

Habitual Behavior Pathophysiology -- The Central Role of Endocannabinoids in OCD

By ACSH Staff — June 20, 2016



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Life is about navigating the familiar and the unfamiliar. We take comfort in driving home the same way each day while we go on vacation to new places. These are habitual versus goal-oriented behaviors.

For people with Obsessive-Compulsive Disorder, the unfamiliar can be paralyzing and they need more ritual and routine to offset the chaos of the outside world. A new study examined how endocannabinoids -- natural messengers in the body that are chemically similar to the active compound in marijuana and known to generally reduce the activity of neurons -- play a role in how the brain controls this fundamental process.

Previous studies suggested that reduced activity in the brain's orbitofrontal cortex (OFC) underlies habit formation. The authors of the new paper hypothesized that endocannabinoids in the OFC could be playing a key role in habit formation. The researchers used a newly developed procedure that allowed them to probe the brain mechanisms involved when a mouse shifts from goal-directed to habitual actions. By chemically inhibiting the activity of neurons in the OFC, they disrupted goal-directed behaviors and the mice relied on habitual actions instead.

"Mice were trained to receive a food reward in two different ways," says [David Lovinger, Ph.D., chief of the NIAAA Laboratory for Integrative Neuroscience](#) [2]. "One way required the animal to respond out of habit, while the second way demanded it to perform behaviors that were goal-directed."

When the team selectively deleted a particular endocannabinoid receptor, called cannabinoid type 1 (CB1), from OFC neurons, they found that mice that lacked these receptors did not form habits, but used goal-directed responses to receive the food reward. Animals with intact CB1 receptors preferentially used habitual responses to obtain the food reward. The authors say the new study points to a molecular mechanism through which endocannabinoids promote the formation of habits by reducing the flow of information in the OFC.

If endocannabinoids act as a brake in the OFC, allowing for habit formation, alterations in the brain's endocannabinoid system could be blocking the brain's capacity to "break habits" as

observed in disorders that affect switching between goal-directed and habitual behaviors.

The authors concluded that their findings demonstrate the existence of parallel brain circuits that mediate goal-directed and habitual behaviors. Drugs of abuse and neuropsychiatric disorders can affect decision-making by changing the balance between habitual and goal-directed actions. In particular, these mechanisms could help explain how cannabis drugs such as marijuana affect memory and decision making. The new findings suggest that strategies that target the brain's endocannabinoid system might restore this balance and alleviate suffering in disorders involving these processes.

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