

# E-cigarettes may promote illicit drug use and addiction

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Credit: TheNorlo/Wikipedia

Like conventional cigarettes, electronic cigarettes (or e-cigarettes) may function as a "gateway drug"—a drug that lowers the threshold for addiction to other substances, such as marijuana and cocaine—according to the 120th Shattuck lecture, presented to the Massachusetts Medical Society by Columbia researchers Denise and Eric Kandel and published today in the online edition of the *New England Journal of Medicine*.

"While e-cigarettes do eliminate some of the health effects associated with combustible tobacco, they are pure nicotine-delivery devices," said co-author Denise B. Kandel, PhD, professor of sociomedical sciences (in psychiatry), Department of Psychiatry and Mailman School of Public Health, at Columbia University Medical Center (CUMC) and a research scientist at the New York State Psychiatric Institute.

The other co-author of the Shattuck lecture is Eric R. Kandel, MD, University Professor and Kavli Professor of Brain Science, co-director of the Mortimer B. Zuckerman Mind Brain Behavior Institute, director of the Kavli Institute for Brain Science, and senior investigator of the Howard Hughes Medical Institute at CUMC. Dr. Kandel shared the 2000 Nobel Prize in Physiology or Medicine for his discoveries related to the molecular basis of memory.

In the lecture, the Kandels review Denise Kandel's earlier work on the gateway hypothesis and on the role of nicotine as a gateway drug, reported in a *Science* paper in 1975. They also review subsequent studies in which they tested the gateway hypothesis experimentally in a mouse model. In those studies, conducted in collaboration with Amir Levine, Yan You Huang, Bettina Drisaldi, Edmund A Griffin, and others at CUMC, they found that when mice are exposed to nicotine, it alters their brain biochemically and induces activation of a reward-related gene. As a result, nicotine primes the animals' subsequent response to cocaine, providing a molecular basis for nicotine as a gateway drug for cocaine.

Dr. Denise Kandel's further analysis of 2004 epidemiologic data from a large, longitudinal sample suggested that nicotine also primes human brains to respond to cocaine. She found that the rate of cocaine dependence was highest among users who started using cocaine after having smoked cigarettes. "Our findings provided a biologic basis for the sequence of drug use observed in people," said Dr. Eric Kandel. "One drug alters the brain's circuitry in a way that enhances the effects of a

subsequent drug."

E-cigarettes have been touted as a tool to curtail the use of conventional cigarettes and reduce the harmful health effects of combustible tobacco. But in light of the skyrocketing popularity of e-cigarettes, particularly among adolescents and young adults, the researchers say that more effective prevention programs need to be developed for all products that contain nicotine.

"E-cigarettes have the same physiological effects on the brain and may pose the same risk of addiction to other drugs as regular cigarettes, especially in adolescence during a critical period of brain development. We don't yet know whether e-cigarettes will prove to be a gateway to the use of conventional cigarettes and illicit drugs, but that's certainly a possibility. Nicotine clearly acts as a gateway drug on the brain, and this effect is likely to occur whether the exposure comes from smoking cigarettes, passive tobacco smoke, or e-cigarettes."

Studies show that the typical e-cigarette user is a long-term smoker who has been unable to stop smoking. However, the researchers point out that [e-cigarette](#) use is increasing exponentially among adolescents and young adults. "The effects we saw in adult mice are probably even stronger in adolescent animals," said Dr. Eric Kandel. "E-cigarettes may be a gateway to both combustible cigarettes and illicit drugs. Therefore, we should do all we can to protect young people from the harmful effects of nicotine and the risks of progressing to illicit drugs."

Jeffrey Lieberman, the Lawrence C. Kolb Professor of Psychiatry and chair of psychiatry at CUMC and director of the New York State Psychiatric Institute, said, "The emergence in our society of new recreational pharmaceuticals such as E-cigarettes and legalized marijuana, while justifiable on one level, may have adverse consequences of which we are not fully aware. The Kandels' research on

'gateway' drugs demonstrates such grave potential consequences."

"The recent legalization of marijuana in Colorado and Washington has rekindled the debate about whether marijuana is a gateway drug," said Dr. Denise Kandel. "Yet both proponents and opponents of legalization have overlooked the role of nicotine in leading to the use of [illicit drugs](#) and to addiction."

**More information:** The article is titled, "A Molecular Basis for Nicotine as a Gateway Drug."

Provided by Columbia University Medical Center

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