

Nicotine-alcohol interaction impacts learning, could have implications for addiction treatment

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The interaction between nicotine and alcohol, two of the most abused and co-abused drugs, can impact a person's ability to learn and could have implications for treating addiction, according to researchers at Temple University.

The researchers, Thomas J. Gould and Danielle Gulick, will present their findings, "Acute, chronic, and withdrawal from chronic nicotine interacts with acute ethanol to modulate fear conditioning," on Nov. 6 at the annual meeting of the Society for Neuroscience in San Diego. The study has also been accepted for publication in the peer-reviewed journal, *Psychopharmacology*.

"Whenever someone uses these two drugs together, there must be a reason why," says Gould, an associate professor of psychology at Temple. "The goal of our research is to understand the interactive effects of these two drugs and, by understanding how they are altering behavior and producing neural changes, we will hopefully be in a better position to develop treatments for drug addiction."

In examining the drugs' interactive effects on learning, the researchers looked at the ability to learn and process contextual information, which is important for multiple reasons. According to Gould, contextual learning taps into the part of the brain that is involved in declarative memory processes that define who we are, such as memories of our

family, our wedding day, or graduating from school. This type of learning involves an area of the brain called the hippocampus, an area that is involved in strengthening short-term memories, and putting them into long-term memory storage, thus making those memories the ones that define who we are.

“We wanted to see if nicotine and alcohol are interacting in the hippocampus, or at another level, and what processes within the brain are they interacting with,” Gould says. “If we can understand how these neural processes are changing and how they interact, then when someone is going through withdrawal or experiencing a cognitive deficit because of one of these two substances, we then may be able to use a therapeutic that blocks or activates a receptor, or that blocks a certain pathway which prevents the occurrence of the withdrawal symptoms and falling back into relapse.”

Using an animal model, Gould and Gulick examined the effects of alcohol and nicotine on learning to determine what happens as the drugs are combined at different doses and different stages of administration.

“Our study showed that initially nicotine in a dose-dependent manner reverses alcohol-induced deficits in learning, but tolerance develops for this effect of nicotine with continued administration,” he says. “We also found that a low dose of alcohol reverses nicotine withdrawal-associated deficits in learning. Furthermore, we found that chronic nicotine produces cross-tolerance to the effects of a low dose of alcohol on learning.”

What does this all mean in terms of addiction?

“Think of a situation in which somebody is drinking and having cognitive difficulties,” says Gould. “Smoking may take the edge off of it at first, so they begin smoking and they smoke more and more until

tolerance develops and they lose that edge.

“Now they are drinking and smoking and they are addicted to both,” he adds. “But if they try to quit smoking, they go into nicotine withdrawal, which results in a learning deficit. Maybe a drink will actually help them out initially, but then they consume more and they develop even worse learning deficits, so now they begin smoking again and they end up relapsing.”

According to Gould, this could feed into a spiral in which initially nicotine and alcohol each block the adverse effects of the other. But as that happens, he says, smokers and drinkers develop tolerance and consume greater amounts of each drug, and then when they try quitting one or the other, they then have this cognitive deficit and may reach for either alcohol or nicotine or both to try and reverse it, but they just spiral into the addiction again.

Source: Temple University

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