

NIH News in Health

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Biology of Addiction

Drugs and Alcohol Can Hijack Your Brain

People with addiction lose control over their actions. They crave and seek out drugs, alcohol, or other substances no matter what the cost—even at the risk of damaging friendships, hurting family, or losing jobs. What is it about addiction that makes people behave in such destructive ways? And why is it so hard to quit?

NIH-funded scientists are working to learn more about the biology of addiction. They've shown that addiction is a long-lasting and complex brain disease, and that current treatments can help people control their addictions. But even for those who've successfully quit, there's always a risk of the addiction returning, which is called relapse.

The biological basis of addiction helps to explain why people need much more than good intentions or willpower to break their addictions.

"A common misperception is that addiction is a choice or moral problem, and all you have to do is stop. But nothing could be further from the truth," says Dr. George Koob, director of NIH's National Institute on Alcohol Abuse and Alcoholism. "The brain actually changes with addiction, and it takes a good deal of work to get it back to its normal state. The more drugs or alcohol you've taken, the more disruptive it is to the brain."

Definitions

Genes

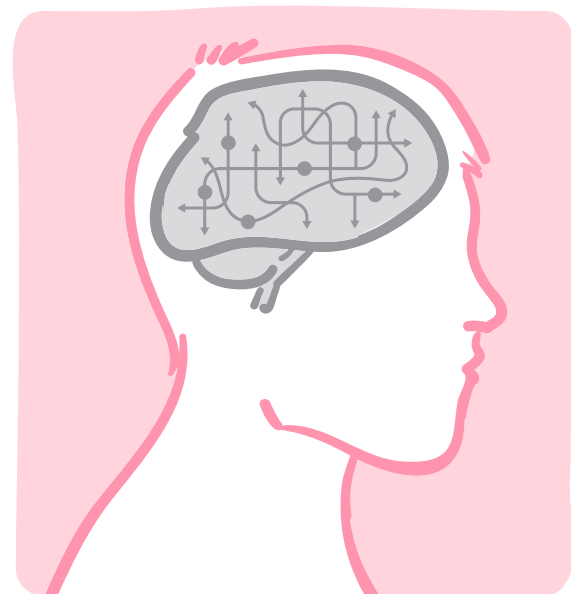
Stretches of DNA, a substance you inherit from your parents, that define characteristics such as your risk for certain disorders, such as addiction.

Researchers have found that much of addiction's power lies in its ability to hijack and even destroy key brain regions that are meant to help us survive.

A healthy brain rewards healthy behaviors—like exercising, eating, or bonding with loved ones. It does this by switching on brain circuits that make you feel wonderful, which then motivates you to repeat those behaviors. In contrast, when you're in danger, a healthy brain pushes your body to react quickly with fear or alarm, so you'll get out of harm's way. If you're tempted by something questionable—like eating ice cream before dinner or buying things you can't afford—the front regions of your brain can help you decide if the consequences are worth the actions.

But when you're becoming addicted to a substance, that normal hardwiring of helpful brain processes can begin to work against you. Drugs or alcohol can hijack the pleasure/reward circuits in your brain and hook you into wanting more and more. Addiction can also send your emotional danger-sensing circuits into overdrive, making you feel anxious and stressed when you're not using the drugs or alcohol. At this stage, people often use drugs or alcohol to keep from feeling bad rather than for their pleasurable effects.

To add to that, repeated use of drugs can damage the essential decision-making center at the front of the brain. This area, known as the prefrontal cortex, is the very region that should help you recognize the



harms of using addictive substances.

"Brain imaging studies of people addicted to drugs or alcohol show decreased activity in this frontal cortex," says Dr. Nora Volkow, director of NIH's National Institute on Drug Abuse. "When the frontal cortex isn't working properly, people can't make the decision to stop taking the drug—even if they realize the price of taking that drug may be extremely high, and they might lose custody of their children or end up in jail. Nonetheless, they take it."

Scientists don't yet understand why some people become addicted while others don't. Addiction tends to run in families, and certain types of **genes** have been linked to different forms of addiction. But not all

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members of an affected family are necessarily prone to addiction. "As with heart disease or diabetes, there's no one gene that makes you vulnerable," Koob says.

Other factors can also raise your chances of addiction. "Growing up with an alcoholic; being abused as a child; being exposed to extraordi-



Wise Choices Warning Signs of Addiction

Warning signs of substance abuse or addiction may include:

- sleep difficulties
- anxiety or depression
- memory problems
- mood swings (temper flare-ups, irritability, defensiveness)
- rapid increases in the amount of medication needed
- frequent requests for refills of certain medicines
- a person not seeming like themselves (showing a general lack of interest or being overly energetic)
- "doctor shopping" (moving from provider to provider in an effort to get several prescriptions for the same medication)
- use of more than one pharmacy
- false or forged prescriptions

nary stress—all of these social factors can contribute to the risk for alcohol addiction or drug abuse," Koob says. "And with drugs or underage drinking, the earlier you start, the greater the likelihood of having alcohol use disorder or addiction later in life."

Teens are especially vulnerable to possible addiction because their brains are not yet fully developed—particularly the frontal regions that help with impulse control and assessing risk. Pleasure circuits in adolescent brains also operate in overdrive, making drug and alcohol use even more rewarding and enticing.

NIH is launching a new nationwide study to learn more about how teen brains are altered by alcohol, tobacco, marijuana, and other drugs. Researchers will use brain scans and other tools to assess more than 10,000 youth over a 10-year span. The study will track the links between substance use and brain changes, academic achievement, IQ, thinking skills, and mental health over time.

Although there's much still to learn, we do know that prevention is critical to reducing the harms of addiction. "Childhood and adolescence are times when parents can get involved and teach their kids about a healthy lifestyle and activities that can protect against the use of drugs," Volkow says. "Physical activity is important, as well as getting engaged in work, science projects, art, or social networks that do not promote use of drugs."

To treat addiction, scientists have identified several medications and



Web Links

For more about the biology of addiction, click the "Links" tab at:
<http://newsinhealth.nih.gov/issue/Oct2015/Feature1>

behavioral therapies—especially when used in combination—that can help people stop using specific substances and prevent relapse. Unfortunately, no medications are yet available to treat addiction to stimulants such as cocaine or methamphetamine, but behavioral therapies can help.

"Treatment depends to a large extent on the severity of addiction and the individual person," Koob adds. "Some people can stop cigarette smoking and alcohol use disorders on their own. More severe cases might require months or even years of treatment and follow-up, with real efforts by the individual and usually complete abstinence from the substance afterward."

NIH-funded researchers are also evaluating experimental therapies that might enhance the effectiveness of established treatments. Mindfulness meditation and magnetic stimulation of the brain are being assessed for their ability to strengthen brain circuits that have been harmed by addiction. Scientists are also examining the potential of vaccines against nicotine, cocaine, and other drugs, which might prevent the drug from entering the brain.

"Addiction is a devastating disease, with a relatively high death rate and serious social consequences," Volkow says. "We're exploring multiple strategies so individuals will eventually have more treatment options, which will increase their chances of success to help them stop taking the drug."

To find publicly funded addiction treatment centers in your state, call 1-800-662-HELP, or visit <https://findtreatment.samhsa.gov/>.

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Keep Your Mouth Healthy

Oral Care for Older Adults

Oral health is important for people of all ages. But the simple routine you learned as a kid—brush your teeth twice a day and floss regularly—can become more of a challenge as you get older. Among adults ages 75 and up, about 1 in 4 has lost all natural teeth, largely because of gum disease and tooth decay.

You can take steps to keep your mouth healthy throughout your lifetime. And if you're a caregiver for an older adult, you can help ensure that he or she gets proper oral care. Tooth decay and gum disease don't have to be a part of getting older.

"We have to worry about the same conditions throughout life, although some conditions are more prevalent at certain ages," says Dr. Dena Fischer, a dental health expert at NIH. The 2 most common oral health problems are tooth decay (**cavities**) and gum disease. "Gum disease is more

common when you're older," Fischer explains. "But cavities can happen at any age, as long as you have natural teeth." Both are largely preventable with proper care.

Cavities develop as **plaque** builds up on your teeth and under chipped fillings, producing acids that can eventually eat away at the tooth's hard outer surface.

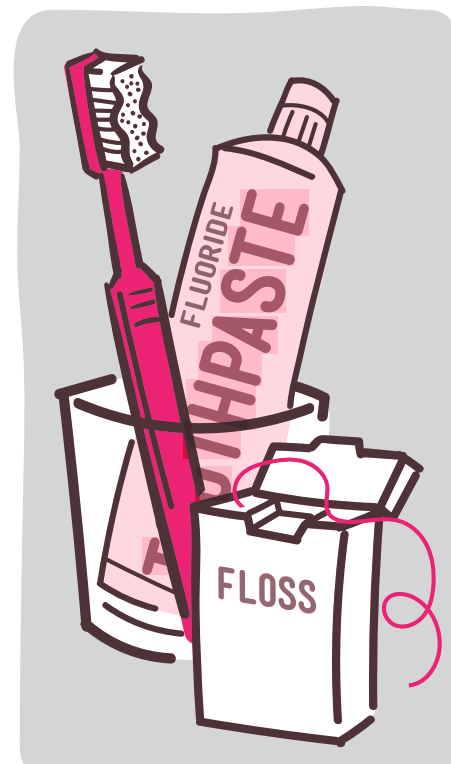
Gum disease is an infection of the gums and surrounding tissues that hold your teeth in place. Gum problems arise as plaque builds up along and under your gum line. In severe cases, the bone and tissue that hold teeth in place can break down, and teeth may eventually become loose and have to be removed.

Reduce your risk of developing tooth decay and gum disease by brushing daily with fluoride toothpaste and flossing. Also visit the dentist regularly for a cleaning and checkup.

Another common problem for older adults is dry mouth. Dry mouth occurs when you don't have enough saliva, or spit, to keep your mouth wet. "Saliva is very important," Fischer says. "The protective factors in saliva prevent cavities, gum disease, and fungal infections."

Dry mouth can be caused by medications; alcohol or tobacco; or medical conditions, such as poorly controlled diabetes. Dry mouth is usually treatable, so talk with your doctor or dentist if you're having problems.

Older adults are also at increased risk for oral cancer. Symptoms include a sore, irritation, or lump in the mouth or throat that lasts more than



two weeks; it may be painful or may cause numbness. It's important to catch oral cancer early, because treatment works best before the disease has spread. Be on the lookout for any changes in your mouth, especially if you smoke or drink.

If you serve as a caregiver to an older adult, you can help that person overcome oral health challenges. Encourage him or her to use an electric or large-handled toothbrush, so it's easier to grip. You might place your hand over his/hers to help guide the toothbrush. Dentures should soak in water overnight and once a week with a denture cleaner. Dentures should also be rinsed after each meal and brushed daily.

A healthy mouth can help you eat well, avoid pain, and feel good about yourself. Take steps to keep your mouth healthy, whatever your age. ■



Wise Choices Keep Your Mouth Healthy

- Drink fluoridated water and use fluoride toothpaste. Fluoride protects against dental decay at all ages.
- Floss and brush teeth daily. (If you're a caregiver for someone who can't brush or floss his/her own teeth, you'll need to help.)
- Visit your dentist regularly, even if you have no natural teeth and have dentures.
- Avoid tobacco and alcohol. They can raise the risk for oral and throat cancers.
- If medicines lead to a dry mouth, ask your doctor if other drugs might be used instead. If dry mouth continues, drink plenty of water, chew sugarless gum, and avoid tobacco and alcohol.



Definitions

Cavities

Small holes in teeth caused by decay.

Plaque

Sticky, colorless film that can lead to tooth decay and gum disease.



Web Links

For more about oral health in older adults, click the "Links" tab at: <http://newsinhealth.nih.gov/issue/Oct2015/Feature2>



Health Capsules

For links to more information, see these stories online:
<http://newsinhealth.nih.gov/issue/Oct2015/Capsule1>

Predicting Suicide Risk

Researchers developed an approach that may help to identify patients most likely to attempt suicide. The experimental technique still must be tested in larger groups of people to assess its effectiveness.

Scientists have long searched for reliable ways to identify those at risk for suicide, which claims the lives of about 40,000 Americans each year. Some researchers are developing questionnaires that measure the likelihood of someone committing suicide. Others are looking for molecular clues in the blood.

An NIH-funded research team decided to combine these methods. To identify molecular clues, they studied 217 male psychiatric patients who made several visits to a medical center. Interviews helped the scientists identify 37 patients whose thoughts of suicide increased between visits. Blood analyses found molecules with different levels between visits. The

scientists then measured these molecules in blood samples from 26 men who had committed suicide.

The team also developed 2 apps that use questionnaires to measure suicide risk. The apps collect information on a patient's emotional state, life events, stress, and mental health. Both apps were able to predict thoughts of suicide more than 85% of the time. The researchers combined the questionnaires with the most predictive blood-based molecules to create a tool called UP-Suicide.

In separate groups of psychiatric patients, the UP-Suicide tool predicted which patients would go on to have serious suicidal thoughts with 92% accuracy. It also predicted with 71% accuracy which patients would be hospitalized for suicidal behaviors in the year following testing.

"We believe that widespread adoption of risk prediction tests based on these findings during health care

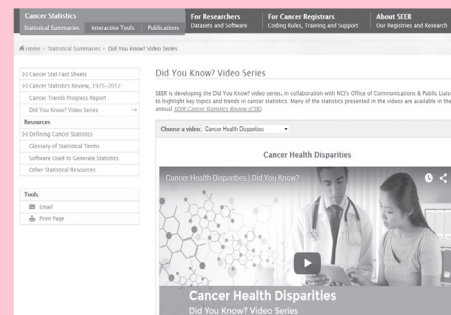
assessments will enable clinicians to intervene with lifestyle changes or treatments that can save lives," says lead researcher Dr. Alexander B. Niculescu of Indiana University School of Medicine.

Because the team studied only male psychiatric patients, further research will be needed to understand how well this approach can predict suicidal thoughts and behaviors in other populations, such as women and those who aren't psychiatric patients. ■

Featured Website Did You Know? Cancer Videos

<http://seer.cancer.gov/statistics/videos/>

A new series of short videos from NIH explains some of the statistics and trends behind different types of cancer, including colorectal, prostate, breast, and lung cancers. Learn about related topics, such as the link between excess weight and cancer risk. To choose from more than a dozen options, open the "Choose a video" drop-down menu.



Helping Older Loved Ones from Afar

Many of us find that we need to help care for aging parents or other loved ones who live far away. Caregiving can be difficult and time-consuming, but it can also be rewarding.

An online booklet from NIH, called *So Far Away: Twenty Questions and Answers for Long-Distance Caregiving*, is filled with ideas that can help make caring for a loved one from afar more manageable and less stressful.

Anyone, anywhere can be a long-distance caregiver. Caregiving might

involve managing an elderly aunt's budget or helping your dad sort through medical bills. You might check the references of a home health aide, or try to take some pressure off a sibling who lives in the same town as your aging relatives.

So Far Away gives straightforward answers to 20 common questions faced by long-distance caregivers. Visit www.nia.nih.gov/HealthInformation/Publications/LongDistanceCaregiving to read or download the online publication. ■

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