animal research that has shown that stimulation of memory centers is more effective than stimulation of reward centers in getting animals to work for drug rewards.”

In the study, to be published in the December 2004 issue of *NeuroImage*, 10 healthy volunteers were not permitted to consume anything other than a vanilla nutritional supplement beverage for the one-and-a-half days before the imaging session. The researchers used the monotonous diet to increase the probability of cravings during fMRI sessions. Previous findings had shown that consuming a monotonous diet leads to large increases in the number of food cravings.

Subjects received enough of the beverage to provide sufficient calories and nutrients. A control group was allowed to eat whatever they wanted, along with several servings of the vanilla supplement.

Each subject provided names of two foods that they “really like.” To trigger cravings during the fMRI scan, names of the liked foods and the liquid diet were alternated on a screen. Subjects were instructed to think about the food listed on the screen, along with its taste, smell, and texture. The researchers decided to use words as cues – rather than pictures - so each subject could imagine their own most desirable version of the liked food.

After the session subjects reported whether they had experienced any food cravings. As expected, the monotonous diet increased the likelihood of food craving when imagining the liked foods. All monotonous diet participants reported food craving while imagining the liked foods, but not while visualizing the monotonous food.

Food cravings are very common: surveys estimate that almost 100% of young women and nearly 70% of young men report having experienced cravings during the past year. The high prevalence of craving behavior increases its potential nutritional impact, as cravings have been linked to snacking behavior and diet compliance, both related to obesity.

Pelchat notes the significance of activation of memory structures, “During a craving we have a sensory memory or template for the food that will satisfy the craving. The food we eat has to match that template for the craving to be satisfied. It’s as if our brain is saying, ‘It has to be chocolate ice cream, lemon pie just won’t do.’” She continues, “Cravings are also like habits. We often reach for a craved food without thinking of it.”

Looking to the future, Pelchat comments, “We need to know more about food cravings in pathological conditions such as obesity, alcoholism, cocaine addiction, and so on. If all these excesses of desire share common brain mechanisms, then it might be possible to use motivational trades-off to treat cravings for harmful substances by substituting craving for something healthier, such as good food.”

Penn researchers Andrea Johnson, Robin Chan, and Jeffrey Valdez also contributed to the work.

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