

Low dopamine levels during withdrawal promote relapse to smoking

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Mark Twain said, "Giving up smoking is the easiest thing in the world. I know because I've done it thousands of times." Many smokers would agree that it's difficult to stay away from cigarettes. A new study in *Biological Psychiatry* this month now suggests that low dopamine levels that occur as a result of withdrawal from smoking actually promote the relapse to smoking.

Dopamine is a [brain chemical](#) messenger that is critically important in reward and motivation. Some research suggests that one of its central roles is to send a signal to the brain to 'seek something enjoyable'. Indeed, dopamine is released during many rewarding experiences, including taking drugs, smoking, having sex, and eating food.

This signal seems to depend on the dopamine which is released in response to environmental cues, called phasic release, as opposed to the tonic seepage of small amounts of dopamine from [nerve cells](#). The tonic release of dopamine is implicated in helping the [dopamine system](#) set the level of its reactivity to inputs.

Since dopamine is released by smoking, it makes sense that dopamine levels become abnormal when a smoker chooses to stop smoking. Researchers from Baylor College of Medicine in Texas undertook their study to characterize these changes.

They studied mice that were administered [nicotine](#), the active constituent of cigarettes, for several weeks. The researchers then withheld the

nicotine and measured the subsequent alterations in dopamine signaling during the withdrawal period.

They reported that withdrawal from nicotine produced a deficit in dopamine in which the basal dopamine concentration and tonic dopamine signals were disproportionately lower than the phasic dopamine signals. Re-exposure to nicotine reversed the hypodopaminergic state.

"This study is an elegant example of yet another way that addiction 'hijacks' the [reward system](#). The phasic release of dopamine triggers us to seek things that, in theory, help us to adapt to our environment," commented Dr. John Krystal, editor of [Biological Psychiatry](#). "However, in addiction the phasic release of dopamine is heightened and it triggers the pursuit of abused substances. This disturbance of dopamine function would, conceivably, make it that much harder to avoid seeking drugs of abuse."

According to the authors, these findings indicate that medications which could help elevate tonic dopamine levels during withdrawal may be successful treatment strategies for nicotine-dependent individuals attempting to quit smoking. Theoretically, such a treatment could help normalize any fluctuating dopamine levels from the sudden lack of nicotine, and also lessen the dopamine-influenced urges to seek out the nicotine, leading to relapse.

More information: The article is "Withdrawal from Chronic Nicotine Exposure Alters Dopamine Signaling Dynamics in the Nucleus Accumbens" by Lifen Zhang, Yu Dong, William M. Doyon, and John A. Dani ([doi:10.1016/j.biopsych.2011.07.024](https://doi.org/10.1016/j.biopsych.2011.07.024)). The article appears in *Biological Psychiatry*, Volume 71, Issue 3 (February 1, 2012)

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