

Study sheds light on source of drug addicts risk-taking behavior

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A study out today provides new insight into how the brains of drug addicts may be wired differently. The findings, which appear in the journal *Psychopharmacology*, show that while drug users have very strong motivation to seek out "rewards," they exhibit an impaired ability to adjust their behavior and are less fulfilled once they have achieved what they desire. Addressing this disconnect between the craving for a drug and the ability to regulate behavior may be one of the keys to breaking the cycle of addiction.

"The vast majority of people, when faced with something they want, will assess how achievable the goal is and adjust their actions and expectations in order to maximize their potential to achieve it," said John Foxe, Ph.D., chair of the Department of Neuroscience at the University of Rochester Medical Center and senior author of the study. "However, it appears that the integrity of this system of assessment and self-regulation is impaired in substance abusers and this may contribute to the risk-taking behaviors and poor decision-making commonly associated with this population."

It has been argued that essentially much of human activity is in the service of achieving [reward](#). In this instance "reward" means something of value, the achievement of which guides our actions and serves as a source of motivation as we seek to avoid missing out (e.g. punishment) or in expectation of achieving a positive outcome. In real life this can range from the mundane - achieving the next level on a video game - to the more consequential - getting a raise at work - or, in the case of [drug](#)

[addicts](#), getting their next fix.

This process can be broken down into three separate stages: reward anticipation - how much someone wants a reward; task monitoring - predicting the likelihood of receiving a reward based upon one's own actions; and reward consummation - the sense of achievement once the reward has been obtained.

It is well known that habitual drug users have problems with decision-making and controlling their behaviors. The researchers speculated that this may be related to how addicts process reward anticipation and achievement.

"Only about 10 percent of people who try cocaine go on to become habitual users," said Foxe. "So there is clearly something different going on in the brains of addicts that is causing them to crave and abuse the drug."

The study recruited 23 active cocaine users and 23 individuals with no drug history who acted as controls. The [participants](#) were asked to perform a series of computer-based tasks which measured how quickly they could react to visual cues; specifically, how fast they could press a button after an "X" appeared on the screen.

Before the experiment commenced, the program would hint at the user's probability of success by flashing a specific color on the screen. After each task, the participants received a reward stimulus in the form of winning points or a punishment in the form of losing points. Over the course of the experiment, the participants could accrue points that were ultimately equated to real world value, which in this instance was represented in the form of gift cards.

What the volunteers did not know is that the game was essentially rigged

in order to ensure that all the participants experienced the same level of success and failure, meaning that at the end of all the sessions, all the participants walked away with the same amount of [gift cards](#).

As they played the games, the volunteers were hooked up to an electroencephalograph (EEG) which recorded the electrical activity in their brains. Using this information, the researchers could determine the participant's response to each phase - anticipation, monitoring, and consummation - of the experiment.

The researchers observed that cocaine users showed far greater response to reward-predicting cues, implying that they were highly motivated to achieve the reward. At the same time, the cocaine users appeared to be less capable of recalibrating their actions to improve their chance of success and had a considerably more muted response to winning points.

"Despite the fact that they seemed to want it more, the cocaine users enjoyed their reward less and then did not learn from their errors," said Foxe.

The reward processing dysfunction in the [cocaine users](#) was also correlated with a higher level of anhedonia, as measured by a questionnaire filled out by the study volunteers. Anhedonia is the inability to experience pleasure from activities or stimuli that people would typically find enjoyable.

The findings could provide researchers with new approaches to treating addiction by focusing on improving an individual's self-monitoring capabilities.

"A key question that arises is whether these differences in our addict participants were already present in the brain before these individuals ever used drugs or whether the differences resulted from the drug use,"

said Foxe. "If they predate the addiction, then these measures could potentially be used to identify children at risk for addiction before they ever actually use. We will need to study these measures in high-risk children to figure out if this is a possibility, but it is an exciting prospect that is worthy of further investigation."

Provided by University of Rochester Medical Center

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