Drugs and the Teen Brain

Adolescence is a critical time in brain development. That means teens are at greater risk of experiencing the harmful effects of drugs and alcohol.

BY THE TIME YOU ARE A TEENAGER, many parts of your brain have developed so much that you may be able to perform complicated calculations and even have a sharper memory than some adults (like how you might be able to memorize your home’s random 11-character Wi-Fi password—while your parents never can!).

But one critical part won’t be developed until your mid-twenties—putting teens at a higher risk for the harmful effects of drugs and alcohol.

Under Construction

The key brain part that’s still developing is the prefrontal cortex and it’s the area you use in critical thinking, such as when you weigh pros and cons before making a decision.

Because the prefrontal cortex is not yet fully developed, teens automatically rely more on the limbic system to make decisions. This system’s network of brain structures is linked to emotions and experiencing rewards rather than critical thinking.

Because their prefrontal cortex is in development, teens are more likely to make decisions based on what provides instant gratification, such as a feeling of happiness. This focus can lead them to take more risks than adults. For example, your peers might pressure you to do something you later regret, such as pulling a prank that lands you in trouble. Rather than thinking carefully about the negative outcomes, the teen brain focuses more on getting the reward of your friends’ acceptance.

Of course, taking chances isn’t always a bad thing—it helps you grow into an adult and become independent. But not thinking through consequences can be dangerous when it comes to decisions related to drugs and alcohol.

That’s one reason teens are more likely than adults to binge drink. Binge drinking is when someone consumes four to five alcoholic drinks within a few hours. Teens may be less able than adults to judge when to stop drinking (remember: underdeveloped prefrontal cortex!).

The scary part? Studies have shown that even a few sessions of binge drinking can cause harmful changes to a developing brain.

Addiction Risk

Teens are also at a higher risk of developing the disease of addiction. Scientists believe that addiction is closely linked to dopamine, a chemical that helps transmit signals in the brain. A person taking drugs causes a surge of dopamine in the brain.

Any rewarding activity, such as enjoying a slice of pizza, causes a dopamine release. But the surge is much higher and more intense with drugs. Over time, repeated drug use can “teach” the brain to seek the substances over other, healthier rewards. That is addiction.

Teens have a higher risk of addiction because their limbic systems are very sensitive to dopamine. As a result, they may crave drugs more strongly than adults. The earlier someone starts drug use, the higher his or her addiction risk.
Because the brain’s prefrontal cortex (the part in charge of critical thinking) is not yet fully developed in teens, they rely more on the limbic system (which is tied to rewards and emotions) to make decisions.

**Brain Changes**

As you grow and learn, your body strengthens pathways between neurons (nerve cells) in the brain and gets rid of ones that aren’t used. These connections, called synapses, determine how your brain processes information. The network of synapses is what supports everything from your memory to your ability to learn and feel emotions.

Exposing the teen brain to drugs can change how these pathways are organized and how the brain functions. The negative impact of drug use can cause problems with attention, memory, and problem solving that can last all the way through adulthood.

The good news is that by thinking through your actions now, you can have a positive impact on your brain for the rest of your life. Taking on challenges to build abilities and skills—such as learning a new sports move or picking up a foreign language—helps build new connections that make your brain stronger and better able to tackle future tasks. If you are good to your brain, it will be good to you.

**GET MORE**

For additional facts about science and your health, visit [scholastic.com/headsup](http://scholastic.com/headsup) and [teens.drugabuse.gov](http://teens.drugabuse.gov).

From Scholastic and the scientists of the National Institute on Drug Abuse, National Institutes of Health, U.S. Department of Health and Human Services.
Drugs and the Teen Brain

As a teacher, you know that teens are at a critical time of development. The brain doesn’t become fully developed until the mid-20s. This fact makes teens especially susceptible to the harmful effects of drugs and alcohol, putting them at a greater risk for addiction as well as damage to the brain. By sharing the article “Drugs and the Teen Brain” and teaching this lesson, you will help students learn how their brain develops and why using drugs and alcohol is especially risky.

Critical-Thinking Questions

1. Describe how your brain changes as you grow. How can these changes affect your behavior or abilities? Answers may include that as you grow older, you develop and refine synapses (connections between neurons). These signal pathways allow you to learn, and they support your memory and emotions. Parts of the brain develop at different times. Specific regions of the brain are responsible for tasks such as movement, emotions, and critical thinking. As each region matures, it strengthens a person’s abilities in the tasks related to that region.

2. Explain the purpose of the prefrontal cortex and the limbic system in the brain. Give examples of types of behavior or activities that are controlled by each of these areas. The prefrontal cortex is the area of the brain that is involved in critical thinking and decision making. This area may be active when someone weighs the pros and cons of a decision, tries to solve a problem, or plans for the future. The limbic system is involved in emotions and rewards. This area is active when a certain activity makes you feel sad or happy, such as spending time with friends.

3. Why are teens more at risk for becoming addicted to drugs than adults? Support your answer with text evidence. Answers may include that because the critical-thinking area of their brains is still developing, teens rely on the limbic system (involved in rewards and emotions) to make decisions. This may cause teens to make risky decisions that give immediate rewards. Teens’ limbic systems are also more sensitive to dopamine, which may cause them to crave drugs more than adults.

Writing Prompts

Grades 6–8 Explain how the prefrontal cortex helps to reduce risk-taking.

Grades 9–10 The legal drinking age is 21. Do you agree with this policy? Cite text evidence to support your answer.

Grades 11–12 Parts of the teen brain are not yet fully developed. Explain why this can be harmful but also beneficial.

Paired Reading

“Addiction Is a Disease” (https://teens.drugabuse.gov/blog/post/addiction-disease)
This article describes how drugs can cause brain changes that lead to addiction.

Writing Prompt Cite text evidence from the article “Addiction Is a Disease” to describe additional ways that drug addiction harms the brain. Also explain why addiction is considered a disease.

Activity Sheet Answers

Multiple choice 1. c; 2. b; 3. d; 4. False; 5. b; 6. True; 7. a; 8. True.

“Now Try This” 1. Answers may include that because the critical-thinking area of their brains is still developing, teens rely on the limbic system (involved in rewards and emotions) to make decisions. This may cause teens to make risky decisions that give immediate rewards. Teens’ limbic systems are also more sensitive to dopamine, which may cause them to crave drugs more than adults.

2. Answers may include that the teen brain is still in development, so exposure to drugs can negatively affect a teen’s neural pathways. Positive experiences, like learning a skill, help the brain build new connections.

Subject Areas

- Science Literacy
- English Language Arts
- Health/Life Skills

Standards

CCSS
- RST.6-8.1 / RST.9-10.1
  - Cite specific textual evidence to support analysis of science and technical texts

W.6-8.1 / W.9-10.1
- Write arguments to support claims using valid reasoning and relevant and sufficient evidence

NGSS
- MS-L1.A / HS-L1.A
  - Structure and function
- MS-L1.D / HS-L1.D
  - Information processing

NGSS Practices
- Obtaining, evaluating, and communicating information/engaging in argument from evidence

NSES
- Personal Health
- Science and technology in society/science and technology in local, national, and global challenges

NCSS
- 8. Science, technology, and society

Additional Lesson Resources

- Vocabulary List: scholastic.com/headsup/drugsandtheteenbrain
- headsup.scholastic.com/teachers
- teens.drugabuse.gov

NIH National Institute on Drug Abuse
What Do You Know About the Teen Brain and Drugs?

Answer these questions to test your knowledge.

1. The brains of teenagers are:
   a. larger than those of adults
   b. the same as adult brains
   c. not yet fully developed
   d. made up of different parts than those of adults

2. The limbic system of the brain is involved mainly with:
   a. decision making
   b. emotions
   c. problem solving
   d. balance

3. The last part of the brain to fully develop is:
   a. the emotion center
   b. the part of the brain that controls automatic behavior like breathing
   c. the reward center
   d. the part of the brain involved in critical thinking

4. Teen brains are less sensitive to the effects of drugs than those of adults.
   ○ True
   ○ False

5. Which of the following statements is NOT true about the brain’s prefrontal cortex?
   a. It helps people to weigh the risks of actions.
   b. It develops fully during childhood.
   c. It is used when adults need to make decisions.
   d. It can be damaged by drug use.

6. Drug use can cause changes to the brain.
   ○ True
   ○ False

7. Dopamine is:
   a. a natural chemical in the brain linked to pleasurable feelings
   b. a chemical found in drugs that affects the brain
   c. the region of the brain involved in emotions
   d. a natural chemical in the brain that decreases risk-taking

8. The number of connections between neurons in your brain can be affected by drug use.
   ○ True
   ○ False

NOW TRY THIS

Answer the following questions on a separate piece of paper after reading “Drugs and the Teen Brain.”

1. What is the importance of the limbic system in the teen brain? Describe two ways this system can make teens more vulnerable to drugs.

2. Explain why a person’s actions during their teen years can have a permanent impact on their life. Use evidence about brain development to support your answer.
Dear Teacher,

The vocabulary list on the following pages is drawn from the “Drugs and the Teen Brain” student article and the “What Do You Know About the Teen Brain and Drugs?” worksheet.

It can be previewed with students prior to reading or reinforced with students afterward. Encourage students to incorporate these words into their discussions and writing about the student article and worksheet.

The list integrates vocabulary words that would be used across several content areas, such as consequence, independent, and transmit, as well as domain-specific words, such as limbic system, neuron, and synapse.

Some suggestions for students to help their understanding include:

- organizing concept maps that include word parts, synonyms, antonyms, and examples;
- composing memory aids that explain the words or use them in a meaningful context;
- employing the words to create newspaper articles, stories, or poems.

Sources: Unless otherwise noted, definitions below are sourced or adapted from:

 Merriam-Webster Collegiate Dictionary
 Scholastic Children’s Dictionary

Supplement for: “Drugs and the Teen Brain”
- Student Article: scholastic.com/hheadsup/drugsandtheteenbrain
- Teacher’s Guide (includes work sheet): scholastic.com/hheadsup/teachers/drugsandtheteenbrain

Continue to vocabulary sheet on next page.
addiction (noun): a brain disorder or illness associated with compulsive (uncontrollable) behavior, such as drug use, despite negative consequences

adolescence (noun): the period of life when a person develops from a child into an adult

automatic (adjective): working mostly or completely by itself

binge (noun): the act of doing something in an excessive or uncontrolled manner

chemical (noun): a substance, such as an element or a mix of elements (compound), that is made by a chemical process

consequence (noun): a result or outcome

consume (verb): to eat, drink, or use up something

crave (verb): to have a strong desire for something

critical (adjective): important or necessary

develop (verb): to grow or cause something to grow larger or more advanced

development (noun): the act or process of growing or causing something to become larger or more advanced

dopamine (noun): a neurotransmitter chemical that helps transmit signals in the brain and is associated with feelings of pleasure

expose (verb): to make something accessible (open) to the action or influence of something else

function (verb): to carry out an action

gratification (noun): a reward or the feeling of pleasure or being rewarded

impact (noun): a significant or powerful effect

independent (adjective): not relying on or needing others for support or care

intense (adjective): having a very strong or extreme degree of something

key (adjective): extremely important

limbic system (noun): a set of five different brain structures that together are involved in emotions and feelings, as well as learning and memory

linked (adjective): connected

network (noun): a group of things that are connected or related to each other

neuron (noun): a nerve cell that carries messages between the brain and other parts of the body

outcome (noun): a result

prefrontal cortex (noun): the front part of the frontal lobe area of the brain that is involved in complex decision making and thinking

process (verb): to go through a series of actions to lead a certain result

release (verb): to allow out; to set free

risk (noun): the possibility of loss or injury; danger

seek (verb): to look for or to go in search for

sensitive (adjective): to be highly responsive or able to be affected by something

session (noun): a period of time set aside for a certain activity

substance (noun): a material with a specific chemical makeup

surge (noun): a sudden increase to a high level

synapse (noun): the structure between neurons (nerve cells) that allows a signal to be transmitted between the neurons

tackle (verb): to deal with or handle a situation

transmit (verb): to send from one person, place, or thing to another

underdeveloped (adjective): not normally or fully developed

vulnerable (adjective): able to be hurt or damaged

weigh (verb): to think about something carefully in order to make a decision