



# Letter to Teachers

## Dear Teacher,

We are pleased to bring you this beautiful and thought-provoking poster as part of this year's "Heads Up: Real News About Drugs and Your Body" program. "Heads Up" is a science-based drug education program, now in its second year, created by Scholastic in partnership with the scientists of the National Institute on Drug Abuse (NIDA).

We are especially excited about this year's poster because it incorporates the original artwork and slogan of a student who probably has much in common with the young people in your own classroom: Ania Lisa Etienne, a 13-year-old eighth-grader from Brooklyn, New York. Ania submitted the winning poster design to our "Heads Up" national poster contest last year. The contest judges, including an editor and an art director from Scholastic, a science teacher, and a scientist from NIDA, felt that of the thousands of poster concepts submitted, Ania's offered the most powerful combination of words and image to convey a sense of the dangers posed by drugs to a young person's life.

We hope you find the poster to be a useful jumping-off point for discussion and ongoing education about drugs of abuse. To help you, we've provided six reproducible pages on the back of the poster. These pages, which provide background information and activities on how drugs affect the brain and body, may be used independently or as a supplement to the "Heads Up" articles appearing in your Scholastic classroom magazine. For more information and teaching support, including online versions of all past articles in the "Heads Up" program, please visit our Web site, [www.scholastic.com/HEADSUP](http://www.scholastic.com/HEADSUP).

Every young person today is faced with choices about drugs. We believe that educating students about how drugs can affect their brains, their bodies, and their lives will empower them to make informed decisions against using drugs. We hope you agree, and that you find these materials useful.

—The Editors

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**A note about our poster:** Ania Lisa Etienne created her poster as an eighth-grade student in Valerie Louzanis's art class at Mark Twain Intermediate School 239 in Brooklyn, New York. "Each student prepared a slogan and then artwork," says Louzanis. "We took a very personal approach to the campaign." Ania won a \$500 savings bond and a trip to New York City. To see the entries of the 25 runners up, go to [www.scholastic.com/HEADSUP](http://www.scholastic.com/HEADSUP)





# For Teachers Only

## TEACHING WITH THE POSTER

The reproducible pages provided here are designed to touch on all the potential effects of drug abuse named on the front of the poster, i.e., “addiction, memory loss, heart failure, organ damage, or death.” In reading the background information and completing the activities, students will come to understand the basic mechanisms of addiction as well as how substance abuse is potentially harmful to both brain and body.

Before having your students work on the skills pages, use the front of the poster as a starting point for a discussion about drug abuse. You may want to ask, for example:

- What do you think the slogan “You Can’t Sniff Away Your Sorrows” means? For what reasons do people abuse drugs?
- What do you think the cracked mirror, with its distorted image of the girl, suggests?
- What does it mean to be addicted to a drug?

## RESOURCES

For more information, go to . . .

>> [www.scholastic.com/HEADSUP](http://www.scholastic.com/HEADSUP)

- close-ups on common drugs of abuse
- pop-up diagrams exploring the brain and the effects of drugs on the body
- teaching support, including printable skills pages

>> [www.drugabuse.gov](http://www.drugabuse.gov)

- the latest scientific information on drug abuse and addiction from the National Institute on Drug Abuse (NIDA)
- fact sheets, statistics and links to special sites on marijuana, steroids, and club drugs

>> [www.BacktoSchool.drugabuse.gov](http://www.BacktoSchool.drugabuse.gov)

- NIDA’s new site for science-based information on drugs of abuse, designed for teachers and students in all grades—and for parents, too.

>> [www.sarasquest.org](http://www.sarasquest.org)

- NIDA’s middle-school curriculum, including an on-line magazine and a comprehensive teacher’s guide.

## ANSWER KEY

### Page 4: Path to a Healthy Future

The correct path through the maze passes through these seven statements about normal brain function:

1. Brain cells or neurons send messages.
2. Chemicals called neurotransmitters carry messages between neurons.
3. Neurotransmitters fit into receptors in the receiving neuron.
4. The brain’s limbic system creates feelings of pleasure after a good meal.
5. Dopamine carries messages of pleasure when you hear your favorite song.
6. The brain’s limbic system creates an appetite for food and good company.
7. Neurotransmitters cross synapses between neurons.

The following statements also describe normal brain function, but they lead to “false paths” in the maze:

8. When a neuron receives a neurotransmitter, it starts an electrical impulse.
9. When you learn a new dance step, shoot a three pointer, or land a skateboard move, you smile.

**Bonus answer:** There are nine ovals in all with statements about normal brain function.

### Page 5: Drugs Change Your Brain

Fill-in-the-blank answers:

- |              |           |              |
|--------------|-----------|--------------|
| 1. shrink    | 5. pain   | 8. craving   |
| 2. stroke    | 6. memory | 9. strategy  |
| 3. breathing | 7. skills | 10. planning |
| 4. myelin    |           |              |

**Bonus answer:** Learn a new skill.

### Page 6: Cause and Effect

*Marijuana:* short-term memory loss; hippocampus

*MDMA:* damage to language and planning skills; cerebral cortex

*Heroin:* slowed breathing; brain stem

*Inhalants:* muscle spasms; myelin sheath on neurons

*Cocaine:* high blood pressure; brain blood supply

### Page 7: Stop Toxic Effects

1. muscle;
2. bones;
3. lungs;
4. lungs, heart;
5. liver;
6. heart;
7. kidneys;
8. heart

### Page 8: Remember Your Brain

*Across:* 1. synapse      4. receptor      6. dopamine  
7. stem      9. neuron

*Down:* 1. stroke      2. neurotransmitter  
3. hippocampus      5. limbic      8. cortex

**Bonus answer:** Ace a test!



# Messed-Up Messages

Addiction and your brain

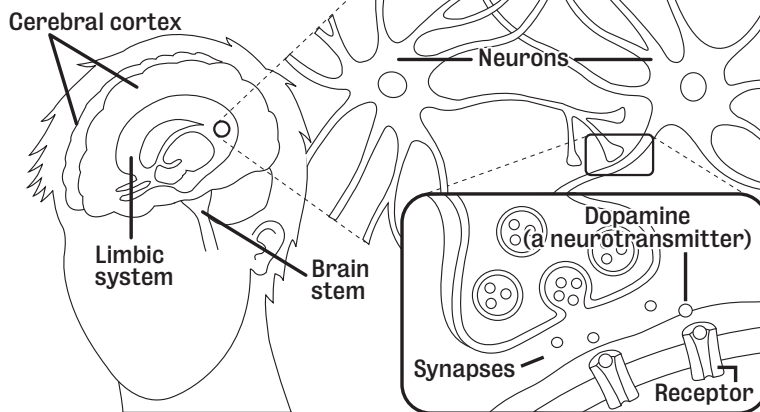
Imagine wanting something more than you long for cold drink on a hot day. Or more than you want to hang with your buddies after a big test. Now, imagine that the thing you desired was expensive, could cause bad breath, pimples, muscle shakes, and even death. Still want it? Some people do. That's how badly people addicted to drugs crave them.

To find out why, you have to look inside the human brain. Drugs change the way your brain works.

To send messages in the brain, your brain cells or **neurons** release chemicals called **neurotransmitters**. Neurons are separated by tiny gaps called **synapses**. The neurotransmitters from one neuron move across the synapse and lock into spaces called **receptors** on other neurons. This starts an electrical impulse in the receiving neuron, which then releases its own neurotransmitter. When you see a friend, recognize her face, remember her name and say, "Hello," you are responding to a series of messages delivered by neurotransmitters.

There are many different neurotransmitters in the brain. The chemical **dopamine**, for example, acts on the brain's **limbic system**. That's where feelings and emotions are processed. Normally, when you eat good food, meet a challenge, or enjoy the company of other people, you feel

## In Your Brain



**Brain cells, or neurons, send messages to other brain cells by releasing chemicals called neurotransmitters. The chemicals fit into receptors, then are released into the gap, or synapse, between neurons and reabsorbed.**

pleasure because your limbic system releases dopamine. Your brain rewards you with pleasure and creates an appetite for those things because they are necessary for life.

Many drugs of abuse invade and manipulate the limbic system, the brain's pleasure pathway. Drugs can do this because, once in the brain, they act similarly to neurotransmitters. Some drugs, such as methamphetamine, cocaine, and even nicotine to a lesser degree, may cause a flood of dopamine. The brain then creates a drive for more drug. An addicted person's drug cravings are so strong that he or she will risk serious consequences to satisfy them.

To make matters worse, drug use

causes changes in the brain. Neurons sense the dopamine flood. In response, they may shut down some dopamine receptors. Or they may produce less dopamine. Now the drug user has lower than normal levels of dopamine, which may cause depression. He or she needs drugs just to feel normal—and needs more and more to produce that dopamine flood or drug "high."

This is why addicted people want drugs, even when they know the drugs are damaging their bodies, emptying their wallets, or replacing their friends. To recover from this brain disease, they must retrain their brains. This requires hard work and often medical and mental-health treatment.

### KNOW YOUR BRAIN GLOSSARY, PART ONE

**Dopamine:** A chemical messenger or neurotransmitter released by neurons in the limbic system

**Limbic System:** The part of the human brain that creates feelings of pleasure when we eat, accomplish things, or enjoy the company of others

**Neurons:** Brain or nerve cells. There are more than 10 billion neurons in the human brain!

**Neurotransmitters:** The chemical messengers in the brain that carry messages between neurons

**Receptors:** Specialized proteins on the ends of neurons into which neurotransmitters fit

**Synapses:** The tiny gaps between neurons

*For more brain terms, see "Drugs Change Your Brain," p. 5.*

# HEADS UP REAL NEWS ABOUT DRUGS AND YOUR BODY



## Path to a Healthy Future

The right choices keep your brain at its best.

After reading “Messed-Up Messages,” complete the maze by following the statements that describe how the brain functions normally without drugs. If you come to a statement describing how the brain functions on drugs, stop and go back—this is a “wall” in the maze. The correct path will take you through seven ovals containing statements about normal brain function. Caution: Some ovals about normal brain function may lead to false paths.

**BONUS** How many ovals in all contain statements about normal brain function?



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# HEADS UP REAL NEWS ABOUT DRUGS AND YOUR BODY



## Drugs Change Your Brain

Drug abusers may alter their brains forever.

Drugs of abuse change the way an abuser's brain works. Some of those changes might last for minutes. But other changes may be permanent. Brain cells may be killed or damaged. Damaged neuron fibers may grow back, but not exactly as they were. An abuser's brain may never be the same—or function exactly the same way—again. Check out what drugs can do to the brain, then fill in the blanks in the box below.

**Brain shrinkage:** Inhalants can kill so many brain cells that the brain actually shrinks! Memories and skills begin to disappear. Learning new things becomes more difficult.

**Memory loss:** Marijuana, inhalants, and ecstasy change neurons in the **hippocampus**, damaging short-term memory. Phone numbers are hard to remember; directions and even conversations may become difficult to follow.

**Interrupted thinking:** MDMA (ecstasy) can destroy brain cells in the **cerebral cortex**, the center of thinking used in math, language, planning, and game strategies.

**Increased pressure:** Cocaine may boost the pressure of blood flowing through the brain until blood vessels explode. Then, brain cells can't receive oxygen from blood and die. This "brain attack" is called a **stroke**.

**Slowed breathing:** Heroin acts on the **brain stem** to slow breathing—sometimes so much that the user stops breathing and dies. Heroin also blocks pain messages from the body so they can't reach the brain.

**Craving:** Drugs such as nicotine, cocaine, and methamphetamine retrain the brain to crave drugs. To a drug abuser, the good things in life—food, the company of others, achievements—no longer feel as pleasurable.

**Impaired movement:** Inhalants can damage or destroy **myelin**, a coating on neurons that helps messages travel quickly from brain to body. Muscle spasms, tremors, or permanent movement difficulties may result.

### KNOW YOUR BRAIN GLOSSARY, PART TWO

**Brain stem:** The base of the brain, in charge of breathing, heart rate, and digestion—things you don't think about.

**Cerebral cortex:** The thinking part of the brain, which you use when you speak, plan, do math, and create strategies.

**Hippocampus:** The part of the brain's limbic system where short-term memories are formed and stored.

### FILL IN THE BLANK

1. The brain may \_\_\_\_\_ [ \_ ] when inhalants kill cells.
2. Cocaine abusers risk damage to their brains from \_\_\_\_\_ [ \_ ] \_\_\_\_\_ because the drug boosts blood pressure.
3. Heroin acts on the brain stem, slowing the user's \_\_\_\_\_ [ \_ ] \_\_\_\_\_.
4. Inhalants can damage \_\_\_\_\_ [ \_ ] \_\_\_\_\_, a protective coating on neuron fibers, resulting in tremors or spasms.
5. Heroin users may feel little \_\_\_\_\_ [ \_ ] if they injure themselves.
6. Marijuana changes the brain's hippocampus, the seat of short-term \_\_\_\_\_ [ \_ ] \_\_\_\_\_.
7. Memories and \_\_\_\_\_ [ \_ ] \_\_\_\_\_ disappear when inhalants kill brain cells.
8. Drug addicts have a \_\_\_\_\_ [ \_ ] \_\_\_\_\_ for drugs, not food or fun with other people.
9. To think of a game [ \_ ] \_\_\_\_\_, you use your cerebral cortex.
10. MDMA (ecstasy) users may have problems \_\_\_\_\_ [ \_ ] \_\_\_\_\_ their own birthday party!

**BONUS** Unscramble the bracketed letters from above.

*If you do this, you can actually boost your brainpower!*

\_\_\_\_\_ a new \_\_\_\_\_

**Myelin:** A fatty coating on the fibers of neurons that helps messages travel quickly along neurons in the brain.

**Stroke:** A "brain attack" caused by burst blood vessels in the brain. Without a flow of blood and oxygen, brain cells die.

*For a brain diagram and more brain terms, see "Messed-Up Messages," p. 3.*

# HEADS UP REAL NEWS ABOUT DRUGS AND YOUR BODY



## Cause and Effect

How drugs change the brain

Drugs of abuse cause changes in the brain that affect the way the drug user thinks and feels. Remember, some of these brain changes may last forever! The human brain may make new connections around damaged portions, but once killed, brain cells are gone forever.

After reading "Drugs Change Your Brain," pick up a pencil and draw a line connecting each drug, below, to the effect it has on the brain. Then, in the blank beside each effect, write the part of the brain that's affected. Choose your answer from the box at the bottom of the page.

DRUG/CAUSES	EFFECTS	BRAIN PART
Marijuana	damage to language and planning skills	
MDMA (ecstasy)	high blood pressure	
Heroin	muscle spasms	
Inhalants	slowed breathing	
Cocaine	short-term memory loss	

### BRAIN PART word choices:

Hippocampus  
Brain stem

Brain blood supply  
Cerebral cortex

Myelin sheath on neurons

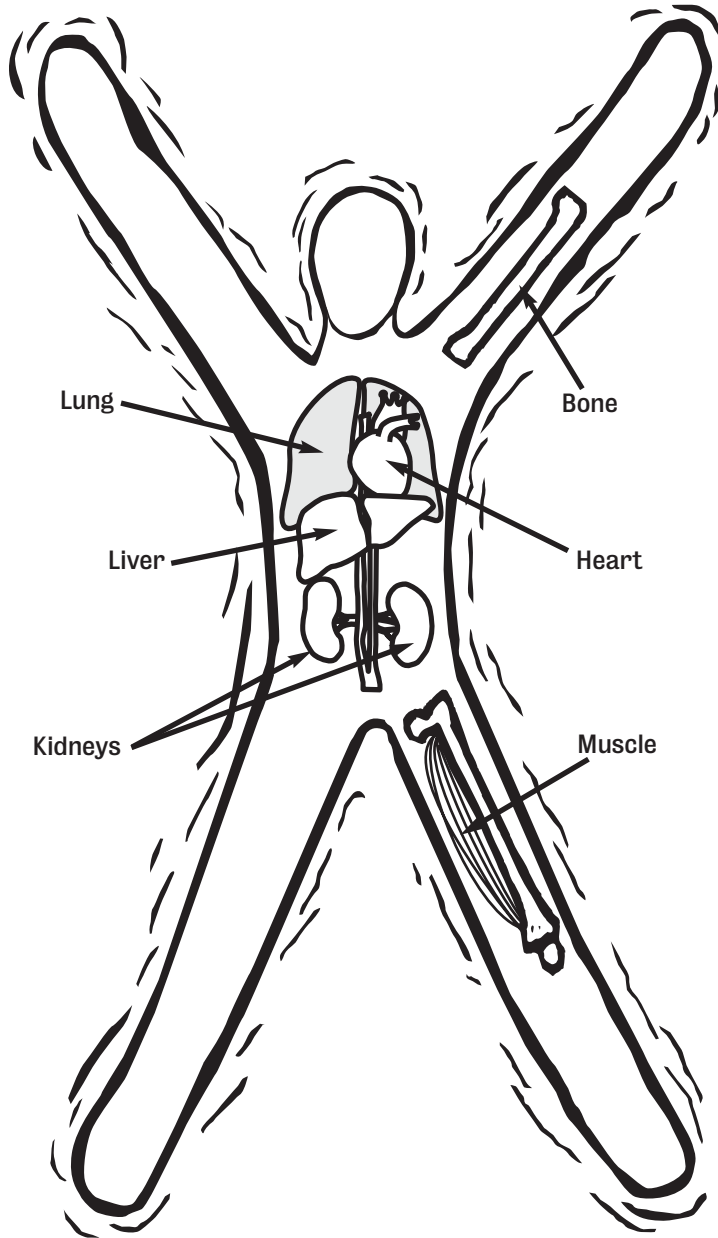
# HEADS UP REAL NEWS ABOUT DRUGS AND YOUR BODY



## Stop Toxic Effects

Make the connections.

Drug users crave drugs of abuse because of the way drugs work in the brain. But these drugs are toxic to the human body, too. Read about some of the ways that drugs of abuse affect the body. Then pick up a pencil and connect each effect, from the list on the right, to the relevant body part on the diagram, at left.



1

Inhalants may cause arms and legs to tremble uncontrollably. This is because inhalants may destroy the protective coating, called myelin, on nerve cells. Because they can't receive messages normally, muscles shake.

2

With steroid use, bone growth may stop—no matter how old the user! This is because the fake hormones signal the brain that the abuser has reached adulthood. Steroid abusers may never reach their adult height.

3

Marijuana and cigarette smokers pull sticky tar into their lungs with every puff. Tar coats the delicate air sacs in the lungs. The results can include coughing, mucous, shortness of breath, emphysema, and cancer.

4

When the chemical fumes from inhalants replace the oxygen in the lungs, suffocation and death can result. Prolonged use of inhalants can also cause irregular and rapid heart rhythms and lead to heart failure and death.

5

Poisons from steroids can collect in the liver. Blood-filled cysts may result. If the cysts burst, dangerous internal bleeding is the result.

6

The carbon monoxide in cigarette smoke weakens the heart, leaving the smoker at risk for heart attack.

7

On MDMA (ecstasy), the body can't control its own temperature. Abusers risk kidney failure—and death—when they run out of sweat and become dehydrated.

8

Cocaine and other stimulants (amphetamines, methamphetamines) can cause heart failure and death. This is because they constrict blood vessels, reducing the flow of blood and oxygen to the heart.

# HEADS UP REAL NEWS ABOUT DRUGS AND YOUR BODY



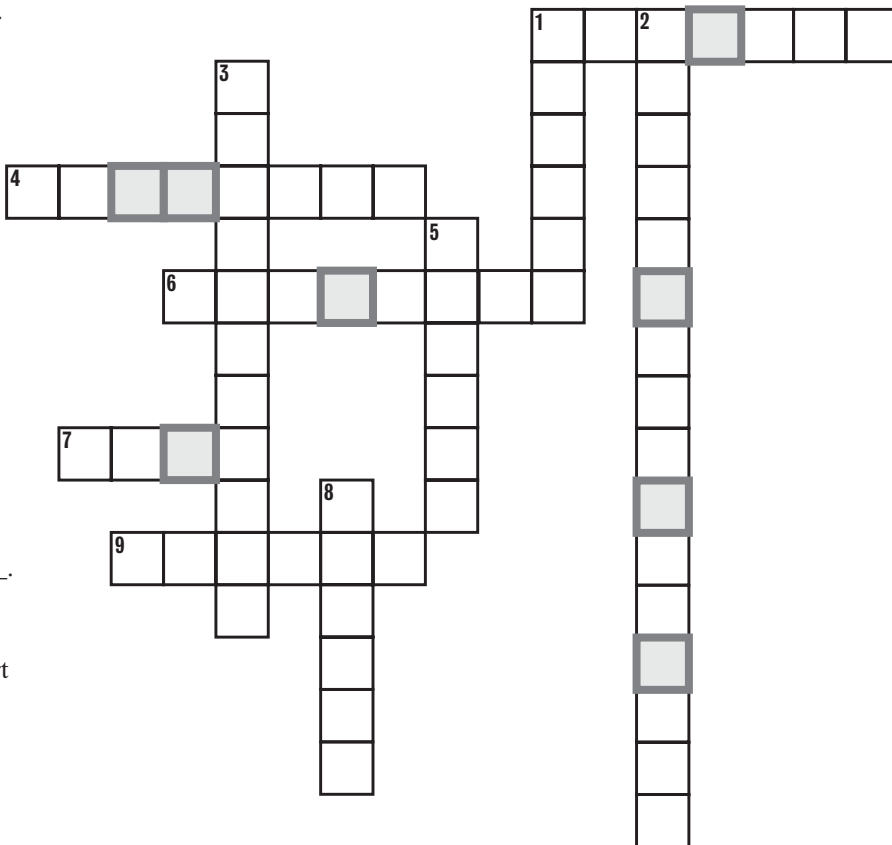
## Remember Your Brain

A crossword challenge

Do you remember how your brain works? Chemical messages are sent from one brain cell to another. These messages spark memories, feelings, and thoughts. Drugs of abuse change the way the brain sends and receives messages. Test *your* brain. Review the “Know Your Brain” glossary boxes on “Mixed-Up Messages” and “Drugs Change Your Brain.” Read the clues. Then fill in the words in the crossword blanks.

### ACROSS

- 1 The tiny gap between two brain cells.
- 4 The receiving part of a brain cell.
- 6 The brain chemical used to send messages about feeling good.
- 7 The brain \_\_\_\_\_ is in charge of breathing and heart rate.
- 9 Another word for brain cell.



### DOWN

- 1 Cocaine use can cause high blood pressure, causing blood vessels in the brain to burst, resulting in a \_\_\_\_\_.
- 2 Chemical messenger in the brain.
- 3 The part of the brain that stores short term memories.
- 5 The \_\_\_\_\_ system is in charge of pleasure.
- 8 The cerebral \_\_\_\_\_ is responsible for language and math.

### BONUS

After completing the crossword, use the letters in the shaded boxes—moving from top to bottom, left to right—to fill in the blanks below.

Treat your brain right and you'll be able to do this. Your accomplishment will make the dopamine flow. You'll feel great!

\_\_\_\_\_ !