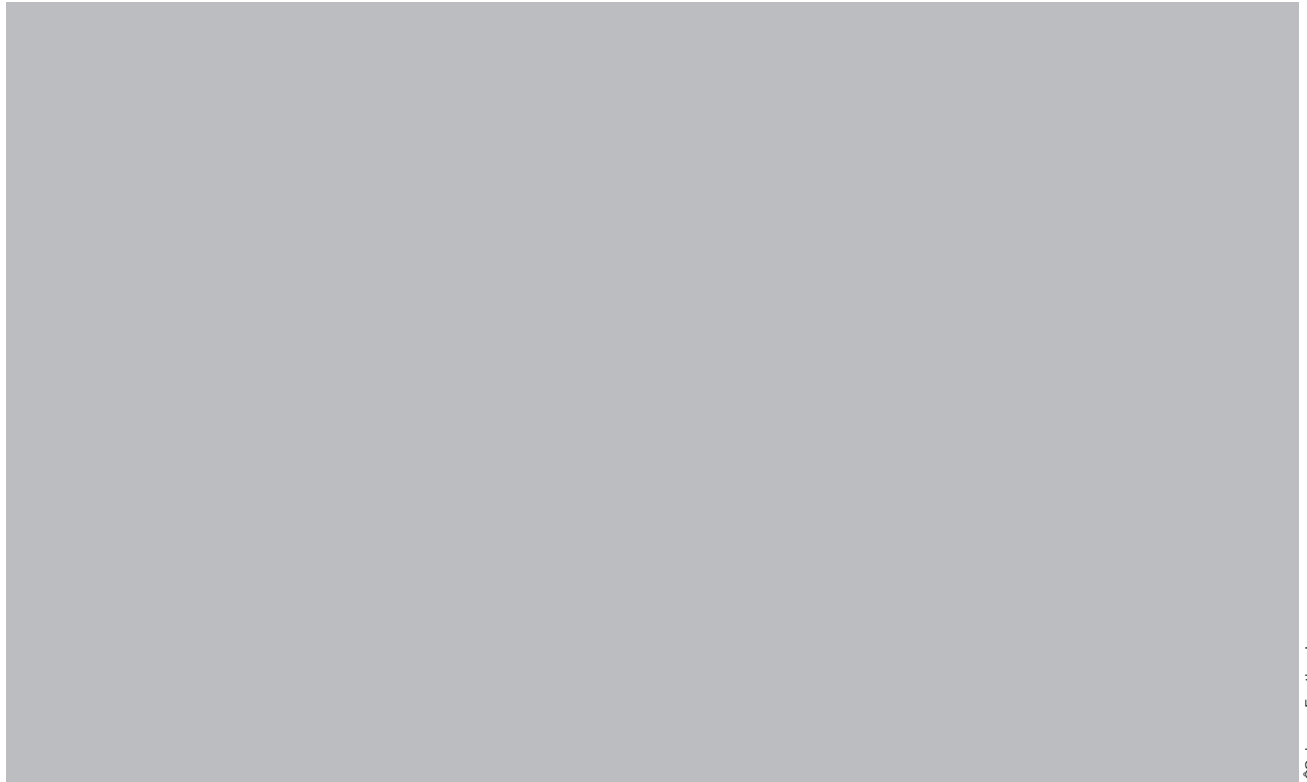


# Heads Up: Real News About Drugs and Your Body








©Science Faction Images

## Welcome to Heads Up

Brought to you by Scholastic and the scientists at the National Institute on Drug Abuse, **Heads Up** gives you the facts about the real effects of drugs on the teen brain and body.

Check out the articles and features inside to get the latest news so you can make informed choices about your health and your future.

## Inside This Compilation:

-  **The Science of Addiction**  
Page 2
-  **The Deadly Effects of Tobacco Addiction**  
Page 8
-  **Stress and Drug Abuse**  
Page 14
-  **Get the Facts: Drug Abuse Puts Your Whole Body at Risk**  
Page 18
-  Plus additional supplements to each article

For more real news about drugs and your body, visit  
[www.scholastic.com/headsup](http://www.scholastic.com/headsup) or  
<http://teens.drugabuse.gov>.

To order additional copies of this Heads Up Student Edition at no charge, call 800-729-6686 and refer to NCADI HURN07-05SC.

# The Science

## What Brain Research Tells

### Vicodin and OxyContin

#### Legal but Dangerous

Addiction can occur with many drugs, not just street drugs like heroin. Painkilling drugs such as Vicodin and OxyContin may seem safe because they are available by prescription, but many teens don't realize that they are also very addictive if not used as directed by a physician. This is not surprising, since the active ingredient in OxyContin acts at the same site in the brain as heroin.

The case of Jacob [name changed] puts the dangers of prescription painkillers in focus. Jacob began using OxyContin at 18, and before long was selling pills to help support his habit. (Selling prescription drugs makes you a drug dealer and subject to criminal prosecution.) Eventually Jacob moved from OxyContin to heroin. "I never touched OxyContin, I wouldn't have done heroin," he claims. Luckily, Jacob eventually faced his addiction and entered a drug treatment program.

### The impact of addiction can be far-reaching:

- Cardiovascular disease
- Stroke
- Cancer
- HIV/AIDS
- Hepatitis C
- Lung disease
- Obesity
- Mental disorders

### How serious is drug addiction?

According to the National Institute on Drug Abuse (NIDA), *drug addiction* is a chronic, relapsing disease, characterized by compulsive drug seeking and use, and by neurochemical and molecular changes in the brain. Like other chronic diseases, drug addiction can seriously impair the functioning of the body's organs. It can also increase the risk of contracting other diseases, such as HIV and viral hepatitis, not just among those who inject drugs, but also through risky behaviors stemming from drug-impaired judgment.

Drug addiction often results from *drug abuse*, which is the use of illegal drugs or the inappropriate use of legal drugs to produce pleasure, to alleviate stress, or to alter or avoid reality (or all three). Risk factors for addiction

#### AN INDIVIDUAL'S RISK AND PROTECTIVE FACTORS FOR DRUG ADDICTION

Risk Factors	Influencers	Protective Factors
Early Aggressive Behavior	Self	Self-Control
Lack of Parental Supervision	Family	Parental Monitoring
Substance Abuse	Peers	Academic Competence
Drug Availability	School	Anti-Drug Use Policies
Poverty	Community	Strong Neighborhood Attachment

and protective factors against it (see table below) can be environmental as well as genetic. Scientists estimate that genetic factors, including environmental effects on these genes, account for between 40 and 60 percent of a person's vulnerability to addiction. Recent research has begun to uncover which genes make a person more vulnerable, which genes protect a person against addiction, and how one's genes and environment interact. There is also evidence that individuals with mental disorders have a much greater risk of drug abuse and addiction than the general population.

*In the past 30 years, advances in science have revolutionized our understanding of drug abuse and drug addiction. Drug addiction is a brain disease.*

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

#### How Drugs Change a Healthy Brain

Normal      Cocaine Abuser (10 days of abstinence)      Cocaine Abuser (100 days of abstinence)

Cocaine abuse can cause changes in the brain. The PET (positron emission tomography) scans above show a normal brain, the brain of an abuser who hasn't taken cocaine in 10 days, and the brain of an abuser who hasn't taken cocaine in 100 days. Even after 100 days without the drug, the activity (yellow) in the cocaine abusers' brains is still much less than in the normal brain.

# of Addiction

## Us About Drug Addiction

### What Is Addiction?

**Addiction is a complex disease.** No single factor can predict who will become addicted to drugs. Addiction is influenced by a tangle of factors involving one's genes, environment, and age of first use.

**Addiction is a developmental disease.** It usually begins in adolescence, even childhood, when the brain is continuing to undergo changes. The prefrontal cortex located just behind the forehead governs judgment and decision-making functions and is the last part of the brain to develop. This fact may help explain why teens are prone to risk-taking, and why they are also particularly vulnerable to drug abuse. It also explains why exposure to drugs during the teen years may affect the likelihood of someone becoming an addict in the future.

**Prevention and early intervention work best in the teen years.** Because the teen brain is still developing, it may be more receptive to interventions to alter the course of addiction. Research has shown many risk factors that lead to drug abuse and addiction: mental illness, physical or sexual abuse, aggressive behavior, academic problems, poor social skills, and poor parent-child relations. This knowledge, combined with better understanding of how the teen brain works, can be applied to prevent drug abuse from starting or to intervene early to stop it when warning signs emerge.

### LATEST Research

#### The Science of Dread

New research shows that people who substantially dread an adverse experience have a different biology than those who better tolerate the experience.

Dr. Gregory Berns of Emory University School of Medicine and his colleagues used MRI

imaging to observe brain activity patterns in non-drug abusers who were awaiting brief electrical shocks (the adverse experience).

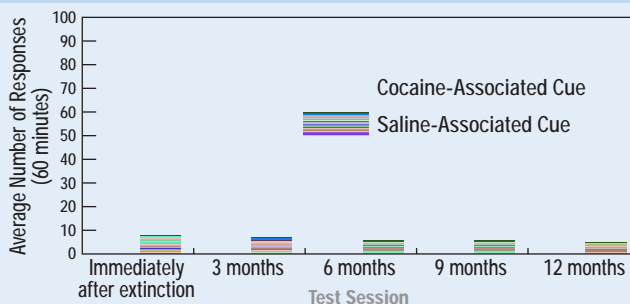
The subjects were given the option of a larger shock to occur in a shorter period of time, or a smaller shock after a longer period of time. The

scientists noted two groups:

**Extreme dreaders** who could not tolerate a delay and preferred an immediate (and stronger) painful stimulus; and **mild dreaders** who could tolerate a delay for a milder shock. The findings suggest that dread derives, in part, from attention and is not simply a fear or anxiety reaction.

Continuing to use drugs despite expecting a bad outcome is a hallmark of addiction. The results of this study form the foundation for future research to determine whether drug abusers exhibit disruption in the brain systems that process dread—the anticipation of unpleasant consequences.

### One-Time Drug Use Can Set Stage for Relapse



In this experiment, rats pressed a lever in response to a cue (white noise) that had originally indicated access to cocaine even a year after the cue stopped being associated with drug availability. This is because there is a very strong association in the brain between the drug experience and the setting of the drug experience. Even a long-dormant craving may be triggered simply by encountering people, places, and things that were present during a previous drug usage. Another reason never to use drugs of abuse even once.

### Prevention Resources

**NIDA and other organizations have spearheaded a number of programs to help prevent addiction, including:**

- Family-based:** Teaching parents better communication skills, appropriate discipline styles, and firm and consistent rule enforcement
- School-based:** Building young people's skills in the areas of peer relationships, self-control, coping, and drug-refusal
- Community-based:** Working with civic, religious, law enforcement, and government organizations to strengthen anti-drug norms and pro-social behaviors

**For more information on effective prevention programs, visit:** [www.nida.nih.gov/drugpages/prevention.html](http://www.nida.nih.gov/drugpages/prevention.html).

**For help with a drug problem, call the National Addiction Treatment Hotline at 1-800-662-HELP or go to** [www.findtreatment.samhsa.gov](http://www.findtreatment.samhsa.gov).

**For more information on healthy effects of drugs and on effective prevention and treatment approaches based on addiction research, visit NIDA at** [www.drugabuse.gov](http://www.drugabuse.gov) and [www.teens.drugabuse.gov](http://www.teens.drugabuse.gov).

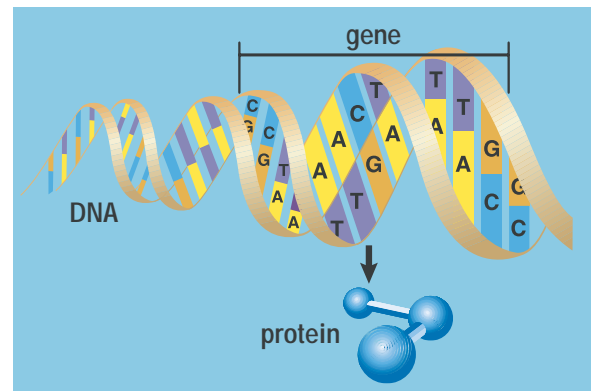
# The Role of Genes in Drug Addiction

The disease known as **drug addiction** shares many features with other chronic illnesses, one of which is *heritability*, meaning a tendency to run in families. Scientists are now studying how **genes** can play a role in making a person vulnerable to drug addiction, or in protecting a person against drug addiction.

While the **environment** a person grows up in, along with a person's behavior, influences whether he or she becomes addicted to drugs, **genetics** plays a key role as well. Scientists estimate that genetic factors account for 40 to 60 percent of a person's vulnerability to addiction.

The National Institute on Drug Abuse (NIDA) is currently supporting a major research effort to identify gene variations that make a person vulnerable to drug addiction. This effort involves studying **DNA (deoxyribonucleic acid)**, which directs the development of every human cell (Figure 1). By mapping DNA sequences in drug addicts, scientists have been able to isolate gene sequences that indicate a greater risk of becoming addicted to drugs. These gene sequences contain the instructions for producing specific **proteins**, which perform most of a body's life functions. The way these proteins function, or don't function, can indicate how vulnerable a person is to drug addiction (Figure 2).

A major finding about the genetics of drug addiction was reported in 2004 by investigators at the Howard Hughes Medical Institute at Duke University Medical Center. The researchers were able to identify a specific protein, **PSD-95**, that had a relationship both to drug addiction and to



**Figure 1. DNA: The Molecule of Life**

A cell is the fundamental working unit of any living organism. All the instructions needed for a cell to carry out its activities are contained in the cell's **DNA (deoxyribonucleic acid)**. These instructions are spelled out by the side-by-side arrangement of bases along a strand of DNA (for example, ATTCCGGA). The specific sequences are known as **genes**, which contain the coded instructions on how to make **proteins**. All living organisms are composed largely of proteins, which perform most of a body's life functions.

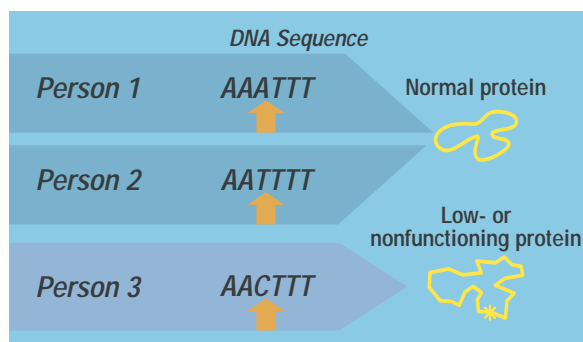
Art adapted from: U.S. Department of Energy Human Genome Program, [www.ornl.gov/hgmlis](http://www.ornl.gov/hgmlis).

learning and memory. Mice that had low levels of PSD-95 took longer to learn their way around a maze, and also were much more sensitive to cocaine. The researchers concluded that mice with normal amounts of PSD-95 were more likely to learn their way around the maze and less likely to become addicted to cocaine. Because cocaine leads to sharp increases in the neurotransmitter **dopamine**, which is responsible for feelings of pleasure, or the high that drug users crave, PSD-95 likely is involved in other types of addiction. According to Marc G. Caron, Ph.D., an investigator who was part of the research team, PSD-95 likely plays a role in addiction to other drugs, including

nicotine, alcohol, morphine, and heroin because they all exert effects through dopamine.

Another important research breakthrough in 2004 was reported by a team led by Dr. Paul Greengard, a Nobel Prize-winning neurobiologist and NIDA-funded researcher at Rockefeller University in New York City. Dr. Greengard's team found that almost every known drug of abuse, including cocaine, opiates, and amphetamines, works through a brain protein known as **DARPP-32**. DARPP-32 is involved as a go-between in the actions of virtually all neurotransmitters (chemical brain messengers) in all parts of the brain. When DARPP-32 was removed from the brains of mice, the mice no longer responded to drugs of abuse.

Research into the role of genes in drug addiction has shown that natural variations in proteins, which are encoded by a person's genes, can lead to differences in how vulnerable that person is to drugs of abuse. Continued study of genetic factors in drug addiction can provide new ways for understanding the disease of drug addiction, and can lead to new therapies for preventing and treating it.



**Figure 2. Health or Disease?**

Some variations in a cell's DNA have no negative effect and create normal-functioning proteins (Persons 1 and 2). Other variations (Person 3) can lead to low- or nonfunctioning proteins, which in turn can lead to a particular disease, or to being vulnerable to disease. By studying gene variations in the DNA of a person addicted to drugs, scientists are looking to isolate gene sequences that indicate a person's vulnerability to addiction.

Art adapted from: U.S. Department of Energy Human Genome Program, [www.ornl.gov/hgmis](http://www.ornl.gov/hgmis).

## SOURCES

1. Drug Addiction, Learning Share Common Brain Protein, Duke University press release. Accessed at [www.dukemednews.org/news/article.php?id=7415](http://www.dukemednews.org/news/article.php?id=7415).

2. Greengard, Paul. Signal Integration in the Brain, NIDA Science Meeting Summaries and Special Reports. Accessed at [www.drugabuse.gov/whatsnew/meetings/apa/signalintegration.html](http://www.drugabuse.gov/whatsnew/meetings/apa/signalintegration.html).

3. Research Report Series Cocaine Abuse and Addiction, NIDA Research Reports. Accessed at [www.nida.nih.gov/ResearchReports/Cocaine/cocaine3.html](http://www.nida.nih.gov/ResearchReports/Cocaine/cocaine3.html).



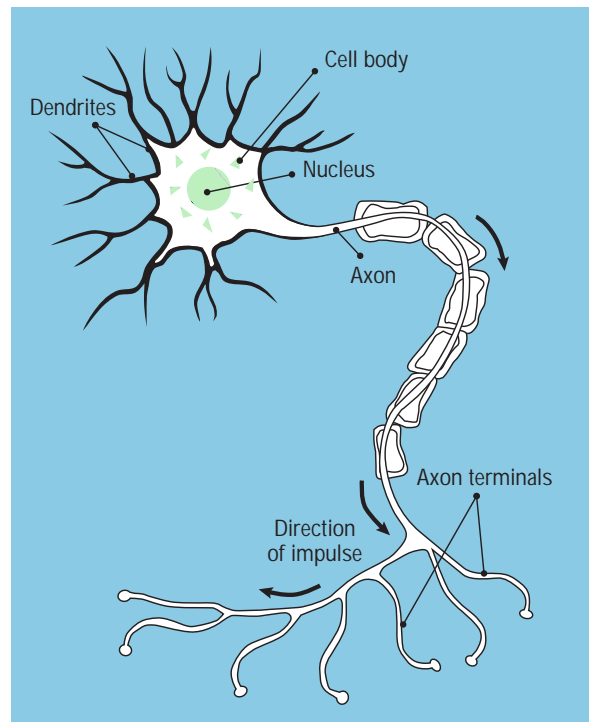
# The Science of Opioid Addiction

**O**pioids such as Vicodin and OxyContin are medications often prescribed because of their pain-relieving properties. Used as prescribed by a doctor, these drugs can safely change the way a person experiences pain. Opioids work by attaching to specific proteins called opioid *receptors* that are found in the brain, spinal cord, and gastrointestinal tract. Opioids relieve pain by triggering excess flow of certain neurotransmitters such as *dopamine*. Yet, when opioids are abused, serious health risks, including overdose and death, can occur.

To understand opioid abuse, it's helpful to understand some fundamentals of how brain cells interact with each other. First, the brain is made up of billions of nerve cells, also known as **neurons** (Figure 1). Typically, a neuron contains three important parts: a central **cell body** that directs all activities of the neuron; **dendrites**, short fibers that receive messages from other neurons and relay them to the cell body; and an **axon**, a long single fiber that transmits messages from the cell body to the dendrites of other neurons or to body tissues, such as muscles.

The communication of a message from the axon of one nerve cell to the dendrites of another is known as **neurotransmission** (Figure 2). Communication between nerve cells occurs mainly through the release of chemical messengers into the space between an axon and a dendrite; this space is called a **synapse**. Molecules called **neurotransmitters** are released from the axon of one neuron to molecules called **receptors** in the dendrites of another neuron.

Opioids, as stated above, trigger excess flow of the neurotransmitter dopamine, which leads to the



**Figure 2. Neurons: Building Blocks of the Brain**

The brain is made up of billions of nerve cells, also known as **neurons**. Neurons communicate with other neurons through a process known as neurotransmission.

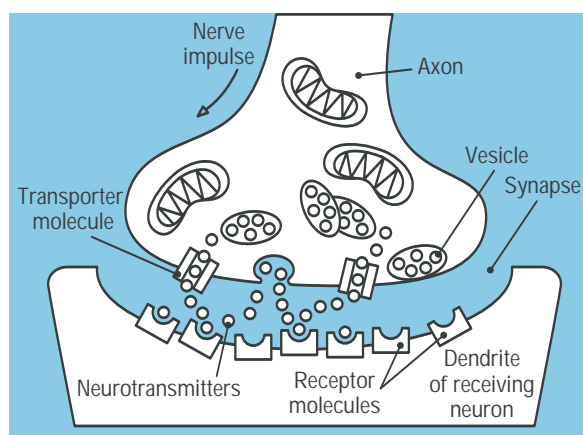
Art adapted from *NIDA for Teens, Nerve Cells and Neurotransmission*.  
[http://teens.drugabuse.gov/mom/tg\\_nerves.asp](http://teens.drugabuse.gov/mom/tg_nerves.asp)

relief of pain. When used as directed by a physician, opioids are designed to deliver pain relief little by little, over a 12-hour period. However, when abused, such as by crushing or chewing the pills, taking them with alcohol, or using them without a physician's prescription, opioids can flood the brain with dopamine and the risk of overdose becomes very great.

Abuse of an opioid can produce drowsiness, cause constipation, and, depending upon the

amount taken, depress breathing. Taking a large single dose can cause severe respiratory depression or death. Long-term use also can lead to *physical dependence*: The body adapts to the presence of the substance, and withdrawal symptoms occur if use is reduced abruptly. Long-term use can also result in *tolerance*, which means that higher doses of a medication must be taken to obtain the same initial effects.

Note that physical dependence is not the same as addiction. Physical dependence can occur even with appropriate long-term use of opioids and other medications. *Drug addiction* is defined as compulsive, often uncontrollable drug use in spite of negative consequences, and is the result of changes in brain function.



**Figure 2. Neurotransmission: How Neurons Communicate with Each Other**

The communication of a message from one nerve cell to another is known as **neurotransmission**. Opioids relieve pain by triggering excess flow of certain neurotransmitters such as dopamine. When opioids are not used exactly as prescribed, serious health risks and even death can occur.

Art adapted from *NIDA for Teens, Nerve Cells and Neurotransmission*.  
[http://teens.drugabuse.gov/mom/tg\\_nerves.asp](http://teens.drugabuse.gov/mom/tg_nerves.asp)

## SOURCES

- 1 NIDA for Teens, Nerve Cells and Neurotransmission. Accessed at [http://teens.drugabuse.gov/mom/tg\\_nerves.asp](http://teens.drugabuse.gov/mom/tg_nerves.asp).
- 2 NIDA for Teens, Opiates Mechanism of Action. Accessed at [http://teens.drugabuse.gov/mom/tg\\_opi2.asp](http://teens.drugabuse.gov/mom/tg_opi2.asp).
- 3 NIDA InfoFacts, Prescription Pain and Other Medications. Accessed at [www.drugabuse.gov/Infofacts/Painmed.html](http://www.drugabuse.gov/Infofacts/Painmed.html).

- 4 NIDA Notes, The Basics of Brain Imaging. Accessed at [www.nida.nih.gov/NIDA\\_Notes/NNVol11N5/Basics.html](http://www.nida.nih.gov/NIDA_Notes/NNVol11N5/Basics.html).
- 5 Swan, Neil, Brain Scans Open Window to View Cocaine Effects on the Brain. NIDA Notes, Volume 13, Number 2 (July, 1998). Accessed at [www.drugabuse.gov/NIDA\\_Notes/NNVol13N2/Brain.html](http://www.drugabuse.gov/NIDA_Notes/NNVol13N2/Brain.html).

# Teens and Tobacco

## The Facts

According to the Monitoring the Future Survey for 2005, cigarette smoking among students is at the lowest levels in the history of the survey. Since 1975 the survey has measured drug, alcohol, cigarette use, and related attitudes among students in 8th, 10th, and 12th grades nationwide. This decrease in use corresponds to a continuous increase in the number of teens who believe there are great health risks from cigarette smoking.

While this is good news, research suggests that teens who do use tobacco are more likely than adults to become addicted. Even occasional smoking can result in tobacco addiction in some teens. In animal research, investigators have shown adolescents to be more susceptible to the effects of nicotine than adults. (For more about teen health dangers, see **Latest Research** on the next page.)

## Addiction:

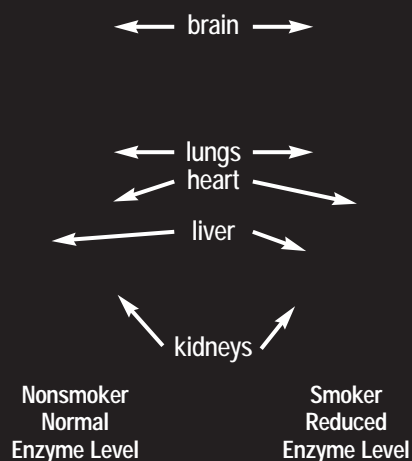
*A chronic disease characterized by compulsive drug seeking and abuse and by long-lasting chemical and molecular changes in the brain.*

**T**obacco is one of the most heavily used addictive products in the United States, according to the National Institute on Drug Abuse (NIDA). In 2004, 70.3 million people used tobacco at least once in the month before being interviewed. That is more than 25 percent of the U.S. population 12 and older.

**Nicotine** is the main ingredient in tobacco that causes addiction. Research shows that nicotine activates the parts of the brain that control feelings of pleasure. Nicotine works fast. Drug levels peak within 10 seconds of inhalation. (Cigar and pipe smokers and smokeless tobacco users absorb nicotine more slowly.) Within a few minutes, the effects of nicotine disappear. To keep feeling good, a smoker takes another puff or lights another cigarette.

Smoking harms every organ in the body. Cigarette smoking accounts for about one-third of all cancer deaths, including those from lung cancer. In fact, cigarette smoking has been linked to about 90 percent of all lung cancer cases. Research shows that smoking increases the risk of heart disease. Smokers harm others as well as themselves through secondhand smoke.

## Cigarette Smoking Affects Enzyme Levels Throughout the Body



These PET (positron emission tomography) scans show the concentration of an important enzyme, MAO B, in the internal organs of a smoker and a nonsmoker. MAO B plays a role in nerve cell communication and in the regulation of blood pressure. The nonsmoker's scan shows normal enzyme levels. (Red is the highest concentration.) The smoker's organs show lower concentrations of MAO B; in some organs, the enzyme is virtually absent.

*An improved overall understanding of addiction and of nicotine as an addictive drug has been instrumental in developing medications and behavioral treatments for tobacco addiction.*

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



# of Tobacco Addiction

## Secondhand Smoke: A Real Danger

Cigarette smoke contains thousands of dangerous chemicals that are unhealthy for both smokers and nonsmokers. **Secondhand smoke** refers to the smoke from the burning end of a cigarette and the smoke exhaled by smokers. More than 126 million Americans are regularly exposed to secondhand smoke at home, at work, and in enclosed public spaces.

### The Deadly Effects

Ⓢ Secondhand smoke can cause heart disease and lung cancer in nonsmoking adults. Breathing secondhand smoke for even a short time increases risk for those diseases.

Ⓢ Children and infants are especially vulnerable to the poisons in secondhand smoke. Almost 3 million children in the United States under the age of six breathe secondhand smoke at home at least four days per week.

Ⓢ Secondhand smoke is a known cause of sudden infant death syndrome (SIDS), respiratory problems, ear infections, and asthma attacks in infants and children.

Ⓢ Secondhand smoke in the home environment can slow the lung growth of exposed children. Older children whose parents smoke get bronchitis and pneumonia more often than the children of nonsmokers.

Ⓢ Wheezing and coughing are also more common in children who breathe secondhand smoke.

### Protecting Yourself and Others

The only way to fully protect yourself and loved ones from the dangerous chemicals in secondhand smoke is through 100 percent smoke-free environments. Opening a window; sitting in a separate area; or using ventilation, air conditioning, or a fan *cannot* eliminate secondhand smoke exposure. If you are a smoker, the single best way to protect your family is to quit smoking.

Even short exposure to secondhand smoke damages the lining of blood vessels and causes blood platelets to stick together. These changes can cause a deadly heart attack.

## Overcoming Tobacco Addiction

### Quitting Has Immediate Health Benefits

Within 24 hours of quitting, blood pressure goes down and chances of heart attack decrease. Long-term benefits of quitting include lower risk of stroke, lung and other cancers, and coronary heart disease.

### Treating Withdrawal from Nicotine

Ⓢ Nicotine withdrawal symptoms include irritability, craving, cognitive and attention deficits, sleep disturbances, and increased appetite.

Ⓢ To reduce the symptoms, nicotine replacementsⓈ gum, patches, sprays, and

inhalersⓈ are used. Another medication works on other areas of the brain to control craving.

Ⓢ Newer medications under study act on nicotine receptors directly. Studies show that medications have better long-term success when combined with behavioral treatment.

### More Information

- [smoking.drugabuse.gov](http://smoking.drugabuse.gov)
- [teens.drugabuse.gov](http://teens.drugabuse.gov)
- [cdc.gov/tobacco](http://cdc.gov/tobacco)
- [smokefree.gov](http://smokefree.gov)
- 1-800-QUITNOW

## LATEST Research

Addiction is a developmental disorder that begins in adolescence, and sometimes as early as childhood. Recent advances have provided more insight into why teens put themselves at risk for addiction through risk-taking and thrill-seeking behaviors. These behaviors are likely due to the fact that the part of the brain responsible for judgment, decision making, and control of emotional responsesⓈ the

**prefrontal cortex**Ⓢ the last area of the brain to mature. But there may be other factors.

Dr. James Belluzzi and colleagues have recently found that a chemical in tobacco smoke, **acetaldehyde**, may play a role in addicting adolescents to smoking.

In the study, adolescent laboratory rats increased their intake of nicotine when it was

combined with acetaldehyde. Adult rats did not.

All the rats were placed in cages where they could poke their noses through holes and receive either nicotine, saline, acetaldehyde, or a mixture of acetaldehyde and nicotine.

Over five days, with increasing frequency, the adolescent rats showed a preference for the acetaldehyde-nicotine

combination. The adult rats did not show any preference.

Ⓢ Our results show that acetaldehyde, at the same relative concentration found in cigarette smoke, dramatically increases the reinforcing properties of nicotineⓈ says Dr. Belluzzi. Ⓢ Furthermore, the effect is age-related, with adolescent animals far more sensitive than adultsⓈ

# The Science of Nicotine Addiction

The news made headlines in 2006: Smokers today get more nicotine from inhaling cigarette smoke than they did in 1998. The news is alarming because nicotine is the chemical in cigarette smoke that causes addiction to tobacco. The Massachusetts Department of Public Health (DPH) reported its discovery that the nicotine yield in cigarettes—meaning the amount of nicotine a smoker gets from a cigarette—had increased steadily between 1998 and 2004. The DPH used information provided by tobacco companies themselves. (Massachusetts is one of only three states in the country to require tobacco companies to report this information each year.)

One deadly consequence of more nicotine yield in cigarettes is that the average smoker will find it harder to quit. Not only is there more nicotine in cigarettes, but nicotine itself is a powerfully addictive drug. In the words of a NIDA-funded researcher, Dr. Daniel McGehee: It would be difficult to design a better drug [than nicotine] to promote addiction.

## Why Nicotine Is So Addictive

In investigating the addictive power of nicotine, NIDA-funded researchers at the University of Chicago found that nicotine's effect on the brain is doubly dangerous. It directly stimulates the feelings

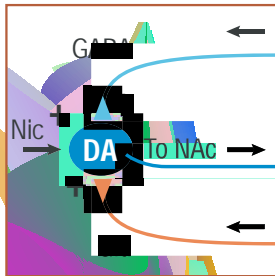
of pleasure and indirectly keeps those pleasurable feelings going strong.

Pleasure and desire drive the process of addiction. Nicotine, like other addictive drugs, attaches to the core neurons (impulse-conducting cells) of the brain's reward system. These neurons flood the brain with a neurotransmitter (a chemical messenger) called dopamine. Dopamine is the source of both feelings of pleasure and the desire to repeat behaviors that led to pleasure—in this case, smoking. But nicotine directly stimulates dopamine-producing neurons for only a few minutes at most.

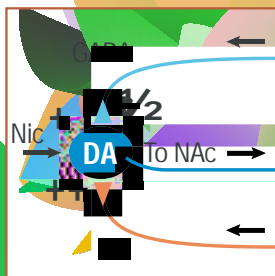
To explain why dopamine levels remain high after direct nicotine stimulus ends, researchers looked at two other neurotransmitters in the brain, glutamate and GABA. Glutamate is a neurotransmitter that speeds up the activity of neurons. GABA is a neurotransmitter that slows down neuron activity.

The researchers discovered that nicotine's effects on glutamate and GABA cause the pleasurable effects of nicotine to last longer. Nicotine causes glutamate to speed up dopamine release. Nicotine prevents GABA from slowing down dopamine release. The result is a high level of dopamine that lasts more than an hour.

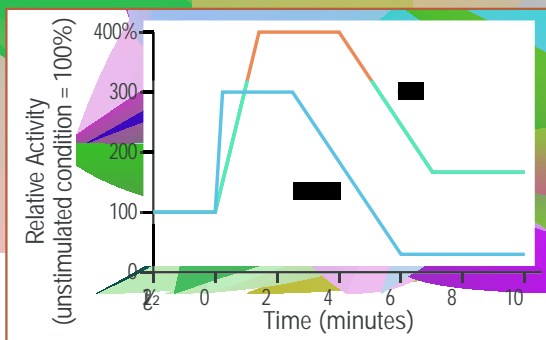
## Nicotine's Double Effect in the Brain



Inside the brain, **nicotine (Nic)** stimulates (+) the release of **dopamine (DA)** in the **nucleus accumbens (NAc)**. Nic also stimulates release of **glutamate (Glu)**, which triggers the release of more DA. **GABA** is released from another part of the brain to slow down DA's effect.



Minutes later, Glu is still stimulating release of DA (as shown by the ++ symbol), but GABA's slow-down effect is weakening (as shown by the 1/2 symbol). More Glu and less GABA means that DA, the source of pleasure from Nic, lasts longer.



The graph shows the relationship between glutamate and GABA when the brain is stimulated by nicotine. Glutamate activity increases and stays at an increased level while GABA levels spike and then fall to lower levels. Since glutamate increases the amount of dopamine released, the pleasurable effects of nicotine last longer.

Art adapted from Patrick Zickler, *Nicotine's Multiple Effects on the Brain's Reward System Drive Addiction*, NIDA Notes, Vol. 17, No. 6 (March 2003), [www.drugabuse.gov/NIDA\\_notes/NNVol17N6/Nicotine.html](http://www.drugabuse.gov/NIDA_notes/NNVol17N6/Nicotine.html).

## SOURCES

- Massachusetts Department of Public Health, *Changes in Nicotine Yield: 1998-2004*, Massachusetts Tobacco Control Program. Accessed at [http://mass.gov/dph/mtcp/reports/nicotine\\_yields\\_1998\\_2004\\_factsheet.pdf](http://mass.gov/dph/mtcp/reports/nicotine_yields_1998_2004_factsheet.pdf).
- Patrick Zickler, *Nicotine's Multiple Effects on the Brain's Reward System Drive Addiction*, NIDA Notes, Vol. 17, No. 6 (March 2003). Accessed at [www.drugabuse.gov/NIDA\\_notes/NNVol17N6/Nicotine.html](http://www.drugabuse.gov/NIDA_notes/NNVol17N6/Nicotine.html).

# Why Secondhand Smoke Is Dangerous

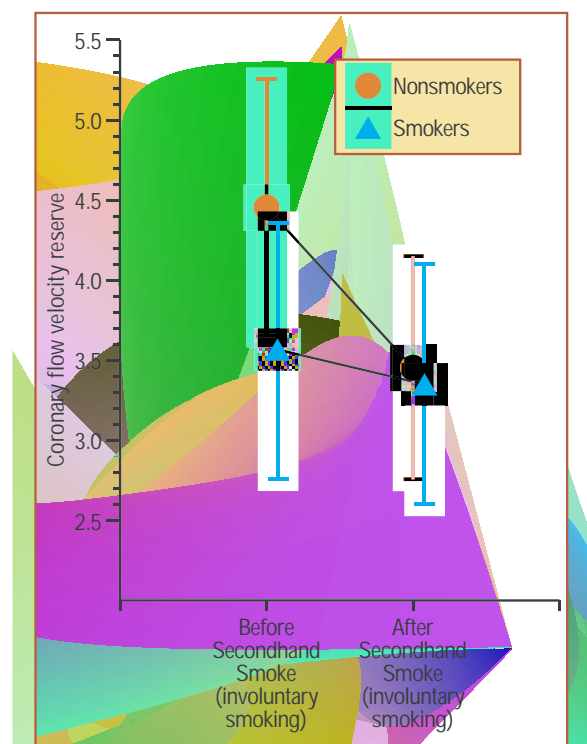
**M**ore than 126 million nonsmoking Americans are regularly exposed to secondhand smoke at home, at work, and in indoor public spaces. **Secondhand smoke** is the smoke from the burning end of a cigarette and the smoke breathed out by smokers. Cigarette smoke contains thousands of dangerous chemicals that endanger the health of smokers and nonsmokers.

The U.S. Surgeon General's report on secondhand smoke warned in 2006, "There is no risk-free level of exposure to secondhand smoke." A research project highlighted in the Surgeon General's report was conducted in 2001 by Dr. Ryo Otsuka and other scientists in Osaka, Japan. They looked at what happened to healthy young adults, both smokers and nonsmokers, who were exposed to secondhand smoke for 30 minutes. The researchers measured changes in blood flow through the subjects' hearts before and after they spent 30 minutes in a hospital smoking lounge.

The researchers found that even a brief 30-minute exposure to secondhand smoke had a harmful effect on the blood vessels of the nonsmokers. Blood vessels are lined by a cell layer known as the endothelium. The endothelium plays a critical role in controlling blood flow. In nonsmokers the effects of 30 minutes of exposure to secondhand smoke significantly reduced the velocity of blood flow to the heart. In smokers, the blood flow velocity was already low and did not change significantly.

Based on this study and on other research, the 2006 Surgeon General's report described smoking as the single greatest avoidable cause of disease and death. Major conclusions of the report included:

- Many millions of Americans, both children and adults, are still exposed to secondhand smoke in their homes and workplaces despite substantial progress in tobacco control.
- Secondhand smoke exposure causes disease and premature death in children and adults who do not smoke.
- Children exposed to secondhand smoke are at an increased risk for sudden infant death syndrome (SIDS), acute respiratory infections, ear problems, and more severe asthma. Smoking by parents causes respiratory symptoms and slows lung growth in their children.
- Exposure of adults to secondhand smoke has immediate adverse effects on the cardiovascular system and causes coronary heart disease and lung cancer.
- The scientific evidence indicates that there is no risk-free level of exposure to secondhand smoke.
- Eliminating smoking in indoor spaces fully protects nonsmokers from exposure to secondhand smoke. Separating smokers from nonsmokers, cleaning the air, and ventilating buildings cannot eliminate exposures of nonsmokers to secondhand smoke.



### Blood Flow to the Heart Before and After 30 Minutes of Secondhand Smoke Exposure

Before exposure to secondhand smoke (involuntary smoking), nonsmokers (•) had significantly higher coronary flow (blood flow to the heart) compared with smokers (▲). Exposure to secondhand smoke significantly reduced the coronary flow in nonsmokers. The smokers' levels did not change significantly.

Adapted from U.S. Department of Health and Human Services, *The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General*, 2006, Chapter 2, p. 57. [www.surgeongeneral.gov/library/secondhandsmoke/report/chapter2.pdf](http://www.surgeongeneral.gov/library/secondhandsmoke/report/chapter2.pdf).

## SOURCES

- 1 U.S. Department of Health and Human Services, *The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General*, 2006, Chapter 2. Accessed at [www.surgeongeneral.gov/library/secondhandsmoke/report/chapter2.pdf](http://www.surgeongeneral.gov/library/secondhandsmoke/report/chapter2.pdf).
- 2 U.S. Department of Health and Human Services, *Six Major Conclusions of the Surgeon General Report, The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General*, 2006. Accessed at [www.surgeongeneral.gov/library/secondhandsmoke/factsheets/factsheet6.html](http://www.surgeongeneral.gov/library/secondhandsmoke/factsheets/factsheet6.html).



# Stress and Dr

## Myth vs. Reality

**Myth 1:** Drug abuse is harmful, but it does relieve stress.

**Reality:** Some drugs of abuse affect your brain the same way stress does. Long-term abuse of drugs makes users more sensitive to everyday stress than non-users.

**Myth 2:** All stress is bad for you.

**Reality:** Stress can help you deal with tough situations. It can also be associated with positive changes, such as a new job. However, long-term stress can lead to physical and emotional health problems.

**Myth 3:** Everyone deals with stress in the same way.

**Reality:** People deal with stress in different ways. How you deal with stress determines how it affects your body.

## The Brain Connection

You are about to take a test. The coach is announcing who made the team. Your best friend is mad at you. Most people find such situations stressful. *Stress* can be defined as an emotional or physical demand or strain (a *stressor*) that causes your body to release powerful neurochemicals and hormones. These changes help your body gear up to respond to the stressor. Your blood-sugar levels and blood pressure rise;

your heart beats faster; your muscles tense.

There are different levels of stress: *Short-term stress* can cause uncomfortable physical reactions, but can also help you to focus. *Long-term stress*, such as stress caused by illness, divorce, or the death of a loved one, can lead to serious health problems. Traumatic events, such as natural disasters, violence, and terrorism, can cause

*post-traumatic stress disorder* (PTSD), a serious illness.

Brain research now indicates that people exposed to stress are more likely to abuse alcohol or other drugs, or to relapse to drug addiction.

Read on to get important facts about this connection.

## How Your Body Responds to Stress

Your body's central nervous, endocrine, immune, and cardiovascular systems are involved in responding to stress.

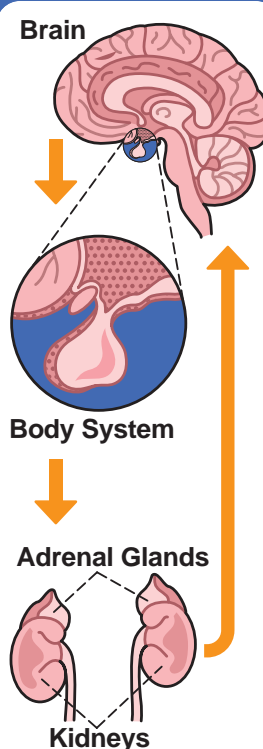
The physical responses can vary: Short-term responses can cause a racing heart, sweaty palms, and a pounding head. Long-term responses can cause back pain, high blood pressure, sleeplessness, and an inability to make decisions. Constant stress floods the body with stress hormones, which can increase the risk of serious health problems.

The hormone that initiates the body's response to stress, CRF, is found throughout the brain. Drugs of abuse also stimulate release of CRF. See the diagram to the right for how this works.

### The Stress Hormone Cycle and Drugs

Under stress, the brain releases CRF, a hormone, into the bloodstream. Some drugs of abuse also stimulate the release of CRF. Through blood vessels, CRF travels to the pituitary gland.

Here CRF causes the release of ACTH, another hormone. ACTH travels to the adrenal glands and triggers the release of still more hormones, the most important of which is cortisol.



Cortisol helps you cope with stress. If stress is mild, cortisol prevents further release of CRF and ACTH. If stress is intense, the cycle continues.

# Drug Abuse

## LATEST RESEARCH

NIDA researchers have found the following connections between **stress and drug abuse**:

Stress can cause changes in the brain like those caused by addictive drugs. This suggests that some people who experience stress may be more vulnerable to drug addiction or drug relapse.

Those who become addicted to drugs may already be hypersensitive to stress.

Long-term potentiation (LTP) is a key brain mechanism involved in memory and learning. Researchers have shown that LTP is involved in how both drug exposure and stress affect the brain.

Stress can put people at risk for substance abuse.

Scientists have uncovered a rise in substance abuse among people in New York City neighborhoods affected by 9/11, which raises new questions about the public health effects of traumatic events such as disasters.

For more information, visit: [www.scholastic.com/headsup](http://www.scholastic.com/headsup) and <http://teens.drugabuse.gov>.

## Managing Stress

Anyone can learn to manage stress, but it does take practice. Here are some practical tips:

### Take care of yourself.

Healthy foods, exercise, and enough sleep really do make you feel better and better able to cope!

### Focus.

To keep from feeling overwhelmed, concentrate on challenges one at a time.

### Keep calm.

Step away from an argument or confrontation by taking a deep breath. Go for a walk or do some other physical activity.

### Move on.

If you don't achieve something you were trying for, practice and prepare for the next time. Or check out some other activity.

### Talk about it.

Talking to an understanding listener who remains calm can be very helpful.

*We all must develop healthy ways to manage stress, and avoid turning to drugs or other substances to escape stressful realities.*

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

## Stressing Out?

Read what some teens have said causes them stress:

### Being Successful:

Between my job, homework, responsibilities at home, and studying for my SATs, it's easy to feel stressed out and overwhelmed.

Female, Los Angeles

### Being Perfect

Having struggled with eating disorders for many years, I finally realize that I make comparisons and let the appearance/discussions of my peers sometimes alter my own body image.

Female, Chicago

**Physical Appearance:** Television and movies influence the physical appearance and style of most teens. The most important influence comes from the opposite sex.

Male, Los Angeles

Teen quotes in *Stressing Out?* www.teenidrug.com/html/pressures.htm. Photos, top to bottom: Science Faction Images; Rosemary Calvert/Photographer's Choice/Getty Images; Masterfile; Red Chopsicks/Getty Images.

# Long-Term Potentiation

If you hit a fastball for a home run, chances are the next time you are at the plate and see a fastball coming, you will be stoked. Why? Part of the reason is **long-term potentiation** (LTP). LTP is one of the brain's key mechanisms for registering experience and using it to shape future responses, as in learning and remembering. When an experience or some other stimulus induces LTP in a cell, the cell responds more strongly to future exposures to the same stimulus. For example, if you hit a fastball for a home run, LTP is part of the reason you might get excited the next time you are at the plate and see a fastball coming.

Scientists have made important discoveries in the role that LTP may play in **drug addiction**, as well as in the body's response to **stress**, which may help to explain a long-observed connection between the two.

Researchers have shown that, in animal studies, a single exposure to some addictive drugs can establish LTP in dopamine-releasing cells in an area of the brain called the ventral tegmental area (VTA). LTP primes these brain cells to react more strongly and release **dopamine** more abundantly in response to future exposure to drugs. Dopamine is a chemical neurotransmitter that triggers feelings of pleasure and also plays a role in alerting people that something important is happening or about to happen.

Researchers have also found that stress alone can induce changes in dopamine-releasing VTA cells similar to those caused by drugs. This raises the possibility of a **priming mechanism** that could make someone who has experienced stress much more vulnerable to addiction, or to relapse during treatment for addiction.

# 9/11 and Substance Abuse

How do traumatic events such as the September 11, 2001, terrorist attacks affect people in the area where the events occurred? In 2001, NIDA-funded researchers Dr. David Vlahov and his colleagues interviewed residents of New York City to find out. Dr. Vlahov explained the researchers' purpose: 9/11 was an event that affected everyone in a major way. We asked, how do people cope with the stress of a disaster? Do they turn to cigarettes, alcohol, or marijuana? What are the implications for public health planning and delivery?

In 2001, five to eight weeks after 9/11, Dr. Vlahov investigated stress, depression, and substance abuse levels in people living in an area of New York City directly affected by the attacks. The results of this initial study showed that many of the 1,008 residents surveyed had developed symptoms of **post-traumatic stress disorder** (PTSD). PTSD is an anxiety disorder that can emerge in some people after exposure to a terrifying ordeal. Other residents experienced **depression**, an illness in which long-lasting feelings of sadness and hopelessness come to dominate a person's life. There was also indication of an increased usage of cigarettes, alcohol, and marijuana after 9/11, particularly in those who had used these substances before 9/11.

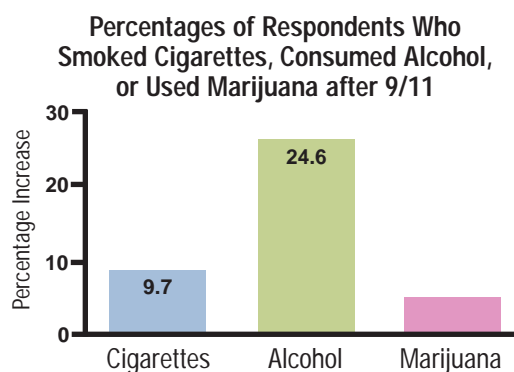
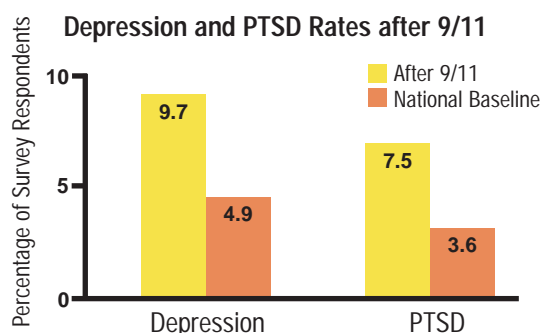
The actual survey results showed that the rates of depression and PTSD were almost twice that of the national baseline. Some 9.7 percent of people had symptoms of depression, compared with a national baseline level of 4.9, while 7.5 could be

diagnosed with PTSD, compared with a national baseline level of 3.6. Regarding the increase in substance use that was documented, the number of respondents who smoked cigarettes increased 9.7 percent, those who consumed alcohol increased 24.6 percent, and those who smoked marijuana increased 3.2 percent. (See the bar graphs on this page that show these statistics.) Researchers estimated that, within five to eight weeks after 9/11, 265,000 people had increased their use of any of the substances in question, with 226,000 consuming more alcohol and 29,000 abusing more marijuana.

Six to nine months after this first study, Vlahov conducted an additional study among randomly selected adults in New York City to see if the rates of substance abuse, depression, and PTSD remained high. While rates of depression and PTSD were drastically reduced, substance abuse rates had not declined substantially. The results of both studies suggest that an increase in substance abuse after a disaster may be a cause for public health concern in the long term. This study is one of the first to capture data on the effects of traumatic events on substance abuse patterns, says Dr. Jacques Normand of NIDA. This study reminds counselors and treatment providers to be alert to increased abuse of alcohol, tobacco, and marijuana in the wake of such events.

## Survey Shows Increases in PTSD, Depression, and Substance Abuse in the Wake of 9/11

As illustrated in the graphs below, a survey of New York City residents after the terrorist attacks of 9/11/01 showed high rates of depression and post-traumatic stress disorder (PTSD), as well as increases in the percentages of respondents who smoked, consumed alcohol, or used marijuana.



Data: [www.nida.nih.gov/NIDA\\_notes/NNVol17N4/Depression.html](http://www.nida.nih.gov/NIDA_notes/NNVol17N4/Depression.html).

## SOURCES: Long-Term Potentiation

- National Institute on Drug Abuse, *The Brain's Response to Drugs* (Teacher Guide). Accessed at <http://teens.drugabuse.gov/mom/teachguide/MOMTeacherGuide.pdf>.
- Zickler, Patrick, Addictive Drugs and Stress Trigger Similar Change in Brain Cells, Animal Study Finds, *NIDA Notes Research Findings*, Vol. 18, No. 5 (December 2003). Accessed at [www.drugabuse.gov/NIDA\\_notes/NNVol18N5/Addictive.html](http://www.drugabuse.gov/NIDA_notes/NNVol18N5/Addictive.html).

## SOURCES: 9/11 and Substance Abuse

- National Institute on Drug Abuse, Trauma-Related Substance Abuse Persists After Mental Health Symptoms Abate, *NIDA Notes Bulletin Board*, Vol. 20, No. 2 (August 2005). Accessed at [www.drugabuse.gov/NIDA\\_notes/NNVol20N2/BBoard.html](http://www.drugabuse.gov/NIDA_notes/NNVol20N2/BBoard.html).
- Williams, Jill S., Depression, PTSD, Substance Abuse Increase in Wake of September 11 Attacks, *NIDA Notes Research Findings*, Vol. 17, No. 4 (November 2002). Accessed at [www.drugabuse.gov/NIDA\\_notes/NNVol17N4/Depression.html](http://www.drugabuse.gov/NIDA_notes/NNVol17N4/Depression.html).

# GET THE

## Drug Abuse Puts Your

### Research shows . . .

### Read the Label

**Prescription medications** may be mistakenly thought of as safe because they are prescribed by a doctor for an illness. But if they are not prescribed for you, then they are not safe for you.

Abuse of **prescription opioids**, such as Vicodin® and OxyContin®, can lead to addiction. Taking a single large dose could cause **severe respiratory depression** (including difficulty in breathing or stopped breathing) that can lead to death. The same holds true for abuse of **prescription central nervous system depressants**, such as Xanax® and Valium®.

Abuse of **prescription stimulants**, such as Ritalin® or Adderall®, can lead to **feelings of hostility or paranoia**. Further, taking high doses of a stimulant may result in **dangerously high body temperature** and an **irregular heartbeat**. There is also the potential for **heart system failure** or **fatal seizures**.

Drug abuse and addiction can affect almost every system in your body. You probably know that drugs affect feelings and moods, judgment, decision making, learning, and memory. But they can also cause or worsen other health problems: **cancer**; **heart disease**; **lung disease**; **liver function**; **mental disorders**; and **infectious diseases** such as **HIV/AIDS**, **hepatitis**, and **tuberculosis**. Some of these effects occur when drugs are used at high doses or after prolonged use, and some may occur after just one use.

**Nora Volkow, M.D., Director of NIDA**

● **Tobacco addiction** increases risk of **lung and heart disease**, as well as **premature aging of the skin**.

● **Inhalants** spread toxic chemicals throughout the body, and can cause **blackouts** and **hearing loss** as well as **liver, kidney, and bone-marrow damage**.

● **Methamphetamine** can cause **cardiac damage**, **elevated heart rate**, and **convulsions**, and can also lead to diseased gums and teeth, known as **meth mouth**.

● **Cocaine** has been linked to **stroke** and **heart attack**, as well as increased **vulnerability to infection**.

● **Drug abuse** is linked to the top U.S. medical problems, including **heart disease**, **cancer**, **HIV/AIDS**, and **mental illness**.

### HIV/AIDS, Hepatitis, and Other Infectious Diseases

Nearly one-third of reported AIDS cases have been linked to **injection drug use**. Heroin, cocaine, or any drug that abusers inject. One way that HIV/AIDS, hepatitis, and other infectious diseases are spread is through the sharing of needles or other injection equipment. But it is not only injection drug users who risk contracting or spreading infections. The intoxicating effects of **all drugs of abuse** **affect judgment and decision making**, leading users to engage in behaviors that could have dire health consequences, including the spread of HIV.



# EFFECTS:

## Whole Body at Risk.

### Mental Health Effects

Drug abuse might affect an existing mental disorder or result in one. More than half of those who are addicted to drugs have also had some form of mental illness—either at the same time as their addiction or at some other point in their lives. This is probably not due to chance: drugs affect many of the same brain

systems that are responsible for mental disorders. There may also be common genetic and environmental causes of both. What we know from research is that long-lasting changes in the brain caused by chronic drug abuse may lead to **depression**, **aggression**, **paranoia**, and **hallucinations**.

### Smoking

Cigarette smoking is the leading preventable cause of death in the United States, causing about 440,000 deaths per year in the U.S. alone. Smoking leads to **heart disease**, **lung cancer**, and other lung problems, such as **emphysema** and **chronic bronchitis**. Tobacco addiction is a direct result of **nicotine**—one of the many chemicals found in tobacco

products—which acts on receptors in the brain and the body. Tobacco smoke also affects other body systems, changing their functions and ultimately leading to disease. Prenatal exposure to tobacco can have long-lasting effects on the next generation; and even **second-hand smoke** is linked to diseases in those exposed.

## Activate for Your Life

**Get More Facts!** Find out more about the medical consequences of drug abuse and addiction at:  
[www.scholastic.com/headsup](http://www.scholastic.com/headsup)  
[www.teens.drugabuse.gov](http://www.teens.drugabuse.gov)  
[www.drugabuse.gov](http://www.drugabuse.gov)

**Check Up!** See a doctor for regular checkups. Be sure to mention if you abuse drugs. This is confidential information your doctor needs to know. A prescribed medication might interact badly with a drug of abuse.

**Get Up!** Do some type of physical activity every day for overall good health.

**Eat Healthy!** Eat balanced meals, limiting your intake of fats and sweets, to give your body the energy it needs.

**Hydrate!** Drink liquids throughout the day, especially while exercising. To nourish your body, reach for water instead of sugared drinks.

**Cover Up!** Wear protective gear and sunblock when outside to block damaging rays.

**Speak Up!** Talk to your parents or to another trusted adult about your health-related questions. Ask questions and insist on answers.

# Surf Smarts

The Internet can be a great source of information. The trick is finding facts from *reliable* sources. And when it comes to health, it's especially important that the information you find is reliable.

Keep these things in mind when getting facts from the Web\*:

- Anyone can publish information on the Web.
- Information may not be fact-checked or verified.
- It's not always clear who writes the information on a Web page.
- Even on a signed page, the author's qualifications may be missing.
- A Web page that looks objective could be a sponsored form of advertising.

Also, ask yourself these questions to evaluate facts you find on a Web site:

- Does the site have a sponsor?
- Is there a link to information about the sponsor?
- Does the sponsor have a stake in the information provided?
- Is there advertising on the Web site?
- Is the author qualified to write on this topic?

- Does the information show any bias or personal opinion?
- Is there a date showing when the information was last updated or revised?
- What topics are covered? How in-depth is the material?

For reliable information on the facts about drug abuse and addiction, check out the sources listed below.

## RESOURCES

### Reliable Resources on the Facts About Drug Abuse

**NIDA for Teens: The Science Behind Drug Abuse**  
<http://teens.drugabuse.gov>

Some of the things you'll find on this site include the Facts on Drugs section, where you can locate info about the health effects of specific drugs of abuse.

**Heads Up: Real News About Drugs and Your Body**  
[www.scholastic.com/headsup](http://www.scholastic.com/headsup)

Check out this Web site for cutting-edge research-based articles for teens about drug abuse and addiction. Click on the feature stories on the home page to find out the latest news, as well as the archive of previous articles and stories.

**National Addiction Treatment Hotline**  
1-800-662-HELP (1-800-662-4357) or  
[www.findtreatment.samhsa.gov](http://www.findtreatment.samhsa.gov)

Here you can find ways to locate help with a specific drug problem, and how to locate drug treatment centers in your state and community.

**National Network of Tobacco Cessation Quitline**  
1-800-QUITNOW (1-800-784-8669) or  
[www.smokefree.gov](http://www.smokefree.gov)

Here you'll find resources to help quit tobacco use, as well as helpful information about the dangers of tobacco and the benefits of quitting.

\*Internet tips: New Mexico State University Library, Evaluation Criteria  
<http://lib.nmsu.edu/instruction/evalcrit.html>

# In Harmful Way: More Facts About How Drug Abuse Puts Your Whole Body at Risk

**R**esearch has shown that drug abuse and addiction can affect almost every system in your body.

Below, find out facts about the harmful health effects of various drugs throughout the body.

## Cocaine

Cocaine restricts blood flow to the brain, increases heart rate, and promotes blood clotting. These effects can lead to a stroke or heart attack. Recent NIDA research suggests that cocaine also limits the body's ability to fight infection. This means that cocaine abusers are at greater risk for infectious illnesses such as hepatitis, sexually transmitted diseases, and HIV/AIDS.

For more information, go to  
**NIDA Drugs of Abuse: Cocaine**  
[www.drugabuse.gov/drugpages/cocaine.html](http://www.drugabuse.gov/drugpages/cocaine.html)

## Ecstasy (MDMA)

Ecstasy speeds up heart rate and blood pressure and disrupts the brain's ability to regulate body temperature, which can result in overheating to the point of hyperthermia. When this happens, abusers begin to sweat, but can't cool off. In a hot and crowded dance atmosphere, this can be life-threatening if medical care is not delivered quickly. Treatment of hyperthermia requires prompt medical attention, as it can rapidly lead to muscle breakdown, which can, in turn, result in kidney failure.

For more information, go to  
**NIDA for Teens: Ecstasy**  
[www.teens.drugabuse.gov/facts/facts\\_xtc1.asp](http://www.teens.drugabuse.gov/facts/facts_xtc1.asp)

*The Harmful Way* continued from page 21

## Heroin

Medical consequences of chronic heroin injection abuse include scarred and/or collapsed veins, bacterial infections of the blood vessels and heart valves, abscesses (boils) and other soft-tissue infections, and liver or kidney disease. Lung complications (including various types of pneumonia and tuberculosis) may result from the poor health condition of the abuser as well as from heroin's depressing effects on respiration. Heroin abusers who share needles can pass the virus to each other. They can also spread other blood-based diseases like hepatitis C and tuberculosis. Heroin overdose can slow the respiratory system until breathing stops and the person dies.

For more information, go to  
**NIDA Drugs of Abuse: Heroin**  
[www.drugabuse.gov/drugpages/heroin.html](http://www.drugabuse.gov/drugpages/heroin.html)

## Inhalants

Sniffing highly concentrated amounts of the chemicals in solvents or aerosol sprays can directly induce heart failure and death within minutes of a session of repeated inhalations. This syndrome, known as sudden sniffing death, can result from a single session of inhalant use by an otherwise healthy young person. Sudden sniffing death is particularly associated with the abuse of butane, propane, and chemicals in aerosols. Also, high concentrations of inhalants also can cause death from suffocation by displacing oxygen in the lungs and then in the central nervous system so that breathing ceases. Deliberately inhaling from a paper or plastic bag or in a closed area, for example, greatly increases the chances of suffocation.

For more information, go to  
**NIDA for Teens: Inhalants**  
[www.teens.drugabuse.gov/facts/facts\\_inhale1.asp](http://www.teens.drugabuse.gov/facts/facts_inhale1.asp)

## Marijuana

People who smoke marijuana often develop the same kinds of breathing problems as cigarette smokers, including coughing and wheezing. They tend to have more chest colds than nonusers. They are also at greater risk of getting lung infections, like pneumonia. Some studies show that when people have smoked large amounts of marijuana for years, the drug takes its toll on mental functions. Heavy or daily use of marijuana affects the parts of the brain that control memory, attention, and learning. A working short-term memory is needed to learn and perform tasks that call for more than one or two steps. In long-term marijuana abusers, some changes in the brain are similar to those seen after long-term abuse of other major drugs, including cocaine, heroin, and alcohol.

For more information, go to  
**NIDA: Marijuana: Facts for Teens**  
[www.drugabuse.gov/MarijBroch/Marijteens.html](http://www.drugabuse.gov/MarijBroch/Marijteens.html)

## Methamphetamine

Methamphetamine can cause cardiac damage, elevates heart rate and blood pressure, and can cause a variety of cardiovascular problems, including rapid heart rate, irregular heartbeat, and increased blood pressure. Methamphetamine also increases wakefulness and physical activity, creating the potential for a combination of activity and overheating (hyperthermia) that, as with ecstasy, can lead to convulsions and a dangerous, sometimes lethal, elevation of body temperature.

For more information, go to  
**NIDA InfoFacts: Methamphetamine**  
[www.drugabuse.gov/infofacts/methamphetamine.html](http://www.drugabuse.gov/infofacts/methamphetamine.html)

## Prescription Drugs

Prescription medications such as pain relievers, tranquilizers, stimulants, and sedatives can be very useful when prescribed by a physician in a specific dosage for a specific patient. Sometimes, however, people abuse prescription medications

as they would an illegal drug for nonmedical reasons and not as prescribed. This is a serious health issue, because the nonmedical use of prescription medications like opioids (Vicodin, OxyContin), central nervous system (CNS) depressants (Xanax, Valium), and stimulants (Ritalin, Adderall) can lead to addiction and other health risks, just like illegal street drugs. When abused, both prescription drugs and illegal drugs alter normal brain function. Drug abusers experience this as a rush of pleasurable feelings, but these feelings do not last, and continued drug abuse can lead to addiction. Just like people who are addicted to illegal drugs, prescription drug abusers can experience craving, addiction, physical dependency and withdrawal, and other dangerous side effects. Sometimes even fatal side effects. Taking a single large dose of a prescription opioid or depressant could lead to severe breathing difficulty. Taking high doses of a prescription stimulant can lead to irregular heartbeat, seizures, or dangerously high body temperature.

For more information, go to  
**NIDA Drugs of Abuse: Prescription Medications**  
[www.nida.nih.gov/drugpages/prescription.html](http://www.nida.nih.gov/drugpages/prescription.html)

## Steroids

The major health consequences from abusing anabolic steroids can include liver tumors and cancer, jaundice (yellowish pigmentation of skin, tissues, and body fluids), fluid retention, high blood pressure, increases in LDL (bad cholesterol), and decreases in HDL (good cholesterol). Other side effects include kidney tumors, severe acne, and trembling. As in the case of heroin or any drug

abuse via needle injection, people who inject anabolic steroids run the added risk of contracting or transmitting hepatitis, which causes serious damage to the liver, or HIV/AIDS. In addition, there are some gender-specific side effects:

For guys: shrinking of the testicles, reduced sperm count, infertility, baldness, breast growth, increased risk for prostate cancer.

For girls: growth of facial hair, male-pattern baldness, changes in or cessation of the menstrual cycle, enlargement of the clitoris, deepened voice.

For all: growth halted prematurely through premature skeletal maturation and accelerated puberty changes. This means that teens risk remaining short for the remainder of their lives if they take anabolic steroids before the typical adolescent growth spurt.

For more information, go to  
**NIDA Drugs of Abuse: Steroids**  
[www.drugabuse.gov/drugpages/steroids.html](http://www.drugabuse.gov/drugpages/steroids.html)

## Tobacco and Secondhand Smoke

Smoking harms every organ in the body. Cigarette smoking accounts for about one-third of all cancer deaths, including those from lung cancer. In fact, cigarette smoking has been linked to about 90 percent of all lung cancer cases. Research shows that smoking increases the risk of heart disease. Secondhand smoke exposure causes disease and premature death in children and adults who do not smoke. Children exposed to secondhand smoke are at an increased risk for sudden infant death syndrome (SIDS), acute respiratory infections, ear problems, and severe asthma. In adults, secondhand smoke causes coronary heart disease and lung cancer. Scientific evidence indicates that there is no risk-free level of exposure to secondhand smoke.



