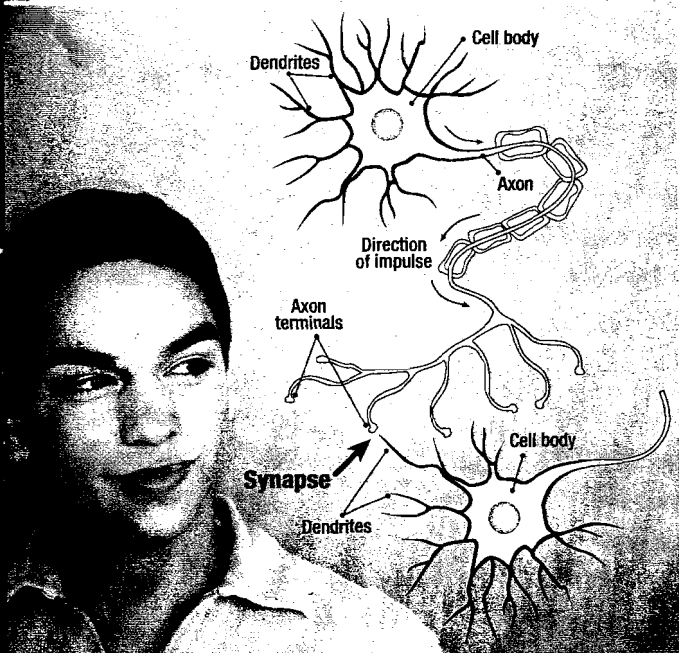


DID YOU KNOW?

While the limbic system continues to mature through a person's early twenties, the prefrontal cortex, located directly behind your forehead, is an important control center for thinking ahead and sizing up risks and rewards.

The Science of Teen Decision Making



continue to mature through a person's early twenties.

One part that matures late is the **prefrontal cortex**, located directly behind your forehead. It is important as a control center for thinking ahead and sizing up risks and rewards.

Meanwhile, a part of the brain that matures earlier is the **limbic system**, which plays a role in emotional responses. Since this system matures earlier, it is more likely to take control in teen decision making. When teens make choices in emotionally charged situations, those choices often have more to do with *feelings* (the mature limbic system) than with *logic* (the not-yet-mature prefrontal cortex). The result? Teens are more likely than adults to make impulsive, emotional decisions—rather than carefully considered, logical choices.

Learning how your brain works can help explain why you sometimes behave the way you do. With this knowledge, you can be better equipped to make smart choices.

Pick Your Brain: After reading the information above answer the following questions:

Teenagers thrive on the spur of the moment. Whether it's jumping into the latest fad, rushing into a decision, or acting before thinking something through, teens are known for taking "risks." Science now provides answers on how the teen brain is particularly "wired" to do so.

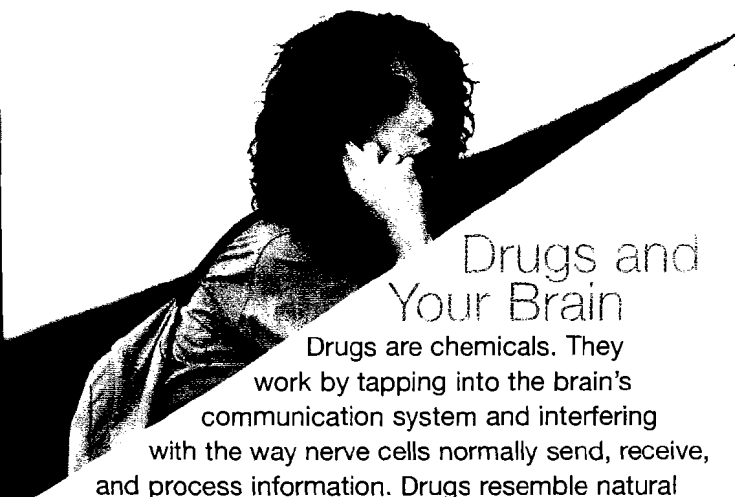
First, a bit on how the brain works. The brain has a relay system in which different cells, called **neurons**, talk with each other by way of electrochemical impulses and chemical messengers, called **neurotransmitters**. Information flows through this system across small gaps called **synapses**. The signal originates in the cell body, travels down the **axon**, crosses the synapse to affect the **dendrites** on the neighboring cell. The ultimate outcome of this signaling system is a feeling or a thought or a behavior.

Research shows that one's brain reaches its full size between ages twelve and fourteen (depending on whether you are a girl or a boy). However, it also shows that a teen's brain development is not yet complete. Parts of the brain

1. Brain cells, called _____, talk with each other through electrochemical impulses and chemical messengers called _____.
2. The _____ cortex, located directly behind your forehead, is an important _____ center for thinking ahead and sizing up risks and rewards.
3. One's brain reaches its full size between ages _____.
4. Parts of the brain continue to mature through a person's _____.
5. The brain's _____ system plays a role in _____ responses.

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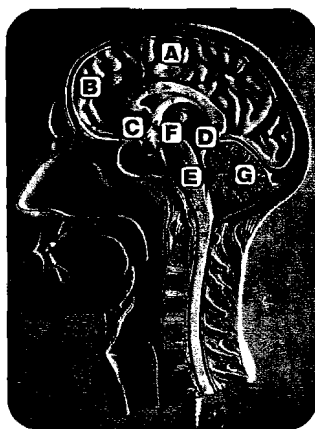




Drugs and Your Brain

Drugs are chemicals. They work by tapping into the brain's communication system and interfering with the way nerve cells normally send, receive, and process information. Drugs resemble natural neurotransmitters, a similarity in structure that "fools" receptors in the brain and allows the drugs to lock onto and activate the nerve cells.

Here's how it works with two commonly abused drugs: marijuana and prescription painkillers. In marijuana, the principal chemical affecting the brain is called THC (or tetrahydrocannabinol) and it attaches to specific receptors called cannabinoid receptors. Prescription painkillers, such as OxyContin® and Vicodin®, are derived from opium in poppy plants and are called opioids. In the brain and body, opioids attach to special proteins called opioid receptors.



- A CEREBRAL CORTEX:** This "thinking center" rules comprehension, self-control, and concentration.
- B PREFRONTAL CORTEX:** Responsible for logic, helps you make decisions and understand long-term consequences.
- C AMYGDALA:** Determines emotional reactions, especially involving excitement or

fear. The amygdala is part of the **limbic system**, a set of interconnected structures, including the hippocampus and the hypothalamus, that works in concert to process emotional information.

- D HIPPOCAMPUS:** The brain's center for memory and certain types of learning.
- E BRAIN STEM:** Controls automatic functions like breathing, sensitivity to pain, level of alertness; relays messages to the cerebrum and back down to the spinal cord.
- F HYPOTHALAMUS:** Controls body temperature, hunger, and thirst; affects appetite and sleep.
- G CEREBELLUM:** Provides coordination, balance, and precise timing for movements.

DID YOU KNOW?

The brain is made up of billions of cells and changes shape as you learn and experience things.

When used as directed by a physician, opioids are designed to ease pain by causing the body to release certain neurotransmitters such as dopamine. But when opioids are abused, there can be serious health risks, including overdose and death.

Both THC and opioids can adversely affect many areas of the brain, impairing a wide range of abilities. In the cerebral cortex, these chemicals dull senses and distort thinking, perception, and judgment; in the cerebellum, they distort coordination, as well as balance and time perception; and in the limbic system, they can alter the brain's wiring for pleasurable experiences.

Additionally, THC affects the hippocampus, causing problems with short-term memory and attention; the hypothalamus, increasing hunger; and the prefrontal cortex, affecting decisions and promoting risk-taking. Opioids affect the brain stem, slowing breathing and heart rate.

Pick Your Brain: After reading the information above, answer the following questions:

1. Opioids can adversely affect a person's breathing. What part of the brain governs respiration and breathing?
 - A Brain stem
 - B Limbic system
 - C Hippocampus
 - D Cerebellum
2. Tetrahydrocannabinol (THC), the active ingredient in marijuana, acts on the brain by:
 - A surrounding the brain
 - B creating electrical charges
 - C binding to specific receptors
 - D reducing blood flow
3. THC can affect the hypothalamus by making someone feel:
 - A angry
 - B hungry
 - C alone
 - D none of the above
4. The cerebral cortex is also known as the:
 - A thinking center
 - B memory and learning center
 - C body regulation center
 - D reward center
5. What part of the brain determines emotional reactions, especially involving excitement or fear?
 - A Brain stem
 - B Hypothalamus
 - C Prefrontal cortex
 - D Amygdala

DID YOU KNOW?

Some of the most common mental health problems occur after prolonged use of drugs.

Drugs and Your Body

Drugs not only affect your brain, they can seriously damage your body. Cardiovascular disease, stroke, cancer, hepatitis, and lung disease can all be consequences of drug abuse. In addition, intravenous drug use can raise the risk of contracting HIV/AIDS. Some of these effects occur when drugs are used at high doses or after prolonged use; however, **impairment** may occur after just one use. Here's what some specific drugs can do to the body:

PRESCRIPTION PAINKILLERS such as oxycodone (OxyContin®) and hydrocodone (Vicodin®) slow breathing and can lead to life-threatening respiratory depression when not used under a doctor's supervision. There is also a high risk of **addiction** and overdose.

INHALANTS are breathable chemical vapors that are often found in common household products, and can produce a state of intoxication similar to alcohol. They are extremely toxic to the brain and other major organs and have been associated with a syndrome called "sudden sniffing death" which results from heart failure and/or suffocation or asphyxiation.

METHAMPHETAMINE or **METH** is a highly addictive central nervous system stimulant that causes rapid heart rate, irregular heartbeat, and increased blood pressure. It also damages kidneys, lungs, and liver, and can cause psychotic behavior, hallucinations, and stroke.

ECSTASY or **MDMA** is a drug that is chemically similar to stimulants and hallucinogens and can make a person feel energized and generate a sense of well-being. It can also interfere with the body's ability to regulate temperature, leading to hyperthermia (increased body temperature) which can cause heart and kidney failure. MDMA can also impair memory and generate **depression** for several days after taking it.

COCAINE is a central nervous system stimulant that causes constricted blood vessels, as well as increased body temperature, heart rate, and blood pressure. It also increases the risk of heart attacks, respiratory failure, strokes, and seizures.

Vocabulary

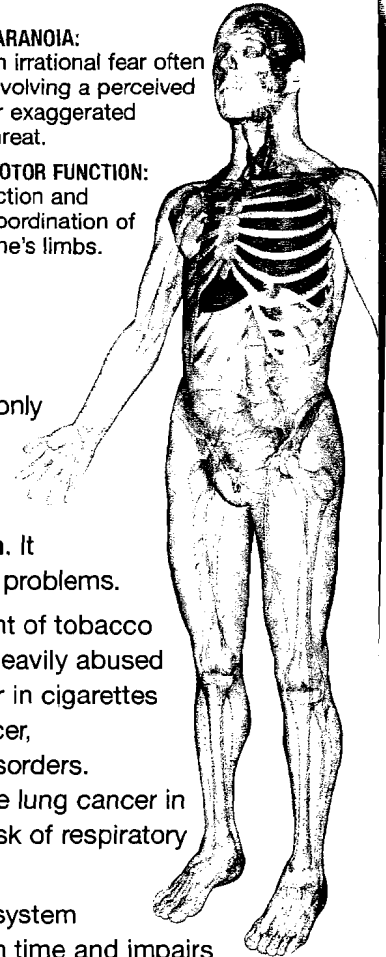
ADDICTION:
a chronic, relapsing brain disease characterized by compulsive drug seeking and use despite harmful consequences.

IMPAIRMENT:
diminished ability to think or function.

DEPRESSION:
a condition of general emotional dejection and withdrawal.

PARANOIA:
an irrational fear often involving a perceived or exaggerated threat.

MOTOR FUNCTION:
action and coordination of one's limbs.



MARIJUANA is the most commonly used illegal drug in the United States. It affects judgment, memory, learning and motor skills, and can cause **paranoia**. It increases the risk of breathing problems.

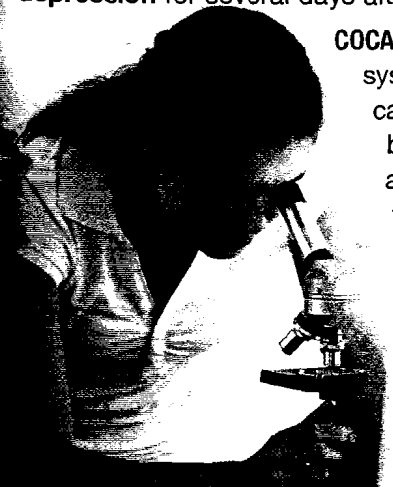
NICOTINE, the addictive element of tobacco products, is one of the most heavily abused drugs in the United States. Tar in cigarettes increases the risk of lung cancer, emphysema, and bronchial disorders. Secondhand smoke can cause lung cancer in adults and an increased the risk of respiratory illness in children.

ALCOHOL is a central nervous system depressant that slows reaction time and impairs complex mental and **motor functions**. It can cause long-term liver failure, cancer, and brain damage. Drinking during pregnancy may result in fetal alcohol syndrome and other abnormalities.

True or False:

- The diminished ability to think or function as a result of drug use can only occur at high doses or after prolonged use.
(A) True (B) False
- If a person drinks alcohol, his or her reaction time will be improved.
(A) True (B) False
- Taking prescription painkillers without a doctor's supervision can result in a high risk of addiction and overdose.
(A) True (B) False

Images: illustration, © 3D4Medical.com/Getty Images; photo, © Alloy/Veer.



Peer Influence

"The teen brain is wired differently from an adult brain when it comes to making decisions," says Dr. Laurence Steinberg, a researcher at Temple University. How? He notes two main differences: First, teens are drawn to the immediate rewards of a potential choice while being less attentive to the possible risks. And, second, they are still learning to control their impulses, to think ahead, and to mediate the influence of others.

Peer influence is not necessarily a bad thing. Everyone is influenced by peers, both negatively and positively, at any age. As teens become more independent of their parents, peers naturally play a greater role in influencing their thoughts, feelings, and actions. But sometimes, especially in emotional situations, peer influence can be hard to resist. It can become "pressure," and a person may feel forced to do something he or she is uncomfortable with.

According to Dr. B. J. Casey from the Weill Medical College of Cornell University, teens do exercise good judgment and make thoughtful decisions when given time to think things through. But when decisions have to be made in the heat of the moment or in social situations, teens are often influenced by peers and find it harder to suppress impulsive or risky behaviors.

Learning how to pause in critical situations is an important part of decision making. Pausing can give teens a better chance to evaluate the facts before making a rushed decision.

In evaluating risky situations, the following questions can be helpful for teens to consider before acting:

- ▶ What are the possible consequences?
- ▶ What are the short-term benefits (such as the feeling of fitting in) versus the possible harmful outcomes (to yourself or others)?
- ▶ How could peer pressure be influencing your decision?
- ▶ Where can you turn for additional information or advice, if you need it?

Imagine This: Using facts you've learned, review the scenarios below and write a paragraph describing how you might respond to each one.

1. As you're leaving school on Friday, a friend invites you to a party. He says it's going to be a blast because his parents are away and some friends are bringing a keg. He asks, "So, are you going to come?"
2. Your friends arrive to pick you up for a concert. They're laughing hysterically as the car pulls up, and you notice some empty beer cans in the front seat. You hesitate as the door swings open, but your friends shout, "Come on, get in!"
3. A friend has started smoking cigarettes. You don't want to smoke, but she keeps pushing you. "You should have one," she says, "It's no big deal. Just take a puff off mine."
4. You're at a party and somebody offers you a Vicodin®, saying "Don't worry, it's legal. Besides, look at all the celebrities who are doing it."

DID YOU KNOW? When making decisions in the heat of the moment or in social situations, teens are often influenced by peers and find it harder to control their behavior.



What Do You Know About Drugs and Your Body?

True or False:

- The teen brain is "wired" to take risks.
 (A) True (B) False
- In the teen brain, the prefrontal cortex is important as a control center for thinking ahead and sizing up risks and rewards.
 (A) True (B) False
- A teen's limbic system develops earlier than the prefrontal cortex.
 (A) True (B) False
- A teen's brain development is complete by the age of fourteen.
 (A) True (B) False
- Learning how to pause in critical situations is an important part of decision making.
 (A) True (B) False



Photo © Fancy/Veer.

Multiple Choice:

- The space separating two brain cells is called:
 (A) a protein (B) a synapse (C) a lock
- Once inside the brain, drugs of abuse can "fool" the brain because they appear similar in shape and size to:
 (A) neurons (B) synapses (C) neurotransmitters
- What is the brain's memory center?
 (A) hippocampus (B) hypothalamus (C) cerebral cortex
- What brain region is responsible for emotional reactions, especially involving pleasure or excitement?
 (A) brain stem (B) prefrontal cortex (C) limbic system

Fill in the Blanks:

- The brain has a _____ in which different structures talk with each other by way of electrochemical impulses and chemical messengers, called _____.
- When teens make choices in emotionally charged situations, those choices often have more to do with _____ than with _____.
- Drugs are _____. They work in the brain by _____ with the way nerve cells normally send, receive, and process information.
- The impact of _____ can be far-reaching. Some of the effects occur when drugs are used at high doses or after prolonged use, however some may occur _____.