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NIDA Study Shows That Methylphenidate (Ritalin) Causes Neuronal Changes in Brain Reward Areas

Similarities and Differences Compared to Cocaine were Found

Investigators funded by the National Institute on Drug Abuse 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 Feb. 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 non-medical 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 two weeks of daily injections of cocaine or methylphenidate, after which reward areas of the brain were examined for changes in dendritic spine formation--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, and 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 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.

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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 www.drugabuse.gov. To order publications in English or Spanish, call NIDA’s new DrugPubs research dissemination center at 1-877-NIDA-NIH or 240-645-0228 (TDD) or fax or email requests to 240-645-0227 or drugpubs@nida.nih.gov.

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