

# Women's hormones play role in drug addiction, higher relapse rates

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Erin Calipari, an assistant professor of pharmacology in the Vanderbilt Center for Addiction Research. Credit: Vanderbilt University

Women's hormonal cycles may not only make them more prone to drug addiction but also more affected by triggers that lead to relapse, a new Vanderbilt University study revealed. The findings are especially significant since there are virtually no addiction studies in women that account for these cycles.

Erin Calipari, an assistant professor of pharmacology in the Vanderbilt Center for Addiction Research, points out that [women](#) represent a particularly vulnerable population, with higher rates of addiction following exposure to drugs, but addiction studies have primarily focused on the mechanisms underlying these effects in men. Her study found that, when fertility-related [hormone levels](#) are high, females learn faster, make stronger associations to cues in their environment and are more prone to seek rewards.

"Women becoming addicted to drugs may be a fundamentally different process than men," Calipari said. "It's important to understand this, because it's

the first step in developing treatments that are actually effective."

The next step, she said, would be to figure out specifics of how hormonal shifts affect women's brains and, ultimately, develop medications that could help override those. But long before those future medications are available, treatment centers could use the information in this study to educate women about their stronger mental connections to places and objects. That may mean a higher chance of relapse just by, for example, visiting a place where they used drugs or holding the kind of spoon they used in the process.

Researchers historically have avoided using female animals in [medical studies](#) specifically so they don't have to account for influences from hormonal cycles. As a result, medication development has often focused on correcting dysfunctions in men, which may explain why women often don't respond to available medications or treatments in the same way as men do, Calipari said.

Her work was published recently in the Nature-affiliated journal *Neuropsychopharmacology* in a paper titled "Cues play a critical role in estrous cycle-dependent enhancement of cocaine reinforcement."

In this study, male and female rats were allowed to dose themselves with cocaine by pushing a lever, with a light set up to come on during dosing. That's similar to the environmental cues, such as [drug paraphernalia](#), present when humans are taking drugs. When their circulating hormone levels were high, female rats made stronger associations with the light and were more likely to keep pushing the lever as much as it took to get any amount of cocaine.

Ultimately, females were willing to "pay" more in the presence of these cues to get cocaine. The results are transferable to humans through behavioral

economic analysis, which uses a complicated mathematical equation with values for the most and least a subject will do to get a payoff. It's one of the few ways that comparisons can be made across species.

"We found that the animals will press a lever just to get the light—that environmental stimuli," Calipari said. "That has value to them.

"There's epidemiological data that says women are more vulnerable, but it's unclear what the factors are. We know they transition to [addiction](#) faster and have more problems with craving and relapse. Now, with research like this, we're beginning to isolate environmental and physiological causes."

This new research builds on earlier work Calipari published at the Icahn School of Medicine at Mount Sinai that showed estrogen intensifies the brain's dopamine reward for [cocaine use](#).

**More information:** Amy R. Johnson et al, Cues play a critical role in estrous cycle-dependent enhancement of cocaine reinforcement, *Neuropsychopharmacology* (2019). [DOI: 10.1038/s41386-019-0320-0](#)

Provided by Vanderbilt University

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