



THE SCIENCE OF MARIJUANA

HOW THC AFFECTS THE BRAIN

Some people believe smoking marijuana carries no risks. But scientific research shows that there are risks, especially for teens. Marijuana affects a person's judgment and can impair his or her ability to drive. For those who use it regularly, it can lead to poor academic performance, or even addiction.

So how does marijuana have such a big impact on a person's ability to function?

Scientists have asked themselves that question for a long time. And after several decades of research they not only figured out how marijuana works, but scientists also discovered an important communications system in the brain and the body, which they called **the endocannabinoid system** after the cannabis plant from which marijuana comes.

“Endo”—what?

Understanding the science of marijuana began in the mid-1960s with the identification of THC (delta-9-tetrahydrocannabinol) as marijuana's main active ingredient. Twenty years later, scientists identified the sites in the brain and body where marijuana acts and called them cannabinoid (CB) receptors.

Scientists then discovered the body's own natural

chemicals—anandamide and 2-AG (2-arachidonoyl glycerol)—which also act on CB receptors. These chemicals (called cannabinoids), along with their receptors, make up the endocannabinoid (EC) system.

The EC system is found in many areas of the brain, which explains

why it affects so many different body functions. Cannabinoids exert their influence by regulating how cells communicate—how they send, receive, or process messages. Cannabinoids act like a type of “dimmer switch,” slowing down communication between cells.

The Endocannabinoid System

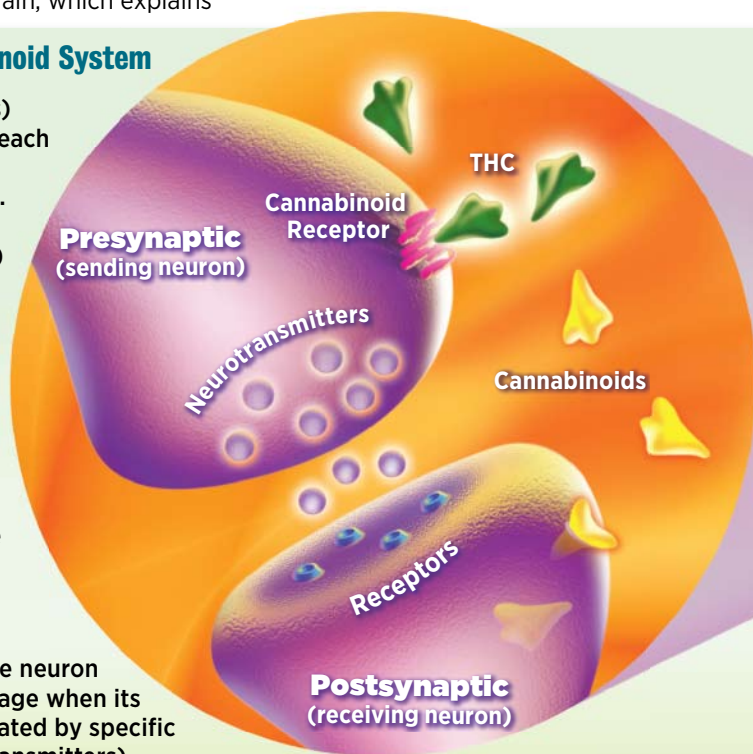
Brain cells (neurons) communicate with each other by sending chemical messages. The chemicals (neurotransmitters) cross a gap between neighboring neurons before attaching to their specific receptors.

Presynaptic: The neuron sending a message by releasing a chemical when signaled to do so

Postsynaptic: The neuron receiving the message when its receptors are activated by specific chemicals (neurotransmitters)

Neurotransmitters: The chemical messengers that travel from one brain cell to another

Receptors: Activated by neurotransmitters, receptors trigger a set of events that allows a message to be passed along to other neurons



Cannabinoids: Natural chemicals (anandamide and 2-AG) that bind to cannabinoid receptors in the brain and the body

THC: The main active ingredient in marijuana; THC, also a cannabinoid, interferes with the normal functioning of the endocannabinoid system

Visit scholastic.com/headsup/endocannabinoid to learn more about how cannabinoids can change how brain cells communicate.

Marijuana leaf illustration: © iStockphoto.

Marijuana Facts: Now You Know

Q: How can I help my brother? He smokes marijuana day and night.

—Student, Middlebury Union High, Vermont

A: Your brother is fortunate to have a strong supporter like you. You can't make him stop, but you can help him by showing your support, pointing out some of the consequences of his using drugs (including its effect on your relationship), and encouraging him to participate in nondrug-related activities (e.g., does he like to skate, bike, or go to the movies?). If you're worried that your brother's use is dangerous, talk to an older sibling or a trusted adult, like your parents, a teacher, or a counselor at school to get guidance.

If your brother is ready to stop smoking, or wants more information on how to find help, call 1-800-662-HELP or go to www.findtreatment.samhsa.gov anytime, 24 hours a day, 7 days a week, to find a treatment facility in your area.

—Michelle Leff, Intramural Research Program, NIDA

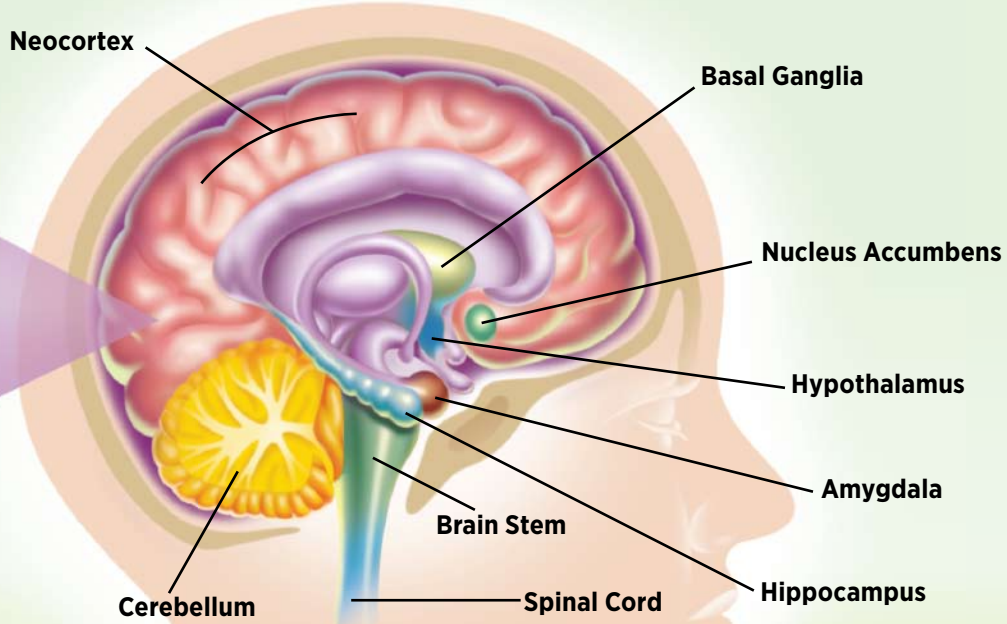
For more facts about marijuana and other drugs, visit teens.drugabuse.gov or scholastic.com/headsup.

So how does THC affect the EC system?

When someone smokes marijuana, THC gets into the brain rapidly and attaches to cannabinoid receptors. The natural EC system is finely tuned

to react appropriately to incoming information. But THC overwhelms the EC system. It prevents the natural chemicals from doing their job properly and throws the whole system off balance.

How does THC affect behavior? It depends on where the CB receptors are in the brain.



Brain Structure	Regulates	THC Effect on User
Amygdala	emotions, fear, anxiety	panic/paranoia
Basal Ganglia	planning/starting a movement	slowed reaction time
Brain Stem	information between brain and spinal column	antinausea effects
Cerebellum	motor coordination, balance	impaired coordination
Hippocampus	learning new information	impaired memory
Hypothalamus	eating, sexual behavior	increased appetite
Neocortex	complex thinking, feeling, and movement	altered thinking, judgment, and sensation
Nucleus Accumbens	motivation and reward	euphoria (feeling good)
Spinal Cord	transmission of information between body and brain	altered pain sensitivity

The brain structures illustrated above all contain high numbers of CB receptors