

## **Grade 5: Hygiene**

### **Lesson 6: Be Smart, Stay Free: The Impact of Drugs on your brain!**

#### **Objectives:**

1. Students will explain how drugs harm the brain
2. Students will describe inhalants and analyze their effects on the brain
3. Students will identify three important personal reasons to not use drugs.

#### **Materials:**

- Common household items, inhalant and non-inhalant
- Materials to create learning station drawings or models
- Box and color paper to make the Question Box
  - Optional:
    - From the kit: Nervous system and brain anatomical charts
- “Drugs on the Brain” information sheet (**See Figure 1**)

#### **Activity Summary:**

In this lesson students will acquire a basic understanding of how drugs affect the brain. The lesson focuses on marijuana and inhalants. Students will identify important personal reasons to not use drugs.

#### **Background information for the teacher:**

This background has been used with permission from information provided in “Mind Over Matter” on the National Institute on Drug Abuse website.

#### Effects of Drug Abuse on the Brain

Pleasure, which scientists call reward, is a very powerful biological force for our survival. If you do something pleasurable, the brain is wired in such a way that you tend to do it again. Life sustaining activities, such as eating, activate a circuit of specialized nerve cells devoted to producing and regulating pleasure. One important set of these nerve cells, which uses a chemical neurotransmitter called dopamine, sits at the very top of the brainstem. These dopamine-containing neurons relay messages about pleasure through their nerve fibers to nerve cells in a limbic system structure called the nucleus accumbens. Still other fibers reach to a related part of the frontal region of the cerebral cortex. So, the pleasure circuit . . . spans the survival-oriented brainstem, the emotional limbic system and the frontal cerebral cortex.

All drugs that are addicting can activate the brain's pleasure circuit. Drug addiction is a biological, pathological process that alters the way in which the pleasure center, as well as other parts of the brain, functions. . . . Almost all drugs that change the way the brain works do so by affecting chemical neurotransmission.

. . . Prolonged drug use changes the brain in fundamental and long-lasting ways. These long-lasting changes are a major component of the addiction itself. It is as though there is a figurative "switch" in the brain that "flips" at some point in an individual's drug use. The point at which this "flip" occurs varies from individual to individual, but the effect of this change is the transformation of a drug abuser to a drug addict.

### Marijuana

Marijuana is the dried leaves and flowers of the cannabis plant. Tetrahydrocannabinol (THC) is the main ingredient in marijuana that causes people who use it to experience a calm euphoria. Marijuana changes brain messages that affect sensory perception and coordination. This can cause users to see, hear, and feel stimuli differently and to exhibit slower reflexes.

THC, the main active ingredient in marijuana, binds to and activates specific receptors, known as cannabinoid receptors. There are many of these receptors in the brain that control memory, thought, concentration, time, depth perception, and coordinated movement.

By activating these receptors, THC interferes with the normal functioning of the cerebellum, the part of the brain most responsible for balance, posture, and coordination of movement.

The hippocampus (*Note: This is an interior area of the cerebrum*), which is involved with memory formation, also contains many cannabinoid receptors. Studies have suggested that marijuana activates cannabinoid receptors in the hippocampus and affects memory by decreasing the activity of neurons in this area. The effect of marijuana on long-term memory is less certain, but while someone is under the influence of marijuana, short-term memory can be compromised.

Marijuana also affects receptors in brain areas and structures responsible for sensory perception. Marijuana interferes with the receiving of sensory messages (for example, touch, sight, hearing, taste, and smell) in the cerebral cortex.

## Inhalants

Most inhalants are common household products that give off mind-altering chemical fumes when sniffed. These common products include paint thinner, fingernail polish remover, glues, gasoline, cigarette lighter fluid, and nitrous oxide.

They also include fluorinated hydrocarbons found in aerosols, such as whipped cream, hair and paint sprays, and computer cleaners. The chemical structure of various types of inhalants is diverse, making it difficult to generalize about the effects of inhalants. It is known, however, that the vaporous fumes can change brain chemistry and may be permanently damaging to the brain and central nervous system.

Inhalant users are also at risk for Sudden Sniffing Death (SSD), which can occur when the inhaled fumes take the place of oxygen in the lungs and central nervous system. This basically causes the inhalant used to suffocate. Inhalants can also lead to death by disrupting the normal heart rhythm, which can lead to cardiac arrest. Use of inhalants can cause hepatitis, liver failure, and muscle weakness. Certain inhalants can also cause the body to produce fewer of all types of blood cells, which may result in life threatening aplastic anemia.

Inhalants also alter the functioning of the nervous system. Some of these effects are transient and disappear after use is discontinued. But inhalant use can also lead to serious neurological problems, some of which are irreversible. . . . For instance, inhalants can cause abnormalities in brain areas that are involved in movement (for example, the cerebellum) and higher cognitive function (for example, the cerebral cortex).

Inhalants enter the bloodstream quickly and are then distributed throughout the brain and body. (*Brain Fact: There are about 40 million olfactory receptor cells. This is what makes the sense of smell so powerful and facilitates such a rapid absorption of inhalants.*) They have direct effects on both the central nervous system (brain and spinal cord) and the peripheral nervous system (nerves throughout the body).

Using brain-imaging techniques, such as magnetic resonance imaging (MRI), researchers have discovered that there are marked structural changes in the brains of chronic inhalant abusers. These changes include a reduction in size in certain brain areas, including the cerebral cortex, cerebellum, and brainstem. . . . Some of these changes may be due to the effect inhalants have on myelin, the fatty tissue that insulates and protects axons and helps speed up nerve conduction. When inhalants enter the brain and body, they are particularly attracted to fatty tissues. Because myelin is a fat, it quickly absorbs inhalants,

which can then damage or even destroy the myelin. . . . In some cases, not only is the myelin destroyed, but also the axons themselves degenerate.

**Vocabulary:**

Addiction  
High  
Overdose  
Tolerance  
Inhalant  
Marijuana  
Myelin  
Hippocampus  
Cannabinoid receptor  
Neurological

**Engage**

Read the following article from Teen Newsweek. Only a portion of the article is copied below. To read the rest you can go to the following website

[http://www.weeklyreader.com/teachers/newsweek/cover\\_story\\_26.asp](http://www.weeklyreader.com/teachers/newsweek/cover_story_26.asp)

**Don't Inhale**

**How common household cleaners can kill you**

*By Mary Kate Frank*

*On a warm Saturday in June 2001, David Manlove, 16, got up early and mowed the yard for his parents. Later, he went to a friend's house to swim. And then the Indiana teen made the decision that cost him his life.*

*David and a friend went to a nearby drugstore and bought a can of computer duster. They returned to the pool and inhaled the duster to get high. David dove underwater to intensify the rush. He did it a few times before his heart stopped. David drowned.*

*Today, David's father, Kim Manlove, says his son, a popular, athletic boy who wanted to become an orthopedic surgeon, didn't realize that inhalants are as dangerous as illegal drugs. "I don't think he saw them as a problem, because you*

*could just buy them at the drugstore," Kim Manlove says. "David had hopes and dreams. This was not what he wanted for himself."*

### **Explore**

Have a number of bottles, cans, and tubes showing a variety of common household items. Have some dangerous inhalant items as well as some non-harmful items. These can be the actual bottles themselves or empty cans and tubes wrapped with paper and labeled.

Inhalant suggestions are: whipped cream, spray paint, modeling glue, nail polish remover, hair spray, computer cleaner, paint thinner, ammonia, etc.

Non-harmful suggested items are: dish soap, bathroom cleanser, spray cleanser, clothes soap, fabric softener, hand soap, etc.

Ask the students to think what these items all have in common. (Items commonly found around the house.)

Remove the non-harmful items leaving the inhalants. Ask: what do these items have in common? (The fumes from these are harmful to us.)

Ask the students to say some other substances and drugs that they know or have heard are harmful to health. Write these on the board. Let the students know that this lesson focuses on inhalants.

### **Explain**

Question: How do drugs harm the brain?

Explore the following website. <http://www.inhalants.org/damage.htm> Put the information on the overhead and discuss.

### Key Points

#### Drugs and the Brain

- Pleasure is a very powerful biological force for our survival. The brain is wired to reinforce pleasurable actions.
- For example: Necessary activities to sustain life, such as eating, activate a circuit of specialized nerve cells devoted to producing and regulating pleasure.
- Nerve cells use a chemical neurotransmitter (dopamine)
- The cells are at the very top of the brainstem.
- These neurons relay messages about pleasure through their nerve fibers to the:

survival-oriented brainstem,  
Emotional limbic system, and  
Frontal cerebral cortex.

#### Why Drugs Are Addicting

- Addicting drugs activate the brain's pleasure circuit.
- Drug addiction is a biological, pathological process.
- It changes how the pleasure center, and other parts of the brain, function.
- Primarily this is accomplished by affecting chemical neurotransmission.

#### Flipping the Switch:

- Fundamental and long-lasting changes result from long-term drug use.
- There is a figurative "switch" in the brain that "flips" at some point in an individual's drug use.
- When the "flip" occurs varies from individual to individual.
- Result is transformation of a drug abuser to a drug addict.

Let the students know that we are going to learn how these substances move through the body from intake (cause) to impact (effect) by using a flow chart. The charts can either be done with boxes, or with an outline of the body. Do a flow chart for inhalants.

Put the flow chart on the board or large easel paper to show how they enter the body, move to the affected brain and nervous system areas, and carry the impact/damage through the body. Have the students tell what each step is through the body from their reading of Drugs on the Brain sheet and any additional research.

<b><u>Box #</u></b>	<b><u>Question (Answers)</u></b>
1.	How is the substance taken into the body? (smelling, sniffing)
2.	What senses and body systems are used? (smell, respiratory)
3.	How is it transported in the body? (Olfactory neurons)
4.	What parts of the brain are affected? (Cerebellum, cerebral cortex, myelin on axons)
5.	What body activities are affected by damage in those areas of the brain? (Cerebellum-affects movement control; Cerebral cortex- impairs thinking;

Central nervous system & lungs-suffocation from lack of oxygen; Heart-cardiac arrest from change in normal heart rhythm)

6. What activities can't you do or are changed because your brain isn't working normally?

Have students brainstorm answers to help them make the connection between brain functions and their activities every day.

What are healthy choices you can make to keep your brain smart and stay free?  
(Discussion of staying drug/substance free, not experimenting with harmful substances.)

If substances like these can harm the brain why do we use them? Do we have a physical process that "makes" us want to use them more? If so, what is that process?

### **Extend**

#### Individual Project

Have each student create a "brochure" about the substance and making their healthy choice. The brochure will be about inhalants. These will be in the form of a tri-fold brochure (8 1/2" x 11" paper turned the long way and folded in thirds). The brochure can be titled: Staying Smart, Staying Free with their name. Students can also create a healthy choice or informative slogan to add to their brochure title page.

The students should use the three "inside" sections. Each section should be titled and give the following information:

#### First Section

Title - Inhalants: What I Know

Information – a) Summary of What it is, b) How it acts in the body

#### Second Section

Title - My Life on Inhalants

Information –

a) Accurately describe the effects of inhalants on the brain, nervous system, etc. Note: this is intended for the student to convey their cognitive understanding of the effects.

b) Describe in personal terms how their life would be effected if they used inhalants i.e., what couldn't they do, do as well, what kinds of difficulties might it cause in school, in sports, with family, friends, etc. Note: This is intended for the student to reflect on the information and make it personal. Here the student connects how substance use would impact them personally and interfere with their life.

### Third Section

Title- My Life Inhalant Free

Information –

- a) My Healthy Choice is: (their personal statement)
- b) I make this choice because: give three reasons (at least) why they to make the choice. Encourage the students to relate it personally. For example the student could give goals they want to accomplish (such as pass the math test, make the softball team, learn gymnastics, etc) or things they want to do that taking these substances would interfere with.

### **Evaluate**

Read Jeny's Story. Pretend you could talk to Jeny before she tried inhalants. Explain to her what they do to the body and why it is dangerous.

Jeny's Story

From The Partnership for a Drug-Free America

[http://www.drugfree.org/Parent/Resources/Jenys\\_Story](http://www.drugfree.org/Parent/Resources/Jenys_Story)

#### *A Common Cleaning Product Killed My Daughter*

*If I could just take a few minutes of your time and hopefully spare another family the nightmare that my family will now live for the rest of our lives. My name is Kelli and my daughter's name was Jeny.*

*On March 25, at 10:30 p.m., we received a call from the hospital telling us that Jeny had been in an accident. They wouldn't tell me she was okay, just to get to the hospital. After driving 15 miles to get there, we weren't allowed to see her and couldn't find out if she was okay. We waited two hours before a police officer took us to another room. He showed us a cleaning product. He said the driver of the car had "huffed" it.*

*We had no idea of what he was talking about - never heard of huffing. The driver of the car had inhaled the cleaner and immediately passed out. The car went down an embankment, across interstate 75 and hit the cement divider in the medium. The driver and the two passengers in the backseat walked away. Jeny's head went through the windshield and hit the divider. She died immediately.*

*Jeny was an A-B student, popular in her school, loved life - and I know she would have never tried inhalants had she known the danger and especially riding with someone who*

*was driving and inhaling. They were just "having fun". We never got to say goodbye to Jeny. In a matter of minutes, her life was cruelly taken away. So, for the parents reading this, please, know what your child is doing, and educate yourself about inhalants. It's a drug and it's dangerous. For the kids out there reading this, please, don't be stupid.*

*Don't think inhalants can't hurt you, because they can and they kill. Don't allow your parents to go through the nightmare that we are now living.*

### **Optional Enrichment Activity:**

#### Group

Create additional Learning Stations for the Nervous System Info Fair.

Have students work together in groups. Topics: Pleasure mechanism of the brain, the action mechanism of how inhalants affect the brain, inhalant effects on the body, how inhalants harm myelin, the cause-effect flow charts for inhalants using a body diagram.

Each group is to:

1. Create a model or drawing of their topic and include an information key indicating the different parts, and important information. Have them make their models to size or scale. Be sure they show what the scale is. Have each group decide how to make the model and the materials they need.
2. Decide on a question the group wants to explore or something they want to know more about regarding their subject
  - a. Determine their methods to answer the question (Research in library or on Internet, books or other information in school or at home).
  - b. Determine the steps to be done to acquire that information.  
(Note: It may work better if students want to conduct simple experiments for them to do that as part of the Lesson Two, Extend activity.)
3. Divide the tasks among themselves to complete their Learning Station.

### **Additional Web Resources**

National Institute on Drug Abuse

Inhalants-

[http://teens.drugabuse.gov/mom/mom\\_inhal.asp](http://teens.drugabuse.gov/mom/mom_inhal.asp)

[http://teens.drugabuse.gov/mom/tg\\_inhal.asp](http://teens.drugabuse.gov/mom/tg_inhal.asp)

KidsHealth.Org

Articles available on Drugs, Marijuana, and Inhalants

<http://www.kidshealth.org/kid/grow/drugs>

The Partnership for A Drug Free America

<http://www.drugfree.org/>

National Inhalant Prevention Coalition

<http://www.inhalants.org/>

### **Missouri Standards:**

III. Risk Assessment and Reduction

C. Tobacco, Alcohol, and other Drugs (TAOD)

What All Students Should Know

1. The ways in which a drug affects the body are determined by the nature of the drug, how it enters the body and how it interacts with the body's chemistry

What All Students Should Know

2. TAOD can affect the healthy functioning of the nervous and reproductive system as well as other systems previously studied.

What All Students Should Be Able To Do

- a. evaluate information regarding body functions and the use of TAOD to determine a cause and effect relationship (eg. marijuana and short term memory)

What All Students Should Know

3. The use of TAOD imposes personal health risks as well as family and societal problems

## **Drugs on the Brain**

### **Figure 1 Inhalants**

#### **What are they?**

- Common household products
- Include: paint thinner, fingernail polish remover, glues, gasoline, cigarette lighter fluid, and nitrous oxide.
- Also: fluorinated hydrocarbons found in aerosols, such as whipped cream, hair and paint sprays, and computer cleaners.

#### **What is the action in the body?**

- Enters the bloodstream quickly via the sense of smell and through the skin
- Sense of smell is very powerful
  - We have about 40 million olfactory receptor cells.
  - So many receptors causes a rapid absorption of inhalants
  - The fumes are distributed throughout the brain and body.
- Especially damaging to myelin
  - Fatty tissue that insulates and protects axons
  - Helps speed up nerve conduction.
  - Inhalants are particularly attracted to fatty tissues.
  - Myelin is a fat and quickly absorbs inhalants
  - Myelin is damaged or even destroyed
  - Can cause axons themselves degenerate

#### **What are the effects?**

Give off mind-altering chemical fumes when sniffed.

Direct effects on both the:

Brain and spinal cord (central nervous system)

Nerves all over the body (peripheral nervous system)

Very, very hazardous to your health

Serious damage to the body

Some effects are temporary and disappear after use is stopped.

Vaporous fumes can

- Change brain chemistry
- May permanently damage the brain and central nervous system.
- Cause hepatitis, liver failure, and muscle weakness
- Alter how the nervous system works

Some cause serious and possibly permanent neurological problems

- Creates abnormalities in brain areas
- Cerebellum areas that control movement
- Cerebral cortex for thinking

Death is a very serious risk also

Sudden Sniffing Death (SSD):

- Inhaled fumes take the place of oxygen in the lungs and central nervous system.
- Causes suffocation.

Other causes of death

- Cardiac arrest from disruption of the normal heart rhythm,
- Decreases production of all types of blood cells

**How do we know about these effects?**

- Brain-imaging techniques, such as magnetic resonance imaging (MRI)
- Marked structural changes in the brains of chronic inhalant abusers can be seen
- Able to see how certain brain areas (including the cerebral cortex, cerebellum, and brainstem) are actually smaller

**Websites to Check Out for Addition Information**

**National Institute on Drug Abuse**

**Inhalants-**

[http://teens.drugabuse.gov/mom/mom\\_inhal.asp](http://teens.drugabuse.gov/mom/mom_inhal.asp)

**KidsHealth.Org**

Articles available on Drugs, Marijuana, and Inhalants

<http://www.kidshealth.org/kid/grow/drugs>