

## Introducing... Your Brain

The brain is the command center of your body. It weighs about three pounds, and has different centers or systems that process different kinds of information.

The brain stem is the most primitive structure at the base of your brain. The brain stem controls your heart rate, breathing, and sleeping; it does the things you never think about.

Various parts or lobes of the brain process information from your sense organs: the occipital lobe receives information from your eyes, for example. And the cerebral cortex, on top of the whole brain, is the "thinking" part of you. That's where you store and process language, math, and strategies: It's the thinking center. Buried deep within the cerebral cortex is the limbic system, which is responsible for survival: It remembers and creates an appetite for the things that keep you alive, such as good food and the company of other human beings. [\[1\]](#), [\[2\]](#)

The cerebellum is responsible for things you learn once and never have to think about, such as balance when walking or how to throw a ball.

## How Does Your Brain Communicate?

The brain's job is to process information. Brain cells called neurons receive and send messages to and from other neurons. There are billions of neurons in the human brain, each with as many as a thousand threadlike branches that reach out to other neurons.

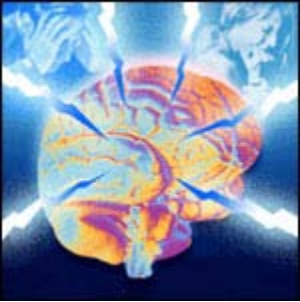
In a neuron, a message is an electrical impulse. The electrical message travels along the sending branch, or axon, of the neuron. When the message reaches the end of the axon, it causes the release of a chemical called a neurotransmitter. The chemical travels across a tiny gap, or synapse, to other neurons.

Specialized molecules called receptors on the receiving neuron pick up the chemical. The branches on the receiving end of a neuron are called dendrites. Receptors there have special shapes so they can only collect one kind of neurotransmitter.

In the dendrite, the neurotransmitter starts an electrical impulse. Its work done, the chemical is released back into the synapse. The neurotransmitter then is broken down or is reabsorbed into the sending neuron. [\[1\]](#), [\[2\]](#)

Neurons in your brain release many different neurotransmitters as you go about your day thinking, feeling, reacting, breathing, and digesting. When you learn new information or

a new skill, your brain builds more axons and dendrites first, as a tree grows roots and branches. With more branches, neurons can communicate and send their messages more efficiently. [1]



## What Do Drugs Do to the Brain?

Some drugs work in the brain because they have a similar size and shape as natural neurotransmitters. In the brain in the right amount or dose, these drugs lock into receptors and start an unnatural chain reaction of electrical charges, causing neurons to release large amounts of their own neurotransmitter.

Some drugs lock onto the neuron and act like a pump, so the neuron releases more neurotransmitter. Other drugs block reabsorption or reuptake and cause unnatural floods of neurotransmitter. [1]

All drugs of abuse, such as nicotine, cocaine, and marijuana, primarily affect the brain's limbic system. Scientists call this the "reward" system. Normally, the limbic system responds to pleasurable experiences by releasing the neurotransmitter dopamine, which creates feelings of pleasure.

## What Happens if Someone Keeps Using Drugs?

Think about how you feel when something good happens-maybe your team wins a game, you're praised for something you've done well, or you drink a cold lemonade on a hot day-that's your limbic system at work. Because natural pleasures in our lives are necessary for survival, the limbic system creates an appetite that drives you to seek those things.

The first time someone uses a drug of abuse, he or she experiences unnaturally intense feelings of pleasure. The limbic system is flooded with dopamine. Of course, drugs have other effects, too; a first-time smoker may also cough and feel nauseous from toxic chemicals in a tobacco or marijuana cigarette. [1]

But the brain starts changing right away as a result of the unnatural flood of neurotransmitters. Because they sense more than enough dopamine, for example, neurons begin to reduce the number of dopamine receptors. Neurons may also make less dopamine. The result is less dopamine in the brain: This is called down regulation. Because some drugs are toxic, some neurons may also die. [1] [3]

## How Many Times Does Someone Have To Take a Drug To Become an Addict?

No one knows how many times a person can use a drug without changing his or her brain and becoming addicted.

A person's genetic makeup probably plays a role. But after enough doses, an addicted teen's limbic system craves the drug as it craves food, water, or friends. Drug craving is made worse because of down regulation.

Without a dose of the drug, dopamine levels in the drug abuser's brain are low. The abuser feels flat, lifeless, depressed. Without drugs, an abuser's life seems joyless. Now the abuser needs drugs just to bring dopamine levels up to normal levels. Larger amounts of the drug are needed to create a dopamine flood or high, an effect known as tolerance.

By abusing drugs, the addicted teen has changed the way his or her brain works. Drug abuse and addiction lead to long-term changes in the brain. These changes cause addicted drug users to lose the ability to control their drug use. Drug addiction is a disease. [1]

## If Drug Addiction Is a Disease, Is There a Cure?

There is no cure for drug addiction, but it is a treatable disease; drug addicts can recover. Drug addiction therapy is a program of behavior change or modification that slowly retrains the brain. Like people with diabetes or heart disease, people in treatment for drug addiction learn behavioral changes and often take medications as part of their treatment regimen. [4]

## References

1. National Institute on Drug Abuse.  
[The Brain: Understanding Neurobiology Through the Study of Addiction \(http://science-education.nih.gov/Customers.nsf/highschool.htm\)](http://science-education.nih.gov/Customers.nsf/highschool.htm):  
NIH Pub. No. 00-4871.
2. National Institute on Drug Abuse.  
[Brain Power! The NIDA Junior Scientists Program \(http://www.nida.nih.gov/JSP/JSP.html\)](http://www.nida.nih.gov/JSP/JSP.html):  
NIH Pub. No. 01-4575. Bethesda, MD: NIDA, NIH, DHHS. 2000.
3. National Institute on Drug Abuse.  
[Mind Over Matter: The Brain's Response to Drugs Teacher's Guide \(http://teens.drugabuse.gov/mom/tg\\_intro.php\)](http://teens.drugabuse.gov/mom/tg_intro.php):

NIH Pub. No. 020-3592. Bethesda, MD: NIDA, NIH, DHHS. Printed 1997. Reprinted 1998, 2002. Revised 2000.

4. National Institute on Drug Abuse.

[NIDA InfoFacts: Drug Addiction Treatment Methods](http://www.drugabuse.gov/infobox/treatmeth.html)

(<http://www.drugabuse.gov/infobox/treatmeth.html>):

Bethesda, MD: NIDA, NIH, DHHS. Retrieved June 2003.