

Neuroscientists finds lateral habenula controls sensitivity to negative effects of drinking alcohol

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University of Utah neuroscientists find a brain region called the lateral habenula is involved in resisting the temptation of alcohol. Credit: Andrew Haack

As recovering spring breakers are regretting binge drinking escapades, it may be hard for them to appreciate that there is a positive side to the nausea, sleepiness, and stumbling. University of Utah neuroscientists report that when a region of the brain called the lateral habenula is

chronically inactivated in rats, they repeatedly drink to excess and are less able to learn from the experience. The study, published online in *PLOS ONE* on April 2, has implications for understanding behaviors that drive alcohol addiction.

While complex societal pressures contribute to alcoholism, physiological factors are also to blame. Alcohol is a drug of abuse, earning its status because it tickles the reward system in the brain, triggering the release of feel-good neurotransmitters. The dreaded outcomes of overindulging serve the beneficial purpose of countering the pull of temptation, but little is understood about how those mechanisms are controlled.

U of U professor of neurobiology and anatomy Sharif Taha, Ph.D. and colleagues, tipped the balance that reigns in addictive behaviors by inactivating in rats a brain region called the lateral habenula. When the rats were given intermittent access to a solution of 20% [alcohol](#) over several weeks, they escalated their alcohol drinking more rapidly, and drank more heavily than control rats.

"In people, escalation of intake is what eventually separates a social drinker from someone who becomes an alcoholic," said Taha. "These rats drink amounts that are quite substantial. Legally they would be drunk if they were driving,"

The lateral habenula is activated by bad experiences, suggesting that without this region the rats may drink more because they fail to learn from the negative outcomes of overindulging. The investigators tested the idea by giving the rats a desirable, sweet juice then injecting them with a dose of alcohol large enough to cause negative effects.

"It's the same kind of learning that mediates your response in food poisoning. You taste something and then you get sick, and then of course you avoid that food in future meals," explained Taha.

Yet [rats](#) with an inactivated lateral habenula sought out the juice more than control animals, even though it meant a repeat of the bad experience.

"The way I look at it is the rewarding effects of drinking alcohol compete with the aversive effects," explained Andrew Haack, who is co-first author on the study with Chandni Sheth, both neuroscience graduate students. "When you take the aversive effects away, which is what we did when we inactivated the lateral habenula, the rewarding effects gain more purchase, and so it drives up drinking behavior."

The group's findings may help explain results from previous clinical investigations demonstrating that men who were less sensitive to the negative effects of alcohol drank more heavily, and were more likely to become problem drinkers later in life.

The researchers think the lateral habenula likely works in one of two ways. The region may regulate how badly an individual feels after over-drinking. Alternatively, it may control how well an individual learns from their bad experience. Future work will resolve between the two.

"If we can understand the brain circuits that control sensitivity to alcohol's aversive effects, then we can start to get a handle on who may become a problem drinker," said Taha.

More information: [dx.plos.org/10.1371/journal.pone.0092701](https://doi.org/10.1371/journal.pone.0092701)

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