Brain's 'sixth sense' for calories discovered

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The brain can sense the calories in food, independent of the taste mechanism, researchers have found in studies with mice. Their finding that the brain's reward system is switched on by this "sixth sense" machinery could have implications for understanding the causes of obesity. For example, the findings suggest why high-fructose corn syrup, widely used as a sweetener in foods, might contribute to obesity.

Ivan de Araujo and colleagues published their findings in the March 27, 2008, issue of the journal *Neuron*, published by Cell Press.

In their experiments, the researchers genetically altered mice to make them "sweet-blind," lacking a key component of taste receptor cells that enabled them to detect the sweet taste.

The researchers next performed behavioral tests in which they compared normal and sweet-blind mice in their preference for sugar solutions and those containing the noncaloric sweetener sucralose. In those tests, the sweet-blind mice showed a preference for calorie-containing sugar water that did not depend on their ability to taste, but on the calorie content.

In analyzing the brains of the sweet-blind mice, the researchers showed that the animals' reward circuitry was switched on by caloric intake, independent of the animals' ability to taste. Those analyses showed that levels of the brain chemical dopamine, known to be central to activating the reward circuitry, increased with caloric intake. Also, electrophysiological studies showed that neurons in the food-reward region, called the nucleus accumbens, were activated by caloric intake,

independent of taste.

Significantly, the researchers found that a preference for sucrose over sucralose developed only after ten minutes of a one-hour feeding session and that neurons in the reward region also responded with the same delay.

“In summary, we showed that dopamine-ventral striatum reward systems, previously associated with the detection and assignment of reward value to palatable compounds, respond to the caloric value of sucrose in the absence of taste receptor signaling,” concluded the researchers. “Thus, these brain pathways do not exclusively encode the sensory-related hedonic impact of foods, but might also perform previously unidentified functions that include the detection of gastrointestinal and metabolic signals,” they wrote.

The scientific questions raised by the discovery of the brain’s calorie-sensing system “are extremely important to understanding the pathogenesis and sociology of human obesity,” wrote Zane Andrews and Tamas Horvath in a preview of the article in the same issue of Neuron.

“For example, high-fructose corn syrup is a ubiquitous sweetener in American society, and evidence suggests that fructose is not as effective as sucrose in terminating a meal. It may be that fructose produces stronger activation of the reward system and that removing high-fructose corn syrup as a sweetener will curb some desire for these products. Regardless, the present study alone will further galvanize the scientific community to understand how higher cognitive centers in the brain control food intake and body weight regulation,” wrote Andrews and Horvath.

Source: Cell Press