Tackling the cycle of drug addiction

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PEAR THERAPEUTICS

What is addiction?

Addiction is a chronic, relapsing disorder characterized by compulsive drug* seeking and use despite adverse consequences.[1,2]

It is considered a brain disorder because it involves functional changes to brain circuits involved in the reward system, stress, and self-control.[2,3]

Just like other diseases, addiction disrupts the normal functioning of the body. In many cases, addiction is preventable and treatable.[4,5]

*(Eg, alcohol, tobacco, and illicit drugs, including opioids.)

The stages of the addiction cycle[4,5]

- **Binge and intoxication**
- **Withdrawal and negative affect**
- **Preoccupation and anticipation (craving)**

How does addiction affect the brain?

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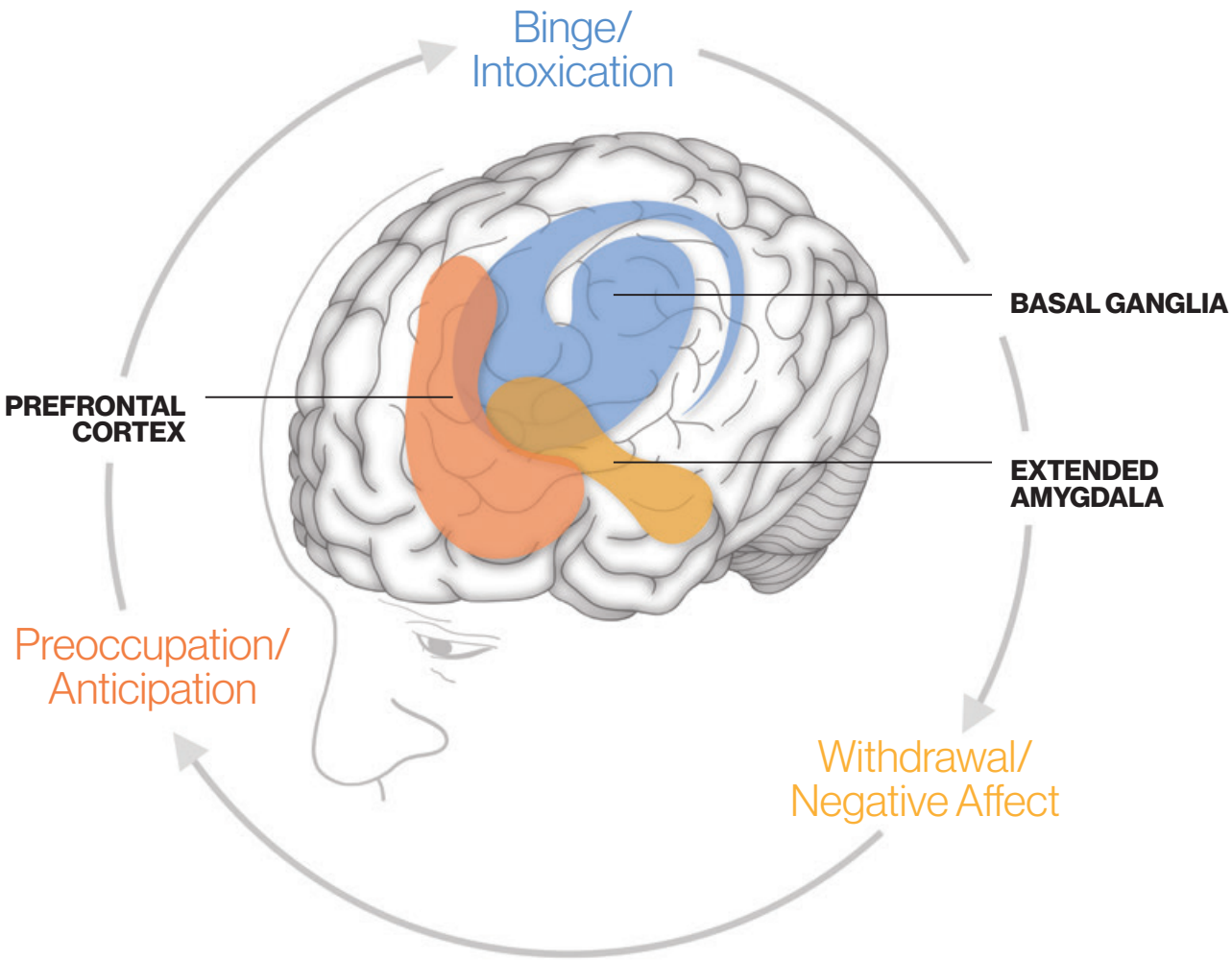


Adapted from US Department of Health and Human Services (HHS), Office of the Surgeon General. Washington, DC: HHS; November 2016.[6]

Basal ganglia control the rewarding, or pleasurable, effects of substance use and are responsible for the formation of habitual substance use.[6]

Extended amygdala is involved in stress and the feelings of unease, anxiety, and irritability that typically accompany substance withdrawal.[6]

Prefrontal cortex is involved in executive function (ie, the ability to organize thoughts and activities, prioritize tasks, manage time, and make decisions), including exerting control over substance use.[6]

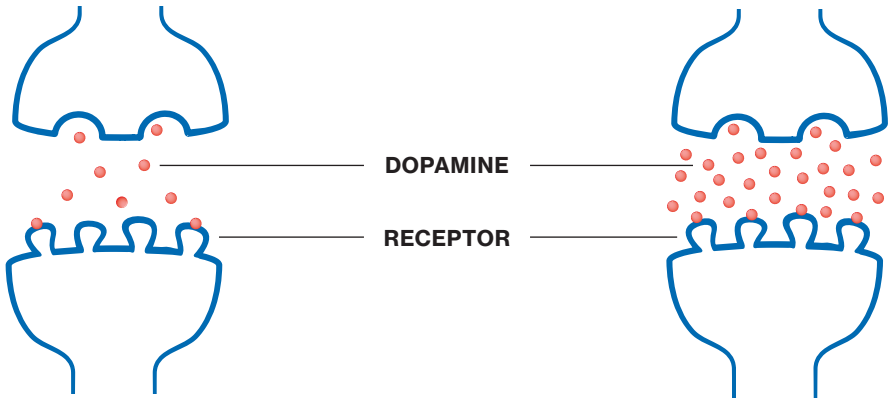
The vicious cycle of addiction

Binge and intoxication is when a person consumes an addictive drug to experience its rewarding effects.[6]

Addictive drugs change the brain reward system
All addictive drugs produce feelings of pleasure by activating neurons that release dopamine. These rewarding effects positively reinforce drug use and increase the likelihood of repeated use.[6]

The repeated experience of rewarding effects becomes associated with the environmental stimuli
When a person uses a drug, they learn to associate the stimuli around them with the drug's rewarding effects. Over time, these stimuli alone can activate the dopamine system, so even being near the environment where the drug was taken in the past can trigger powerful urges to take the drug.[6]

Drugs stimulate areas of the brain involved in habit formation
With repeated use of a drug, the habit circuitry of the basal ganglia gets activated and contributes to compulsive and addictive behavior.[6]



Adapted from: National Institute on Drug Abuse. Drugs, brains, and behavior: the science of addiction.

ADDICTING DRUGS INCREASE DOPAMINE LEVELS AND ACTIVATE REWARD REGIONS IN THE BRAIN.[2,6]

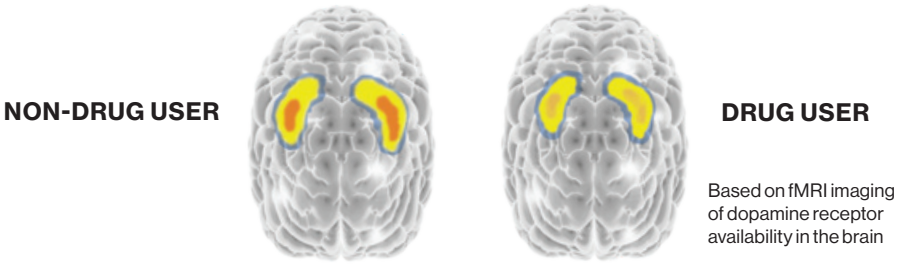
Withdrawal and negative affect is when a person experiences a negative emotional state in the absence of drug use.[6]

Decreased activation in the reward circuitry of the basal ganglia
As people with addiction continue drug use long-term, their brains adjust by producing fewer dopamine in their reward systems, and by reducing the number of receptors that transmits reward signals.[6]

The loss of reward sensitivity may explain the compulsive escalation of drug use in an attempt to regain the pleasurable feelings the reward system once provided.[6]

Activation of the brain's stress systems in the extended amygdala
In the absence of a drug, the addicted user experiences withdrawal symptoms when they stop taking the drug. These symptoms can include negative emotions and physical illness.[6]

Overactivation of the brain's stress system may lead people with addiction to take the drug to temporarily relieve negative feelings associated with withdrawal.[6]



Adapted from: US Department of Health and Human Services (HHS), Office of the Surgeon General, *Facing Addiction in America: The Surgeon General's Report on Alcohol, Drugs, and Health.* Washington, DC: HHS, November 2016.

DRUG USE LEADS TO DECREASED ACTIVATION IN THE REWARD CIRCUITRY OF THE BASAL GANGLIA.[6]

Preoccupation and anticipation is when a person seeks substances again after a period of abstinence.[6]

Disrupted executive function system in the prefrontal cortex
This stage involves changes in the function of the prefrontal cortex, which is the region that controls the executive processes, affecting major functions such as self-regulation, decision-making, and error monitoring.[4,6]

The signaling of neurotransmitters is disrupted in the prefrontal region and impairs the brain's ability to resist strong urges or follow through on decisions, including the decision to stop drug use.[4,6]

Which biologic and social factors are associated with addiction?

Only a minority of drug users actually become addicted, not everyone has the same risk level of developing addiction.[4]

Genetic, environmental, and social factors influence the development of addiction. Some examples include:

Family history[4]

- Heritability
- Child-rearing practices

Early exposure to drugs[4]

- Adolescence yields the greatest vulnerability

Exposure to high-risk environments[4]

- Socially stressful environments
- Restricted behavioral alternatives
- Environments with easy access to drugs
- Permissive normative attitudes toward drug use

Mental illness comorbidities[4]

- Mood disorders
- Attention-deficit/hyperactivity disorder
- Psychosis
- Anxiety disorders

How do you treat patients for addiction?

Which medications can help treat addiction?

Medications are available to help manage withdrawal symptoms, relapses, and co-occurring conditions while the brain heals and normal functioning is restored.[4]

Opioids

Methadone

Lessens the symptoms of withdrawal and blocks the euphoric effects of opiates[7]

Buprenorphine

Decreases withdrawal symptoms and cravings for opiates and lowers the risk of misuse[8]

Naltrexone

Blocks the euphoric effects of opiates and prevents feelings of euphoria if used[9]

Alcohol

Disulfiram

Treats chronic alcoholism in those who have already gone through detoxification[9]

Acamprosate

Works to prevent people from drinking alcohol[9]

Naltrexone

Blocks the euphoric effects and feelings of intoxication[9]

Other medications are currently being studied to treat stimulant (cocaine and methamphetamine) and cannabis addiction. People who use more than 1 drug need treatment for all of the substances they use.[10]

What behavioral therapies are available?

Although medications have been shown to be effective for treating addiction, they may not be enough. Behavioral interventions can help restore balance in brain circuitry.[4]

Cognitive behavioral therapy

An evidence-based psychosocial intervention that seeks to modify harmful behaviors and help patients cope with situations in which they are most likely to misuse drugs.[1]

Contingency management

An evidence-based psychosocial intervention in which patients are given tangible rewards to reinforce positive behaviors such as abstinence.[1]

Other psychosocial interventions include[1]:

- Community reinforcement approach
- Motivational enhancement therapy
- 12-step facilitation therapy
- Family behavior therapy

Developing strategies to increase healthy life skills, and modifying attitudes and behaviors related to drug use can help people stay in recovery.

How can prescription digital therapeutics help put recovery within reach?

Because of the brain changes associated with drug addiction, people in recovery could benefit from a tool that they can access around the clock.

Prescription digital therapeutics (PDTs) are a new category of treatment that uses software applications to treat diseases.[11]

Their safety and efficacy are regulated by the Food and Drug Administration. PDTs require a prescription from licensed clinicians.[11]

PDTs can be standalone therapeutics or used in combination with other therapies to improve the effectiveness of therapy.[11]

The benefits of PDTs include:

- **Improved outcomes** based on clinically meaningful endpoints[11]

- **Personalization of treatment** based on the patient's individual needs[11]

- **Accessible anywhere, anytime** reduces the stigma usually associated with the therapeutic treatment[11]

- **Consistent delivery** of evidence-based therapy[11]

How do we move forward in the addiction crisis?

- **Addiction** is a chronic, relapsing disorder characterized by compulsive drug* seeking and use despite adverse consequences[1,2]
- **The cycle of addiction** can be described in 3 stages: binge and intoxication, withdrawal and negative affect, and preoccupation and anticipation[4,5]
- **Genetic, environmental, and social factors** influence the development of addiction[4]
- **Medications are available to help** restore normal brain function, and many aid in preventing relapse in people with drug addiction[4,9]
- **Cognitive behavioral therapy,** contingency management, and other behavioral therapies are available to help with recovery[1]
- **People in recovery** can benefit from new technologies that offer 24/7 access to clinically-validated therapeutics[11]

*(Eg, alcohol, tobacco, and illicit drugs, including opioids).

Ask us about how prescription digital therapeutics can help people in recovery.

1-833-697-3738
PearConnect@PearTherapeutics.com

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