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Researchers discover why cocaine is so addictive

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Mount Sinai researchers have discovered how cocaine corrupts the brain and becomes addictive. These findings -- the first to connect activation of specific neurons to alterations in cocaine reward -- were published in *Science* on October 15. The results may help researchers in developing new ways of treating those addicted to the drug.

Led by Mary Kay Lobo, PhD, Postdoctoral Fellow in the Department of Neuroscience at Mount Sinai School of Medicine and first author of the study, researchers found that the two main neurons (D1 and D2) in the nucleus accumbens region of the brain, an important part of the brain's reward center, exert opposite effects on cocaine reward. Activation of D1 neurons increases cocaine reward whereas activation of D2 neurons decreases cocaine reward.

"The data suggest a model whereby chronic exposure to cocaine results in an imbalance in activity in the two nucleus accumbens neurons: increased activity in D1 neurons combined with decreased activity in D2 neurons," said Dr. Lobo. "This further suggests that BDNF-TrkB signaling in D2 neurons mediates this decreased activity in D2 neurons."

The study was conducted using optogenetics, a technology to optically control neuronal activity in freely moving rodents.

Opposite cocaine reward similar to those found when activating each neuron is achieved by disrupting brain-derived neurotrophic factor, which is a protein in the brain known for its involvement in neuronal

survival, learning, and memory and drug abuse signaling through its receptor TrkB in D1 or D2 neurons.

"This new information provides fundamentally novel insight into how cocaine corrupts the brains reward center, and in particular how cocaine can differentially effect two neuronal subtypes that are heterogeneously intermixed in the nucleus accumbens," said Eric Nestler, MD, PhD, Chair of Neuroscience, Nash Family Professor, and Director of The Friedman Brain Institute at Mount Sinai and co-author on the study. "We can use this information to potentially develop new therapies for cocaine addiction, possibly aimed at altering neuronal activity selectively in either neuronal subtype."

Provided by The Mount Sinai Hospital

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