



Scientists Working to Break the Connection Between Drug Abuse and Stress

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People who undergo stress sometimes turn to alcohol or drugs to help them cope. For many adults, drinking can help them relax or clear their head after a rough day. But in cases of long term emotional strain, this is not a reliable coping mechanism as it can easily lead to dependence and addiction.

Drug dependence or alcoholism can lead to a whole host of negative health effects. These adverse effects are made even worse by the fact that there are social problems associated with it as well. Addicted individuals may prioritize the substance over their own relationships. They may begin neglecting their responsibilities. In the process, their career, their family, their relationships, and their social life may suffer.

The physical, mental, and social effects of addiction can pile up and overwhelm anybody, making it more difficult to get sober again. For an addicted person, the easiest way to deal with the problem is to just keep drinking or abusing drugs.

Neuroscientist Klaus Miczek has spent decades exploring the relationship between substance abuse and stress. He hopes that by breaking this connection, he can save millions of lives.

"In my wildest dreams, I would like to see a molecule developed that interferes in the cascade of events and reverses the stress effect and prevents increased drug-taking," he said.

He has conducted studies in order to understand why social stress causes some people to become unhealthily dependent on chemical substances. This is interesting because not everyone falls into the same habits.

"You would like to learn who is most vulnerable and who is resilient," said Miczek, Moses Hunt Professor of Psychology and Neuroscience in the School of Arts and Sciences.

Understanding certain mechanisms in the brain could lead to the creation of a diagnostic tool for doctors that can help them identify people who are most at risk of stress-induced drug-taking. It could also lead to finding targets for therapeutic drugs to break the connection between stress and drug use. "The question is whether you can therapeutically protect or reverse these neuroadaptations produced by the social stress experience," he said.

Miczek has been looking at the association between drug dependence and stress since he first arrived at Tufts from Germany via the University of Chicago and Carnegie-Mellon University forty years ago. Early on, he discovered that exposing animals to even small or occasional amounts of stress increased their drug-taking. This result was consistent across species, including mice, rats, and monkeys.

"Only a few seconds of exposure to social stress creates behavioral changes that last for many weeks and months," said Miczek, who is also a co-director of the Circuits and Behavior Core of the Sackler School's Center for Neuroscience Research.

In the 1990s, he and his colleagues made a discovery about the potential cause of these changes in the brain: social stress increased the action of dopamine, the neurotransmitter more commonly associated with pleasure and enjoyment.

"For many years, dopamine has been thought to be associated with the reward system in the brain. Here, we found exactly the opposite—that intensely aversive experiences also cause dopamine synthesis, activation, and release."

The researchers eventually learned that there are different kinds of dopamine systems in the brain, some of which have to do with pleasurable experiences, while others are tied to more negative ones. They started focusing on the interactions between dopamine and neuropeptides—brain proteins—outside the hypothalamus and pituitary and adrenal glands, the structures in the brain usually associated with dopamine.

In order to create a stressful scenario for animals under controlled conditions of the laboratory, Miczek and his colleagues created a confrontation between an aggressive and non-aggressive animal. "These are very common reactions that animals show in the wild—they fight for territory or dominance or protecting their offspring."

In some sophisticated models, they don't expose the animals directly to one another, but just create the idea of a confrontation by putting them in close proximity and separating them with a barrier. After exposing the animals to social stress, the researchers then allowed the animals to self-administer drugs, either drinking a solution containing alcohol or injecting themselves with cocaine by outfitting the mice with an intravenous catheter connected to a syringe pump. "They have total control over when they administer pulses of drug solution," he said.

In these controlled conditions, researchers have observed marked differences in the way that animals use alcohol and cocaine in response to stress. Alcohol ingestion seems to increase most in response to repeated episodes of social stress. "It is most striking when the social stress is intermittent," he said.

Animals may escalate their drinking, varying according to the day, over the course of several months. Meanwhile, cocaine use and relapse also increased in response to sudden bouts of social stress. Click the link to see Plattsburgh's top rehab placement programs.

The scientists then discovered that the brain mechanisms followed a similar pattern. Bouts of stress sparked a cascade of stress hormones in the brain. The team also found that if they block CRF receptors in certain areas of the brain, they can almost completely undo the craving for alcohol and cocaine that social stress induces. Animals subjected to stress in those cases drink no more than their unstressed fellows.

But while the team has been able to reproduce this effect in multiple situations, the drug that they have been using to block the CRF receptors have a host of negative side effects. It disrupts other hormones in the body released by the thyroid, testes, and adrenal glands, wreaking havoc on the body's equilibrium. "Many of these drugs are experimental drugs that are not really useful in the clinic as of yet, because of these unacceptable side-effect profiles," he said.

Recently, Miczek has found success with one compound so experimental that it doesn't have a name yet. However, it has the disadvantage of being short-acting. "That's not very useful," he said. "No one wants to take a drug every few hours."

"The goal is to make sure that what we study in the laboratory can be translated from the rodent model to the human condition." Miczek hopes that one day, instead of taking drugs or drinking alcohol when under stress,

people can take a pill that would take away their craving for potentially harmful drugs. It can someday help people develop better ways to cope with stress.

If someone in the family is struggling with opioid addiction, it is important to seek help. A combination of medical detox and behavioral therapy can go a long way in the fight against drug abuse. But because every individual is affected by addiction differently, a comprehensive program tailored to their specific needs is necessary. Look for a nearby addiction treatment facility today and find out how drug treatment programs work.

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