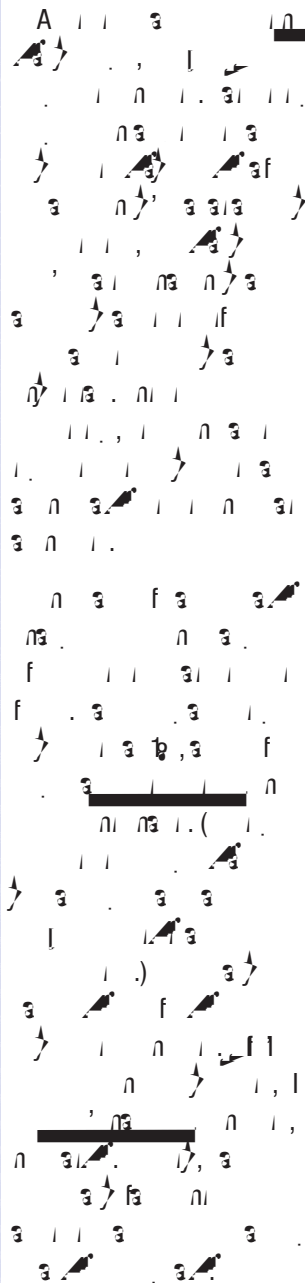


The Science

What Brain Research Tells

Vicodin and OxyContin

Legal but Dangerous



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	Life Factors	Protective Factors
• Alcohol	• Family	• Friends
• Stress	• Education	• Mental Health
• Access	• Support	• Awareness
• Availability	• Role	• Attitude
• Use	• Environment	• Action

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



of Addiction

Us About Drug Addiction

What Is Addiction?

- **Addiction is a complex disease.**

- **Addiction is a developmental disease.**

- **Prevention and early intervention work best in the teen years.**

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

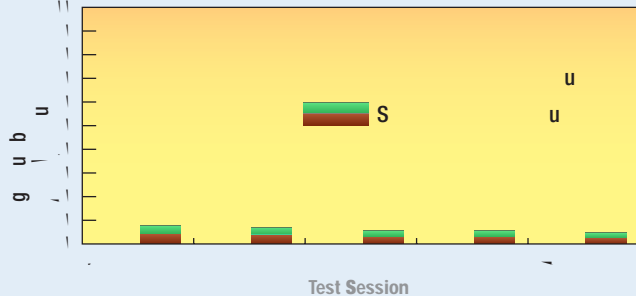
imaging to observe brain activity patterns in non-drug abusers who were awaiting brief electrical shocks (the adverse experience).

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.
- For help with a drug problem, call the National Addiction Treatment Hotline at 1-800-662-HELP or go to 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 and www.teens.drugabuse.gov.

The Role of Genes in Drug Addiction

The role of genes in drug addiction is a complex and rapidly evolving field of research. Genes are segments of DNA that contain instructions for making proteins, which are the building blocks of life. In the context of drug addiction, certain genes have been found to influence an individual's susceptibility to addiction and the severity of their response to drugs. For example, the MAO-A gene has been associated with aggression and impulsivity, which are traits that can increase the risk of addiction. Similarly, the DRD4 gene has been linked to the brain's reward system, which is involved in the pleasurable effects of drugs. Research also suggests that environmental factors, such as stress and trauma, can interact with genetic predispositions to influence the development of addiction. This interplay between genes and environment is a key area of ongoing research in the field of addiction science.

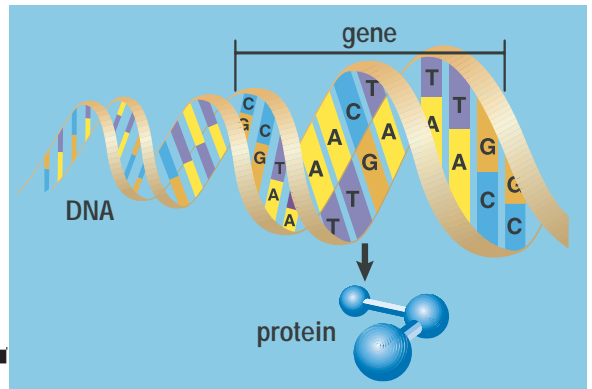


Figure 1. DNA: The Molecule of Life

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, ATCCGGA). 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.

Research has identified several genes that are associated with drug addiction. One of the most well-studied is the MAO-A gene, which is involved in the breakdown of neurotransmitters like serotonin and dopamine. A specific variant of the MAO-A gene, known as the MAO-A low-activity variant, has been found to be associated with increased risk of aggression and impulsivity, which are traits that can lead to addiction. Another gene, DRD4, is part of the dopamine receptor system in the brain. A variant of the DRD4 gene, known as the 7R variant, has been found to be associated with a higher risk of addiction to substances like cocaine and amphetamines. Additionally, the COMT gene, which is involved in the breakdown of dopamine, has been found to be associated with a higher risk of addiction to substances like alcohol and nicotine. These findings suggest that genetic factors play a significant role in the development of addiction, and understanding these genetic influences can help researchers develop more effective treatments for addiction.

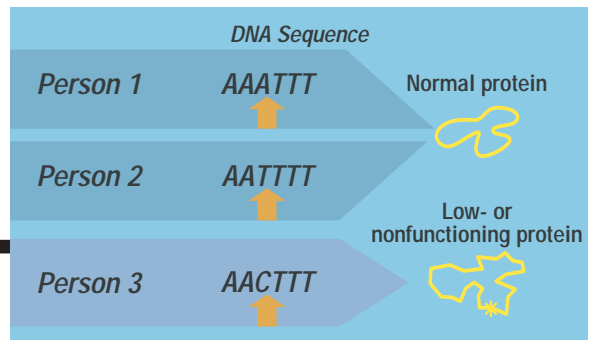
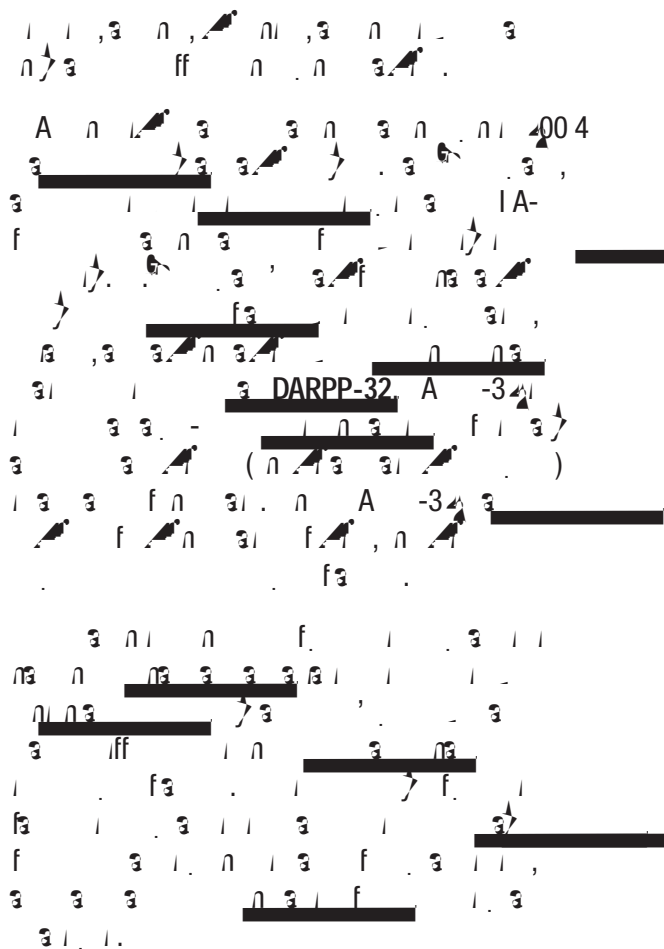


Figure 2. Health or Disease?

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.

SOURCES

www.dukemednews.org/news/article.php?id=7415

www.nida.nih.gov/ResearchReports/Cocaine/cocaine3.html

www.drugabuse.gov/whatsnew/meetings/apa/signalintegration.html

The Science of Opioid Addiction

One of the most important building blocks of the brain is the neuron. Neurons are specialized cells that transmit information throughout the body. They are the basic units of the nervous system. Each neuron consists of a cell body, dendrites, and an axon. The cell body contains the nucleus, which is the control center of the cell. Dendrites are branching structures that receive signals from other neurons. The axon is a long, thin projection that carries the signal away from the cell body. At the end of the axon are axon terminals, which release neurotransmitters to communicate with other neurons. The process of neurotransmission involves the release of neurotransmitters from the axon terminals into the synaptic cleft, where they bind to receptors on the target cell. This binding triggers a series of events that lead to the generation of an action potential, which travels down the axon. The action potential is a brief electrical pulse that moves along the axon, carrying the signal to the axon terminals. The frequency of action potentials is proportional to the strength of the signal. The brain uses this system to process information and control the body's actions. The study of neurons and their function is a key area of research in the field of neuroscience. Understanding how neurons work is essential for understanding how the brain works and how it is affected by drugs and other factors. The science of neurons is a complex and fascinating field that continues to advance our understanding of the human mind and body.

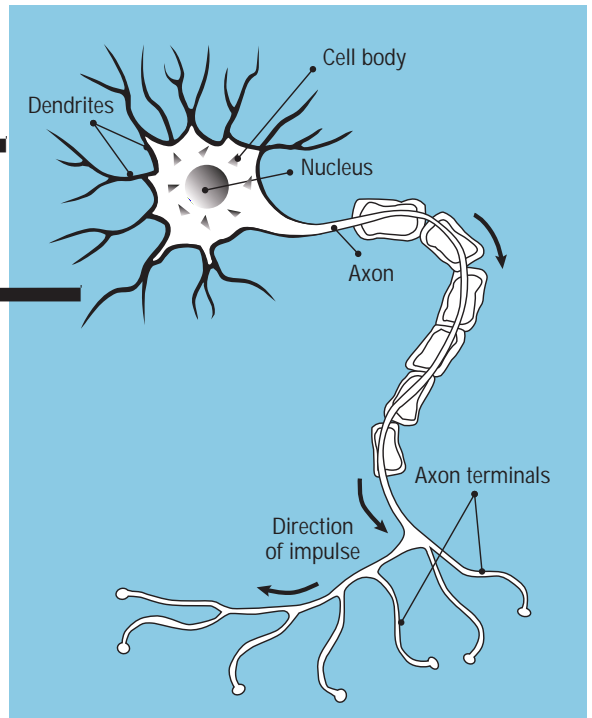


Figure 2. Neurons: Building Blocks of the Brain

The diagram shows a single neuron with its various parts labeled. The cell body contains the nucleus, and the axon carries the signal away from the cell body. The axon terminals release neurotransmitters to communicate with other neurons.

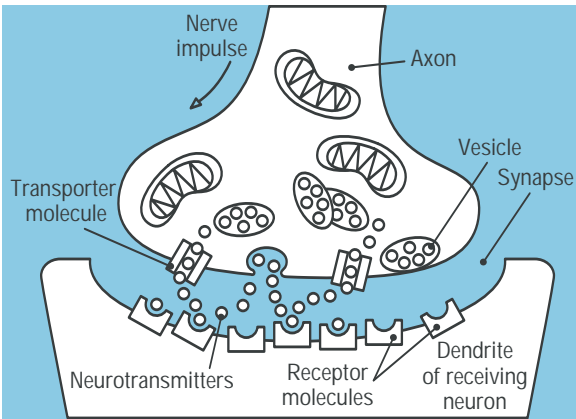
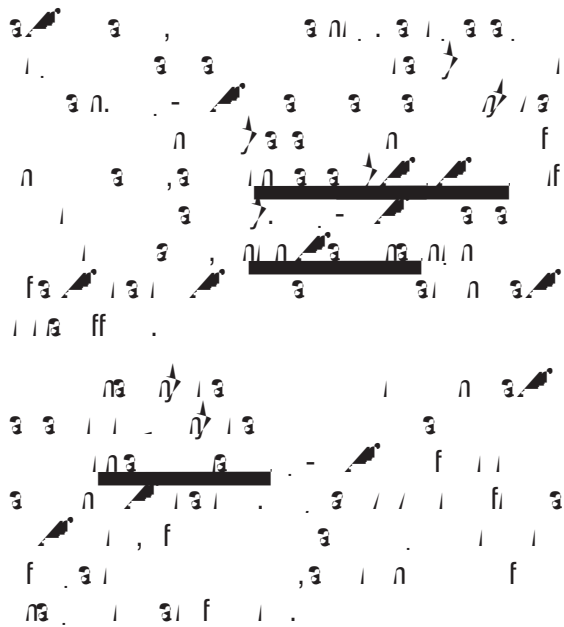


Figure 2. Neurotransmission: How Neurons Communicate with Each Other

The diagram illustrates the process of neurotransmission. A nerve impulse travels down the axon, causing vesicles containing neurotransmitters to move toward the synapse. At the synapse, neurotransmitters are released into the synaptic cleft. Some neurotransmitters bind to receptor molecules on the dendrite of the receiving neuron, while others are taken up by transporter molecules on the axon terminal.

SOURCES

<p>http://teens.drugabuse.gov/mom/tg_nerves.asp</p> <p>http://teens.drugabuse.gov/mom/tg_opi2.asp</p> <p>www.drugabuse.gov/Infofacts/Painmed.html</p>	<p>www.nida.nih.gov/NIDA_Notes/NNVol11N5/Basics.html</p> <p>99 www.drugabuse.gov/NIDA_Notes/NNVol13N2/Brain.html</p>
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The Science of Nicotine Addiction

The science of nicotine addiction is a complex field that involves understanding the biological, psychological, and social factors that contribute to the development of this habit. Nicotine, the primary addictive substance in tobacco, acts on the brain's reward system, leading to the release of dopamine, a neurotransmitter associated with pleasure and reinforcement. This process creates a cycle of craving and use that is difficult to break. Research has shown that nicotine addiction is not just a matter of willpower but a chronic condition that can be treated with medication and behavioral therapy. The science of nicotine addiction is a complex field that involves understanding the biological, psychological, and social factors that contribute to the development of this habit. Nicotine, the primary addictive substance in tobacco, acts on the brain's reward system, leading to the release of dopamine, a neurotransmitter associated with pleasure and reinforcement. This process creates a cycle of craving and use that is difficult to break. Research has shown that nicotine addiction is not just a matter of willpower but a chronic condition that can be treated with medication and behavioral therapy.

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Why Nicotine Is So Addictive

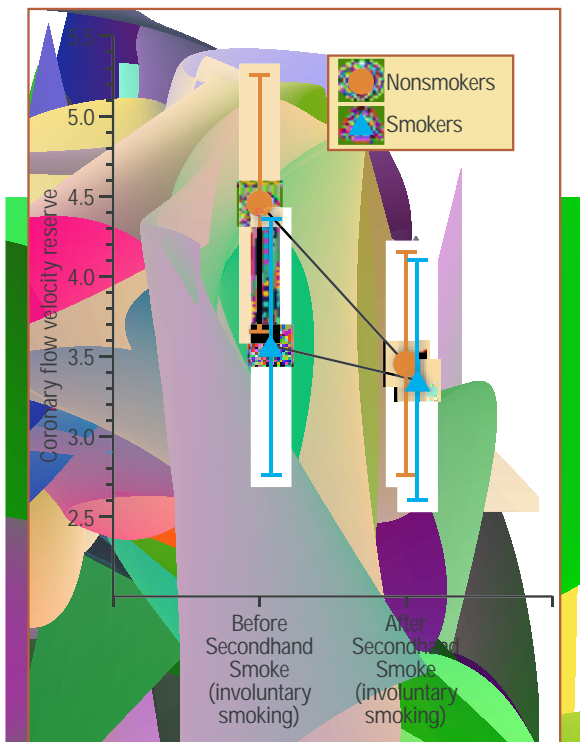
Nicotine is so addictive because it acts on the brain's reward system, leading to the release of dopamine, a neurotransmitter associated with pleasure and reinforcement. This process creates a cycle of craving and use that is difficult to break. Research has shown that nicotine addiction is not just a matter of willpower but a chronic condition that can be treated with medication and behavioral therapy.

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Why Secondhand Smoke Is Dangerous

More than 48 million people in the United States live with someone who smokes. Secondhand smoke is the smoke that comes from the cigarette and is inhaled by others. It is also called passive smoke. Secondhand smoke is a mixture of the smoke that comes from the burning tip of the cigarette and the smoke that comes from the cigarette as it is smoked. It contains many of the same harmful chemicals as the smoke that is inhaled by the person who is smoking. These chemicals can cause heart disease, lung disease, and cancer. Secondhand smoke is also a major cause of asthma in children. In fact, children who live with someone who smokes are more likely to have asthma than children who do not. Secondhand smoke is also a leading cause of death in children. Each year, about 3,600 children die from secondhand smoke. This is because secondhand smoke can cause sudden infant death syndrome (SIDS) in young children. SIDS is the sudden, unexpected death of an infant under the age of one year. The exact cause of SIDS is not known, but it is thought that secondhand smoke is one of the factors that can lead to SIDS. In addition, secondhand smoke can cause other serious health problems in children, such as ear infections, bronchitis, and pneumonia. For these reasons, it is important to avoid secondhand smoke. If you are a smoker, you should quit. If you are not a smoker, you should avoid smoking areas. This will help protect the health of everyone around you.

Secondhand smoke is a leading cause of death in children. Each year, about 3,600 children die from secondhand smoke. This is because secondhand smoke can cause sudden infant death syndrome (SIDS) in young children. SIDS is the sudden, unexpected death of an infant under the age of one year. The exact cause of SIDS is not known, but it is thought that secondhand smoke is one of the factors that can lead to SIDS. In addition, secondhand smoke can cause other serious health problems in children, such as ear infections, bronchitis, and pneumonia. For these reasons, it is important to avoid secondhand smoke. If you are a smoker, you should quit. If you are not a smoker, you should avoid smoking areas. This will help protect the health of everyone around you.



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.

As f... s f s ns f n i, n s n f s, 006, ns f .57. ... / / ns / / ns /

SOURCES

www.surgeongeneral.gov/library/secondhandsmoke/report/chapter2.pdf

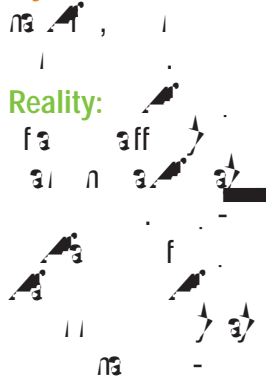
www.surgeongeneral.gov/library/secondhandsmoke/factsheets/factsheet6.html

Stress and Drugs

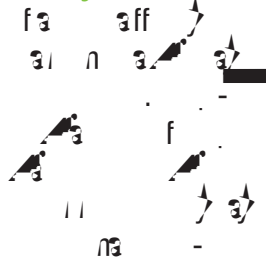
The Brain Connection

Myth vs. Reality

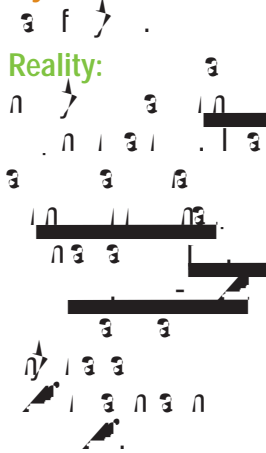
Myth 1:



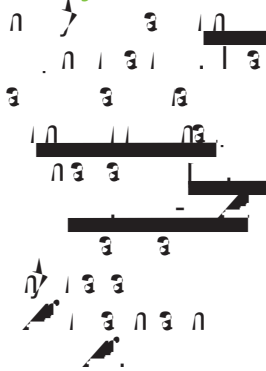
Reality:



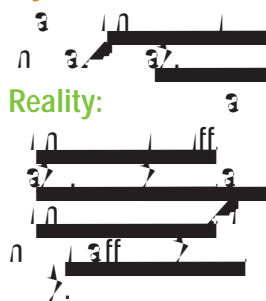
Myth 2:



Reality:



Myth 3:



Reality:



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.

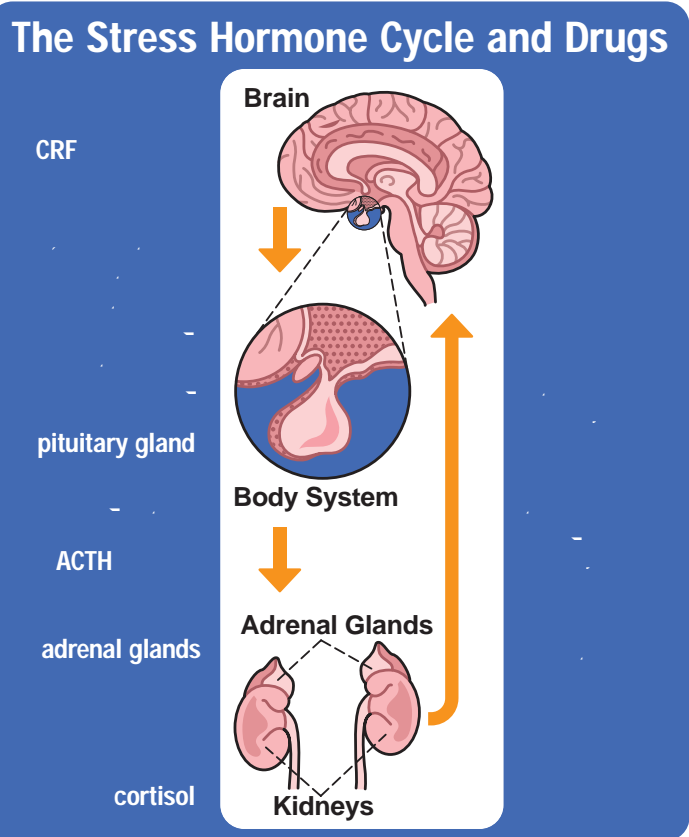
Read on to get important facts about this connection.

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.



Drug Abuse

LATEST RESEARCH

stress and drug abuse:

For more information, visit:
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:

... I have to be perfect in everything I do. If I fail, I feel like I'm not good enough. I have to be the best at everything I do.

Being "Perfect":

... I have to be perfect in everything I do. I have to be the best at everything I do. I have to be perfect in everything I do.

Physical Appearance:

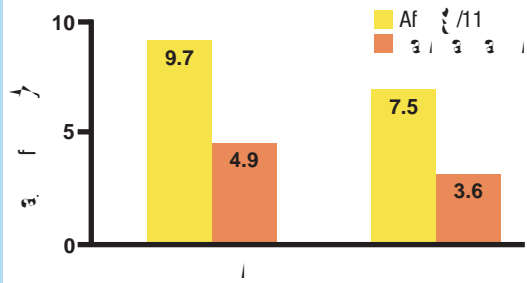
... I have to be perfect in everything I do. I have to be the best at everything I do. I have to be perfect in everything I do.

Teen quotes in "Stressing Out?": www.theantidrug.com/niml/pressures.htm. Photos, top to bottom: © Science Faction Images; © Rosemary Calvert/Photographer's Choice/Getty Images; © Masterfile; © Red Chopsticks/Getty Images.

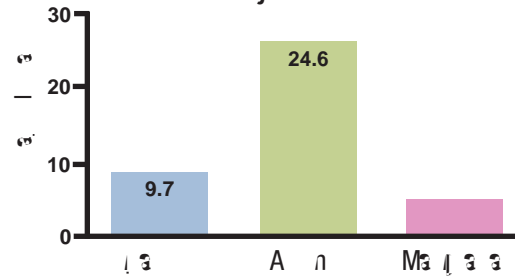
Survey Shows Increases in PTSD, Depression, and Substance Abuse in the Wake of 9/11

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.

Depression and PTSD Rates after 9/11



Percentages of Respondents Who Smoked Cigarettes, Consumed Alcohol, or Used Marijuana after 9/11



1. The first graph shows that the percentage of New York City residents who reported depression increased from 4.9% before 9/11 to 9.7% after 9/11. Similarly, the percentage of residents who reported PTSD increased from 3.6% before 9/11 to 7.5% after 9/11.

2. The second graph shows that the percentage of New York City residents who reported smoking cigarettes increased from 9.7% before 9/11 to 24.6% after 9/11. The percentage of residents who reported consuming alcohol increased from 5.5% before 9/11 to 9.7% after 9/11. The percentage of residents who reported using marijuana increased from 3.6% before 9/11 to 5.5% after 9/11.

SOURCES: Long-Term Potentiation

<http://teens.drugabuse.gov/mom/teachguide/MOMTeacherGuide.pdf>

www.drugabuse.gov/NIDA_notes/NNvol18N5/Addictive.html

SOURCES: 9/11 and Substance Abuse

www.drugabuse.gov/NIDA_notes/NNvol20N2/BBoard.html

www.drugabuse.gov/NIDA_notes/NNVol17N4/Depression.html

GET THE

Drug Abuse Puts Your

Research shows . . .

Read the Label

Prescription medications

can cause serious side effects, including:

All prescription opioids, including prescription painkillers, can cause severe respiratory depression (a life-threatening condition) and prescription central nervous system depressants, including alcohol, can cause:

All prescription stimulants, including ADHD medications, can cause feelings of hostility and paranoia, dangerously high body temperature, irregular heartbeat, heart system failure, and fatal seizures.

Research shows that drug abuse can lead to serious health problems, including:

Tobacco addiction, lung and heart disease, premature aging of the skin, cocaine addiction, heart attack, stroke

Inhalants can cause blackouts, hearing loss, liver, kidney, bone-marrow damage.

Methamphetamine can cause cardiac damage, elevated heart rate, convulsions, and "meth mouth."

vulnerability to infection.

Drug abuse can lead to heart disease, cancer, HIV/AIDS, and mental illness.

HIV/AIDS, Hepatitis, and Other Infectious Diseases

Research shows that injection drug use can lead to HIV/AIDS, hepatitis, and other infectious diseases. All drugs of abuse affect judgment and decision making.

Surf Smarts

The National Institute on Drug Abuse (NIDA) is the leading national authority on drug abuse and addiction. NIDA is part of the U.S. Department of Health and Human Services (HHS).

NIDA's mission is to advance the science of drug abuse and addiction, to reduce the public health consequences of drug abuse and addiction, and to improve the lives of people affected by drug abuse and addiction.

NIDA's research programs focus on understanding the causes of drug abuse and addiction, the effects of drugs on the brain and behavior, and the development of effective treatments and prevention strategies. NIDA also works to disseminate research findings to the public and to support the development of new drugs and treatments.

NIDA's research programs are supported by a network of research centers and programs across the United States. NIDA also works closely with other federal agencies, state and local governments, and the private sector to address the public health consequences of drug abuse and addiction.

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RESOURCES

Reliable Resources on the Facts About Drug Abuse

<http://teens.drugabuse.gov>

66
www.findtreatment.samhsa.gov

www.scholastic.com/headsup

669
www.smokefree.gov

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

In Harm's Way: More Facts About How Drug Abuse Puts Your Whole Body at Risk

Research shows that drug abuse can damage your brain and heart, and it can lead to addiction. It can also affect your ability to think and learn. Drug abuse can also lead to other health problems, such as liver disease, kidney disease, and HIV/AIDS.

Cocaine

Cocaine is a powerful stimulant that can cause a range of health problems, including heart disease, high blood pressure, and stroke. It can also lead to addiction and mental health problems, such as paranoia and hallucinations. Cocaine use can also lead to physical damage, such as nosebleeds and tooth decay.

www.drugabuse.gov/drugpages/cocaine.html

Ecstasy (MDMA)

Ecstasy (MDMA) is a stimulant and hallucinogen that can cause a range of health problems, including heart disease, high blood pressure, and stroke. It can also lead to addiction and mental health problems, such as paranoia and hallucinations. Ecstasy use can also lead to physical damage, such as dehydration and overheating.

www.teens.drugabuse.gov/facts/facts_xtc1.asp

"In Harm's Way" continued from page 21

Heroin

Marijuana is a drug that is used by millions of people in the United States. It is a natural substance that comes from the leaves and flowers of the marijuana plant. It is often smoked or eaten, and it can be addictive. Heroin is a powerful drug that is made from the bark of the poppy plant. It is often injected, but it can also be smoked or eaten. Heroin is highly addictive and can cause serious health problems, including overdose and death.

www.drugabuse.gov/drugpages/heroin.html

Inhalants

Inhalants are drugs that are breathed in through the nose or mouth. They are often used to get high and can be very addictive. Common inhalants include glue, paint, and nitrous oxide. These drugs can cause serious health problems, including damage to the brain and heart, and they can be fatal. Many people who use inhalants are young people who are looking for a quick fix. It is important to know that using inhalants is very dangerous and can lead to long-term health problems.

www.teens.drugabuse.gov/facts/facts_inhale1.asp

Marijuana

Marijuana is a drug that is used by millions of people in the United States. It is a natural substance that comes from the leaves and flowers of the marijuana plant. It is often smoked or eaten, and it can be addictive. Marijuana is often used for recreational purposes, but it can also be used for medical purposes. However, it is important to know that marijuana can cause health problems, including impaired memory and judgment, and it can be addictive. Many people who use marijuana are young people who are looking for a quick fix. It is important to know that using marijuana is very dangerous and can lead to long-term health problems.

www.drugabuse.gov/MarijBroch/Marijteens.html

Methamphetamine

Methamphetamine is a powerful drug that is used by millions of people in the United States. It is a synthetic substance that is often used to get high and can be very addictive. Methamphetamine is often used for recreational purposes, but it can also be used for medical purposes. However, it is important to know that methamphetamine can cause serious health problems, including damage to the brain and heart, and it can be fatal. Many people who use methamphetamine are young people who are looking for a quick fix. It is important to know that using methamphetamine is very dangerous and can lead to long-term health problems.

www.drugabuse.gov/infofacts/methamphetamine.html

Prescription Drugs

Prescription drugs are drugs that are prescribed by a doctor. They are used to treat a variety of conditions, including pain, depression, and anxiety. However, it is important to know that prescription drugs can be addictive and can cause serious health problems, including overdose and death. Many people who use prescription drugs are young people who are looking for a quick fix. It is important to know that using prescription drugs is very dangerous and can lead to long-term health problems.

