

## Scientists Discover Answers

Fortunately, scientists have figured out how cocaine works, which will help them discover treatments for cocaine addiction. Right now there are talk therapies that can help, but someday there may be medications as well.

## The Search Continues

There's still a lot that scientists don't know about the effects of cocaine on the brain. Maybe someday you'll make the next big discovery. Until then, join me—Sara Bellum—in the other magazines in my series, as we explore how drugs affect the brain and nervous system.



For more information, visit:

[www.teens.drugabuse.gov](http://www.teens.drugabuse.gov)

To learn more about cocaine and other drugs of abuse, or to order materials on these topics, free of charge, in English or Spanish, visit the NIDA Web site at [www.drugabuse.gov](http://www.drugabuse.gov) or contact the DrugPubs Research Dissemination Center at 877-NIDA-NIH (877-643-2644; TTY/TDD: 240-645-0228).

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## The Brain's Response to Cocaine

Hi, my name's Sara Bellum. Welcome to my magazine series exploring the brain's response to drugs. In this issue, we'll investigate the fascinating facts about the drug cocaine, which is considered a stimulant.

Have you eaten any chocolate or drunk any soda lately? If you have, there's a good chance you gave your body a dose of a stimulant—caffeine, which is also in coffee.

Eating or drinking a large amount of caffeine can make you feel jittery, nervous, or energetic. That's because caffeine—like any stimulant—changes the way your brain works.

But caffeine is just a mild example of a stimulant. Many other stimulant drugs are much stronger—and some are illegal and very dangerous.

Cocaine is made from the leaf of the coca plant. It often comes in the form of a white powder that some people inhale through their nose. Another form of cocaine, known as crack, can be smoked.



National Institute on Drug Abuse

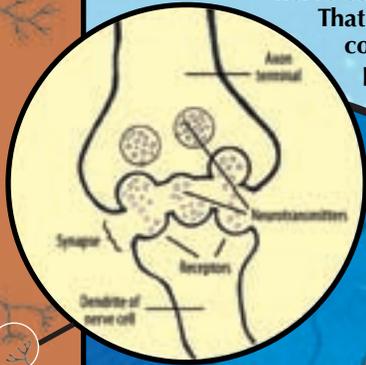
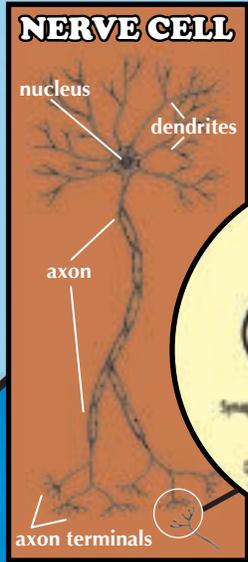
# Miscommunication in the Brain

Cocaine changes the way the brain works by changing the way nerve cells communicate. Nerve cells, called neurons, send messages to each other by releasing special chemicals called neurotransmitters. Neurotransmitters are able to work by attaching to key sites on neurons called receptors.

One of the neurotransmitters affected by cocaine is called dopamine. Dopamine is released by neurons in the limbic system—the part of the brain that controls feelings of pleasure.

Normally, once dopamine has attached to a nerve cell's receptor and caused a change in the cell, it's pumped back to the neuron that released it. But cocaine blocks the pump, called the dopamine transporter. Dopamine then builds up in the gap (synapse) between neurons.

The result: dopamine keeps affecting a nerve cell after it should have stopped. That's why someone who uses cocaine feels an extra sense of pleasure for a short time.



# Cocaine Can Change the Way the Brain Works

Although cocaine may make someone feel pleasure for a while, later it can take away a person's ability to feel pleasure from natural rewards, like a piece of chocolate or a good time with friends. Research suggests that long-term cocaine use may reduce the amount of dopamine or number of dopamine receptors in the brain. When this happens, nerve cells need

more dopamine to function normally—or more drug to be able to feel pleasure.

If a long-term user of cocaine stops taking the drug, the person feels tired and sad, and experiences strong craving for the drug. These feelings can last for a long time, until the brain (and the person) recovers from addiction.

# Cocaine Tightens Blood Vessels

Cocaine causes the body's blood vessels to become narrow, constricting the flow of blood. This is a problem. It forces the heart to work harder to pump blood through the body. (If you've ever tried squeezing into a tight pair of pants, then you know how hard it is for the heart to pump blood through narrowed blood vessels.)

When the heart works harder, it beats faster. It may work so hard that it temporarily loses its natural rhythm. This is called fibrillation, and it can be very dangerous because it stops the flow of blood through the body.

Many of cocaine's effects on the heart are actually caused by cocaine's impact on the brain—the body's control center.

