Investigating the pleasure centers of the brain: How reward signals are transmitted

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New research presented today by Dr. Jonathan Britt, from McGill University, helps to better understand how reward signals, such as those produced by addictive drugs, travel through the brain and modify brain circuits. Dr. Britt obtained these results using optogenetics, which use light-responsive proteins to study the activation of neural circuits in distinct locations, allowing the researcher to precisely dissect the roles of different neural circuits in the brain. Dr. Britt's studies have helped reveal circuits that are responsible for habitual behavior, which could be suitable targets for pharmacotherapies designed to treat drug addiction. These results were presented at the 2014 Canadian Neuroscience Meeting, the annual meeting of the Canadian Association for Neuroscience - Association Canadienne des Neurosciences (CAN-ACN) which takes place May 25 - 28th 2014.

One of the most immediate effects of drugs on the brain is an increase in the levels of dopamine, particularly in a region of the brain called the nucleus accumbens. Located near the center of the brain, the nucleus accumbens is connected, by intermingled populations of cells, to many other brain structures having roles in pleasure seeking and drug addiction . The nucleus accumbens is recognized as an integration centre for signals coming from many different brain regions, but the precise role of the different connections, and the means of their integration, resulting in specific behaviours, was until recently impossible to dissect. The advent of optogenetics has made it possible to study the various inputs that come from different regions of the brain, and their positive or negative effects on reward seeking, and their role in drug response in mice and

rats.

Dr. Britt has characterized some of the ways that the nucleus accumbens integrates dopamine dependent reinforcement signals with environmental stimuli, which depend on a second neurochemical called glutamate. Glutamate-dependent signals to the nucleus accumbens come from many other brain regions, such as the hippocampus, the amygdala, the thalamus and the prefrontal cortex. Understanding how these different brain regions are interconnected will deepen our understanding of motivation, desire, pleasure seeking and addiction. This research is also applicable to the understanding of conditions such as Tourette's syndrome and obsessive-compulsive disorder.

"Goal-directed behaviour is regulated by large collection of interconnected brain regions. It is important to understanding how these component parts interact with each other in order to devise treatment strategies for psychiatric diseases such as addiction, Tourette's syndrome and obsessive-compulsive disorder," concludes Dr. Britt.

More information: www.can-acn.org/meeting2014

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