

## The Brain's Response to Nicotine

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 nicotine. Some of this information was only recently discovered by leading scientists.

For centuries, people have chewed and smoked tobacco, which comes from the plant *nicotiana tabacum*. The reason tobacco is used by so many people is because it contains a powerful drug known as nicotine.

When tobacco is smoked, nicotine is absorbed by the lungs and quickly moved into the bloodstream, where it is circulated throughout the brain. All of this happens very rapidly. In fact, nicotine reaches the brain within 8 seconds after someone inhales tobacco smoke. Nicotine can also enter the bloodstream through the mucous membranes that line the mouth (if tobacco is chewed) or nose (if snuff is used), and even through the skin.

Nicotine affects the entire body. Nicotine acts directly on the heart to change heart rate and blood pressure. It also acts on the nerves that control respiration to change breathing patterns. In high concentrations, nicotine is deadly, in fact one drop of purified nicotine on the tongue will kill a person. It's so lethal that it has been used as a pesticide for centuries.

So why do people smoke? Because nicotine acts in the brain where it can stimulate feelings of pleasure.

## How Does Nicotine Act in the Brain?

Your brain is made up of billions of nerve cells. They communicate by releasing chemical messengers called neurotransmitters. Each neurotransmitter is like a key that fits into a special "lock," called a receptor, located on the surface of nerve cells. When a neurotransmitter finds its receptor, it activates the receptor's nerve cell.

The nicotine molecule is shaped like a neurotransmitter called acetylcholine. Acetylcholine and its receptors are involved in many functions, including muscle movement, breathing, heart rate, learning, and memory. They also cause the release of other neurotransmitters and hormones that affect your mood, appetite, memory, and more. When nicotine gets into the brain, it attaches to acetylcholine receptors and mimics the actions of acetylcholine.

Nicotine also activates areas of the brain that are involved in producing feelings of pleasure and reward. Recently, scientists discovered that nicotine raises the levels of a neurotransmitter called dopamine in the parts of the brain that produce feelings of pleasure and reward. Dopamine, which is sometimes called the pleasure molecule, is the same neurotransmitter that is involved in addictions to other drugs such as cocaine and heroin. Researchers now believe that this change in dopamine may play a key role in all addictions. This may help explain why it is so hard for people to stop

## Easy to Start, Hard to Quit

Did you know that nicotine is as addictive as heroin or cocaine? If someone uses nicotine again and again, such as by smoking cigarettes or cigars or chewing tobacco, his or her body develops a tolerance for it. When someone develops tolerance, he or she needs more drug to get the same effect. Eventually, a person can become addicted. Once a person becomes addicted, it is extremely difficult to quit. People who start smoking before the age of 21 have the hardest time quitting, and fewer than 1 in 10 people who try to quit smoking succeed.

When nicotine addicts stop smoking they may suffer from restlessness, hunger, depression, headaches, and other uncomfortable feelings. These are called "withdrawal symptoms" because they happen when nicotine is withdrawn from the body.

## America's Leading Preventable Killer

Withdrawal may be bad, but long-term smoking can be much worse. It raises your blood pressure, dulls your senses of smell and taste, reduces your stamina, and wrinkles your skin. More dangerously, long-term smoking can lead to fatal heart attacks, strokes, emphysema, and cancer.

You may be surprised to learn that tobacco use causes far more illnesses and death than all other addicting drugs combined. One out every six deaths in the United States is a result of smoking.

But even when faced with risk of death, many people keep using tobacco because they are so addicted to nicotine. Believe it or not, half of the smokers who have heart attacks keep smoking, even though their doctor warns them to stop. That's a strong addiction!

Smokeless tobacco also has harmful effects. Chewing tobacco can cause damage to gum tissue and even loss of teeth. It also reduces a person's ability to taste and smell. Most importantly, smokeless tobacco contains cancer causing-chemicals that can cause cancers of the mouth, pharynx, larynx, and esophagus. This can even happen in very young users of chewing tobacco. In fact, most people who develop these cancers were users of chewing tobacco.

## Got A Match?

The brain's best defense against nicotine is to think hard before using it. Start by trying to match the correct percentages to the statements located below.

1. Percentage of smokers who start smoking in their teens:
2. Percentage of smokers age 17 or less who say they regret starting:
3. Percentage of youth smokers who will continue smoking and die early from a smoking-related disease:
  - A. About 30%
  - B. 80% - 90%
  - C. 70%

## Answers:

1. Percentage of smokers who start smoking in their teens:  
**B. 80% - 90%**
2. Percentage of smokers age 17 or less who say they regret starting:  
**C. 70%**
3. Percentage of youth smokers who will continue smoking and die early from a smoking-related disease:  
**A. About 30%**

## **The Search Continues**

The truth is, there's still a whole lot that scientists don't know about nicotine's effects 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.

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