

UNDERSTANDING THE NEUROBIOLOGY OF AUD

To understand alcohol use disorder (AUD),
we must look to the brain.

AUD is a chronic, relapsing brain-based treatable medical condition shaped by a variety of factors that are^{1,2}:

BIOLOGICAL

PSYCHOLOGICAL

SOCIAL

Yet AUD is often misunderstood as³:

- Not serious enough to require treatment
- A problem that will resolve over time

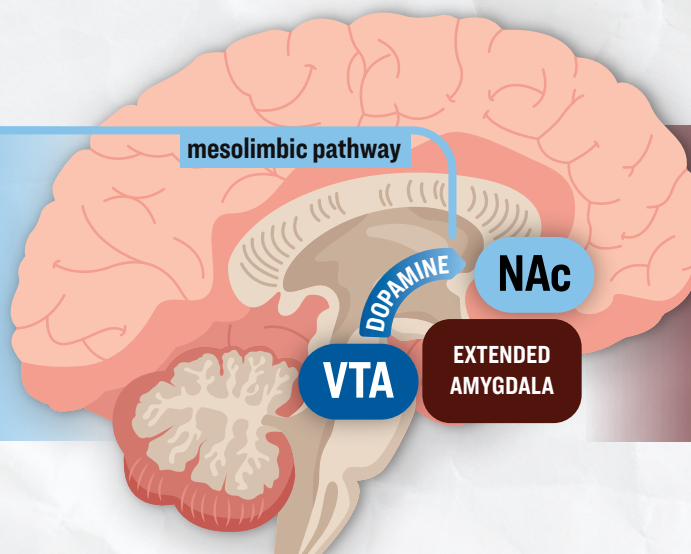
These perceptions do not reflect the underlying neurobiology of AUD.



AUD is often seen as a personal failing. Bringing neurobiology into your conversations with patients gives you a way to reframe AUD—*not as a moral failure but as a disorder of brain circuitry.*⁴

Reward and relief are early drivers of
the processes that can lead to AUD.⁵⁻⁷

↑ Alcohol increases dopamine release in the mesolimbic pathway, producing a reward-associated signal that reinforces drinking.



Alcohol can temporarily relieve distress by modifying GABA and glutamate signaling, dampening activity in stress-related regions such as the extended amygdala. ↓

Repeated alcohol use disrupts more signaling molecules than just dopamine, a common misconception^{2,8-10}



SIGNALING MOLECULE

NEUROBIOLOGICAL PROCESSES AFFECTED

Serotonin	Dopamine	GABA	Glutamate	Acetylcholine	Endogenous opioid peptides
Mood regulation	Motivation and reward	Tolerance, dependence, and withdrawal	Tolerance and withdrawal	Motivation and reward (indirect)	Motivation and reward (indirect)

Chronic alcohol use alters neuronal networks *that regulate reward, motivation, decision-making, and emotion processing.*¹¹

AUD progressively changes the brain in ways that make alcohol use increasingly harder to control.¹²

AUD can be understood as a 3-stage cycle^{1,6,11}:

Basal ganglia Binge/intoxication

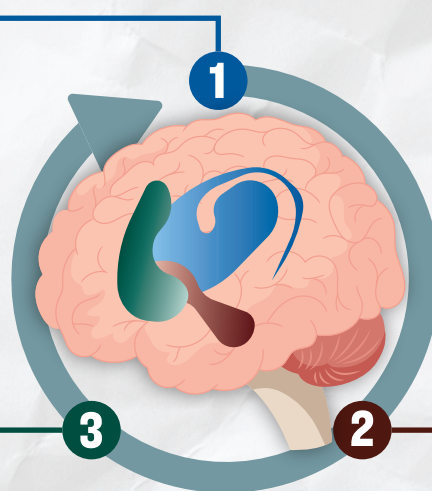
Intoxication reinforces alcohol use through reward circuitry

Pleasurable cues and positive reinforcement strengthen habitual drinking

Prefrontal cortex Preoccupation/anticipation

Dysregulation of prefrontal cortex function makes it harder to resist drinking

Reduced executive function weakens the ability to ignore alcohol-related cues



Modified from Volkow and Boyle.¹¹

Extended amygdala Withdrawal

Withdrawal activates stress circuitry

Over time, reward system activity is reduced, and stress circuitry is activated; this can be experienced as anxiety, irritability, dysphoria, and craving

At this stage, drinking may shift from seeking pleasure to temporarily relieving this distress, perpetuating the cycle

AUD changes the brain in ways that perpetuate alcohol use and *increase susceptibility to relapse despite negative consequences.*¹



**The neurobiology of AUD demonstrates that
*it is not a moral failing,
but a brain-based disorder.***

Consider being the change catalyst for your patients. Approach alcohol use conversations with empathy and help them see the whole picture.

**Find more resources on AUD at the
LILLY MEDICAL WEBSITE**



References

1. National Institute on Alcohol Abuse and Alcoholism. Alcohol's effects on the body. Updated June 2025. Accessed June 23, 2026. <https://www.niaaa.nih.gov/alcohols-effects-health/alcohols-effects-body> 2. MacKillop J, et al. *Nat Rev Dis Primers*. 2022;8(1):80. 3. Hammarlund R, et al. *Subst Abuse Rehabil*. 2018;9:115-136. 4. Heilig M, et al. *Neuropsychopharmacology*. 2021;46:1715-1723. 5. Ferrer-Pérez C, et al. *Psychoactives*. 2024;3(1):35-47. 6. National Institutes of Alcohol Abuse and Alcoholism. Neuroscience: the brain in addiction and recovery. Accessed June 23, 2026. <https://www.niaaa.nih.gov/health-professionals-communities/core-resource-on-alcohol/neuroscience-brain-addiction-and-recovery> 7. Roberto M, et al. *Cold Spring Harb Perspect Med*. 2012;2:a012195. 8. Banerjee N. *Indian J Hum Genet*. 2014;20(1):20-31. 9. Yang W, et al. *Biomedicines*. 2022;10(5):1192. 10. Volkow ND, et al. *Physiol Rev*. 2019;99:2115-2140. 11. Volkow ND, Boyle M. *Am J Psychiatry*. 2018;175(8):729-740. 12. National Institute on Alcohol Abuse and Alcoholism. Alcohol use disorder: from risk to diagnosis to recovery. Published May 8, 2024. Accessed June 23, 2026. <https://www.niaaa.nih.gov/health-professionals-communities/core-resource-on-alcohol/alcohol-use-disorder-risk-diagnosis-recovery>