Mechanism involved in addictions and some forms of obesity discovered

4 October 2010

A researcher from the Faculty of Medicine & Dentistry at the University of Alberta has discovered a mechanism underlying some forms of obesity and addictions which could lead to a treatment for both diseases.

When a hungry animal finds food in the wild, it is a rewarding stimulus for the animal and is recognized by the brain by the release of the chemical messenger dopamine. Because narcotics such as cocaine, heroin and amphetamines, and even tasty and highly-caloric foods also cause the release of dopamine and therefore make people feel rewarded, it's clear that dopamine has a role in addiction and the development of obesity. When an animal knows it can expect rewarding stimuli, like a treat, in a certain location, either in the wild or captivity, this is called 'conditioned place preference' and is dependent on spatial memories being formed in a specific part of the brain called the dentate gyrus.

Professor Bill Colmers and his research group, in the department of pharmacology, set out to find if dopamine may have an effect on the memory-forming brain cells in the dentate gyrus. His group used living brain slices from laboratory models and were able to mimic activity in brain cells when an animal is exploring a novel environment. When dopamine was added, it increased the excitability in part of the brain cell called the dendrites. A chemical secreted by the brain, Neuropeptide Y, had the opposite effect making the cells less excitable.

They took this experiment further by looking at a model called long term potentiation, which is the name for a form of cellular learning. When the scientists stimulated dopamine receptors they found that cellular learning was strengthened. While doing the same experiment with neuropeptide Y, applied together with dopamine, it prevented long-term potentiation from happening

The group also did this in human brain slices taken from patients undergoing therapy for temporal lobe epilepsy. The human brain cells showed the same properties as cells found in rats, and they also undergo dopamine-dependent cellular learning when stimulated in the same fashion as the laboratory models.

Considering Colmers and his group's major focus is in obesity, this is a very exciting finding.

"You can find the fridge and you know there's good stuff in there, so you can find it in your sleep, and people do," said Colmers. "So there's this whole reward aspect to place that we've been able to unravel."

These results help explain the mechanisms that underlie the formation of reward-cued spatial memories in both the laboratory model and human dentate gyrus. Understanding this mechanism not only explains the biology of an important form of learning, but may also lead to potential treatments for addiction and obesity.

Provided by University of Alberta