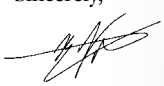
Dear Teacher:

This year's *Heads Up* articles highlight myths versus facts about marijuana. Many youths and adults believe that using marijuana is no big deal. Mixed media messages—from popular music, TV, and the Internet—and efforts to legalize marijuana are contributing to this misperception. But contrary to such messages, the risks associated with marijuana use are real.

About 9 percent of people who use marijuana become addicted to it, and regular use increases the likelihood of academic and athletic failure. Even occasional use can lead to car accidents and lapses in judgment. In the accompanying article, students will learn the science of how THC—the active ingredient in marijuana—mimics natural brain chemicals, undermining a whole range of key functions, including critical thinking, memory, motor skills, and coordination.

I hope you will use this article, and the accompanying lesson and work sheet, to help your students become knowledgeable about the real risks and dangers associated with marijuana use.

Sincerely,



Nora D. Volkow, M.D.
Director,
National Institute on Drug Abuse

In This Installment:

- **Student article:** Scientific facts about how THC affects brain cells and activities controlled by the brain
- **Student work sheet:** Identifying the effects of THC on the brain

THE SCIENCE OF MARIJUANA

Overview: The lesson below and the reproducible work sheet on the reverse side reinforce student comprehension of key facts and concepts in the article "The Science of Marijuana: How THC Affects the Brain."

Alignment With National Standards

- *Science (NSES):* Life Science: Structure and Function in Living Systems; Science in Personal and Social Perspectives: Personal and Community Health
- *Life Skills (McREL):* Self-Regulation; Thinking and Reasoning

Lesson

Before-Reading Questions:

- What do you know about how brain cells communicate with one another, and how the brain controls body functions?
- What is THC?
- What are some of the effects of marijuana on the brain?

After-Reading Questions

Distribute the student work sheet and discuss the answers as a class:

Brain Activities—Amygdala: Emotions, fear, anxiety. **Basal Ganglia:** Planning/starting a movement. **Brain Stem:** Information between brain and spinal column. **Cerebellum:** Motor coordination, balance. **Hippocampus:** Learning new information. **Hypothalamus:** Eating, sexual behavior. **Neocortex:** Complex thinking, feeling, and movement. **Nucleus Accumbens:** Motivation and reward. **Spinal Cord:** Transmission of information between body and brain.

"Think It Through" Questions

(factual responses in italics):

1. THC disrupts the function of the endocannabinoid system in a person's brain. Which areas are critical to the ability to safely drive a car? How might THC impair driving ability? *(The basal ganglia, neocortex, and cerebellum can all affect a person's ability to drive. The basal ganglia regulates planning and starting a movement. The neocortex regulates complex thinking and movements. The cerebellum regulates motor control and coordination.)*
2. Which areas of the brain are most in play when studying for a test? How would smoking marijuana affect these areas and a person's ability to study for a test? *(The hippocampus is important for memory and learning new information. THC impairs the ability to learn and store new information.)*
3. How might marijuana use affect a person's relationships with other people such as friends, teachers, or parents? *(THC affects the amygdala, an area important in emotions and anxieties, as well as the nucleus accumbens and the neocortex. Some people who use marijuana often may show a lack of motivation or drive, or they may seem depressed, which can in turn affect relationships.)*

Follow-up Discussion:

- Evaluate students on their ability to think through the scientific information presented on the work sheet.
- Discuss everyday situations that marijuana use can affect.

More Information

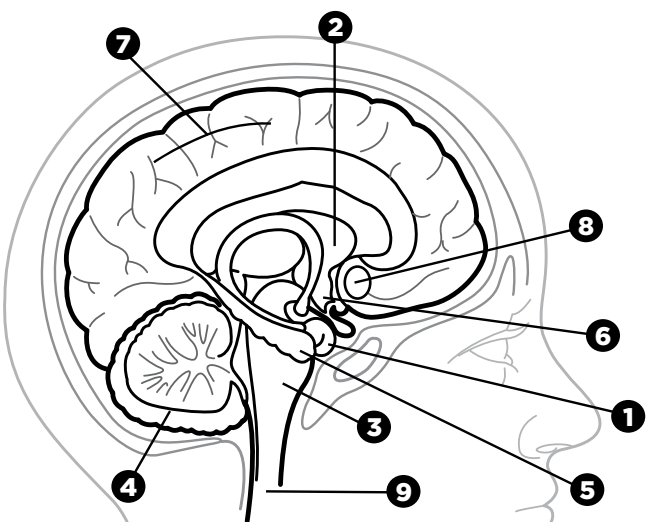
- For more information on drugs, go to **http://teens.drugabuse.gov** or **www.scholastic.com/headsup**.
- For immediate help with a crisis, call **1-800-273-TALK**.
- To locate a treatment center, call **1-800-662-HELP** or visit **http://findtreatment.samhsa.gov**.

For printable past and current articles in the **HEADS UP** series, as well as activities and teaching support, go to **www.drugabuse.gov/parent-teacher.html** or **www.scholastic.com/headsup/teachers**.

Name _____ Date _____

The Effects of THC on the Brain

Brain Activities: Areas of the brain that have high levels of cannabinoid receptors are labeled in this illustration. Fill in the blanks with the activities that are regulated by the numbered parts of the brain. Then answer the "Think It Through" questions below.



1. Amygdala: _____

2. Basal ganglia: _____

3. Brain stem: _____

4. Cerebellum: _____

5. Hippocampus: _____

6. Hypothalamus: _____

7. Neocortex: _____

8. Nucleus accumbens: _____

9. Spinal cord: _____

"Think It Through" Questions: (Write your answers on separate paper.)

1. THC, the main active ingredient in marijuana, disrupts the function of the endocannabinoid system in a person's brain. Which areas of the brain are critical to the ability to safely drive a car? How might THC impair driving ability?
2. Which areas of the brain are most in play when studying for a test and why? How would smoking marijuana affect these areas and a person's ability to study for a test?
3. How might marijuana use affect a person's relationships with other people, such as friends, teachers, or parents? Answer the question in terms of THC's effect on brain function.

FROM SCHOLASTIC AND THE SCIENTISTS OF THE NATIONAL INSTITUTE ON DRUG ABUSE, NATIONAL INSTITUTES OF HEALTH, U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES