

NIDA Study Shows That Methylphenidate (Ritalin) Causes Neuronal Changes In Brain Reward Areas 02 Feb 2009

Investigators funded by the National Institute on Drug Abuse (NIDA) have shown that the medication methylphenidate (Ritalin), which is commonly prescribed to treat attention-deficit hyperactivity disorder (ADHD), can cause physical changes in neurons in reward regions of mouse brains; in some cases, these effects overlapped with those of cocaine. Both methylphenidate and cocaine are in the class of drugs known as psychostimulants. While methylphenidate is widely prescribed, this study highlights the need for more research into its long-term effects on the brain. These research findings will be published February 3 in *Proceedings of the National Academy of Sciences*.

"Studies to date suggest that prescribed use of methylphenidate in patients with ADHD does not increase their risk for subsequent addiction. However, nonmedical use of methylphenidate and other stimulant medications can lead to addiction as well as a variety of other health consequences," said NIDA Director Dr. Nora Volkow. "This study highlights the fact that we know very little about how methylphenidate affects the structure of and communication between brain cells."

The researchers exposed mice to 2 weeks of daily injections of cocaine or methylphenidate, after which reward areas of the brain were examined for changes in dendritic spine formation, which is related to the formation of synapses and the communication between nerve cells; and the expression of a protein, delta Fos B, which has been implicated in the long-term actions of addictive drugs. Both drugs increased dendritic spine formation and the expression of delta Fos B; however, the precise pattern of their effects was distinct. It differed in the types of spines affected, the cells that were affected, and the brain regions. In some cases, there was overlap between the two drugs; further, in some cases, methylphenidate produced greater effects than cocaine—for example, on protein expression in certain regions.

"Methylphenidate, which is thought to be a fairly innocuous compound, can have structural and biochemical effects in some regions of the brain that can be even greater than those of cocaine," stated Dr. Yong Kim, lead author of the study. "Further studies are needed to determine the behavioral implications of these changes and to understand the mechanisms by which these drugs affect synapse formation," he added.

Previous studies, including two that were reported by NIDA on April 1, 2008 ("NIH Research Suggests Stimulant Treatment for ADHD Does Not Contribute to Substance Abuse Later in Life"), have shown that children treated with stimulants for ADHD early in life have no greater risk of drug addiction as adults.

The National Institute on Drug Abuse is a component of the National Institutes of Health, U.S. Department of Health and Human Services. NIDA supports most of the world's research on the health aspects of drug abuse and addiction. The Institute carries out a large variety of programs to inform policy and improve practice. Fact sheets on the health effects of drugs of abuse and information on NIDA research and other activities can be found on the NIDA home page at <http://www.drugabuse.gov>.

The National Institutes of Health (NIH) - *The Nation's Medical Research Agency* - includes 27 Institutes and Centers and is a component of the U.S. Department of Health and Human Services. It is the primary Federal agency for conducting and supporting basic, clinical, and translational medical research, and it investigates the causes, treatments, and cures for both common and rare diseases.

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