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, tobacco has been chewed and smoked by many people around the world. Tobacco is a plant, Nicotiana tabacum, and 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. 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.

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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. 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 smoking.

**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.

**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.  
   - A. About 30%
   - B. 80%-90%
   - C. 70%

2. Percentage of smokers age 17 or under who say they regret starting.  
   - A. About 30%
   - B. 80%-90%
   - C. 70%

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%