



Center for Behavioral Health Studies



Even Modest Cocaine Use May Cause Brain Changes

A major goal of the National Institute on Drug Abuse (NIDA) research is to determine how voluntary drug use turns into compulsive drug use and addiction. A recent NIDA-supported study sheds light on drug-induced brain changes that may play an important role in this process.

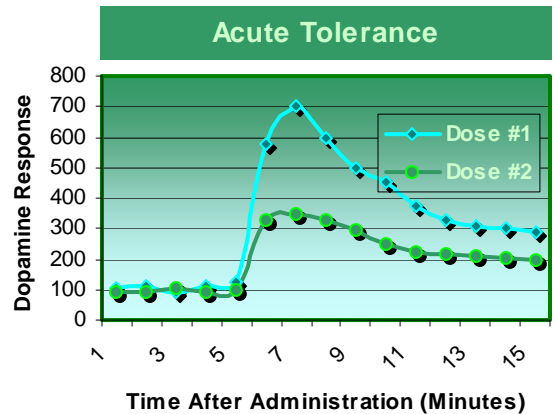
This study, conducted in rhesus monkeys, found that even a single low dose of cocaine reduced the brain's response to an identical dose of the drug taken later in the same day. Conversely, weekly exposure to low doses of cocaine made the monkeys' brains progressively more sensitive to the drug. These findings suggest that even occasional cocaine use can alter brain function in ways that may put voluntary users at increased risk of addiction.

"Perhaps the most striking aspect of this study is the relatively low drug exposure—in each session and cumulatively over the course of the study—that resulted in progressive changes in brain response," says Dr. Bradberry of Yale University School of Medicine. Characteristic patterns of human cocaine consumption in which cocaine is taken repeatedly can result in much higher levels of exposure and could lead to even more pronounced changes in brain functioning.

A previous study indicated that the 0.5 mg/kg dose produces blood levels of cocaine in the monkeys that are equivalent to those found in humans.

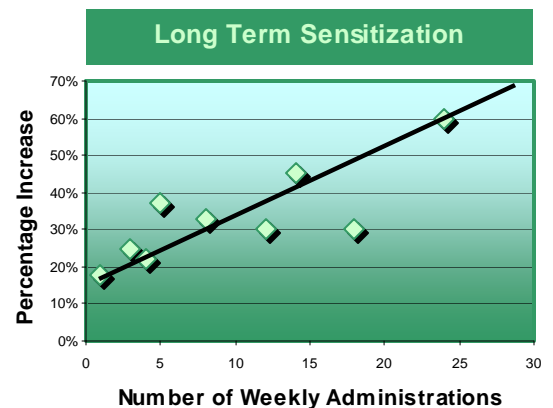
The monkeys self-administered each dose by pressing a lever when a light indicated that cocaine was available. The weekly self-administration of low doses of cocaine was designed to simulate human patterns of weekend cocaine use.

Short-Term Brain Changes



Acute Tolerance - Exposure to a single low dose of cocaine made the monkeys' brains less responsive to a subsequent dose of the drug taken shortly thereafter, a phenomenon called acute tolerance.

Long-Term Brain Changes



Long-Term Sensitization - Modest weekly exposure to cocaine gradually made the monkeys' brains more responsive to the drug, a phenomenon called neurochemical sensitization.

The modest doses of cocaine once a week also caused long-lasting changes in the way the monkeys brains responded to the drug cocaine over time.

According to NIDA researchers, this finding demonstrates for the first time that when primates are exposed to a pattern of occasional cocaine use, they develop neurochemical sensitization, a phenomenon marked by an increase in brain response following repeated administration of a drug.

Summary Finding

“This rapid development of tolerance to cocaine’s effects could underlie the repeated consumption of escalating doses of the drug that is typical of human cocaine binge sessions.”

Editorial Staff

Editor in Chief:
David W. Cunningham

Assistant Editors:
Hugh Kilbourne
Kay Seder

Art/Graphics Designer:
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Health Studies

Rimrock Foundation
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