



DRUG FREE WORKPLACE PROGRAM

Winter 2009

DRUG FREE WORKPLACE PROGRAM (DFWP)
HUMAN RESOURCES OFFICE, NORFOLK
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Drugs and the Brain

Introducing the Human Brain

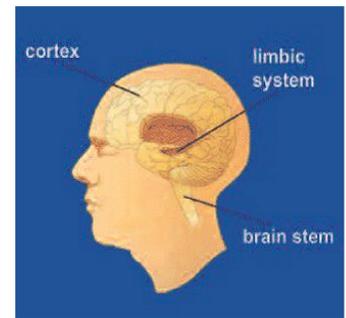
The human brain is the most complex organ in the body. This three-pound mass of gray and white matter sits at the center of all human activity - you need it to drive a car, to enjoy a meal, to breathe, to create an artistic masterpiece, and to enjoy everyday activities. In brief, the brain regulates your basic body functions; enables you to interpret and respond to everything you experience; and shapes your thoughts, your emotions, and your behavior.

The brain is made up of many parts that all work together as a team. Different parts of the brain are responsible for coordinating and performing specific functions. Drugs can alter important brain areas that are necessary for life-sustaining functions and can drive the compulsive drug abuse that marks addiction. Brain areas affected by drug abuse –

The brain stem controls basic functions critical to life, such as heart rate, breathing, and sleeping.

The limbic system contains the brain's reward circuit - it links together a number of brain structures that control and regulate our ability to feel pleasure. Feeling pleasure motivates us to repeat behaviors such as eating - actions that are critical to our existence. The limbic system is activated when we perform these activities - and also by drugs of abuse. In addition, the limbic system is responsible for our perception of other emotions, both positive and negative, which explains the mood-altering properties of many drugs.

The cerebral cortex is divided into areas that control specific functions. Different areas process information from our senses, enabling us to see, feel, hear, and taste. The front part of the cortex, the frontal cortex or forebrain, is the thinking center of the brain; it powers our ability to think, plan, solve problems, and make decisions.



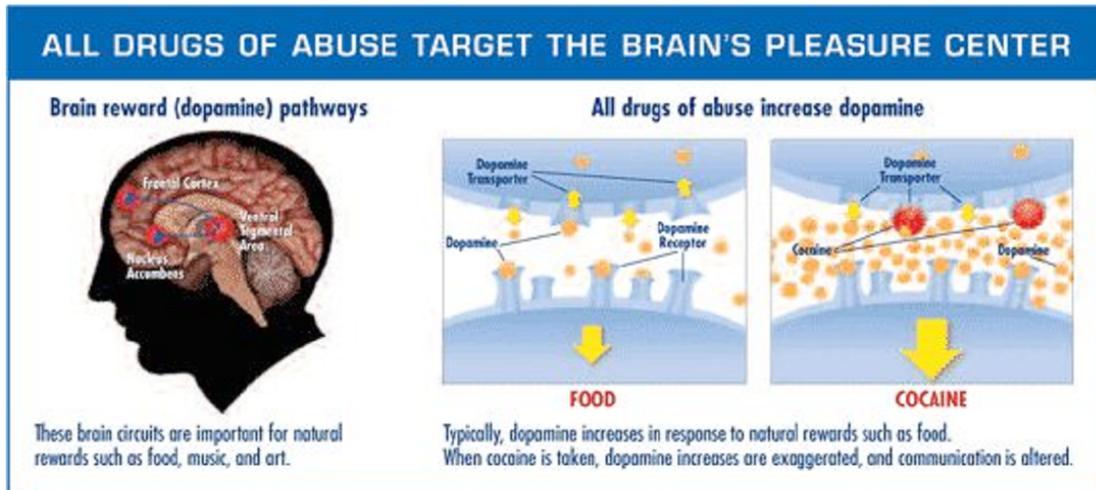
How does the brain communicate? The brain is a communications center consisting of billions of neurons, or nerve cells. Networks of neurons pass messages back and forth to different structures within the brain, the spinal column, and the peripheral nervous system. These nerve networks coordinate and regulate everything we feel, think, and do.

Neuron to Neuron ~ Each nerve cell in the brain sends and receives messages in the form of electrical impulses. Once a cell receives and processes a message, it sends it on to other neurons.

Neurotransmitters - The Brain's Chemical Messengers ~ The messages are carried between neurons by chemicals called neurotransmitters. (They transmit messages between neurons.)

Receptors - The Brain's Chemical Receivers ~ The neurotransmitter attaches to a specialized site on the receiving cell called a receptor. A neurotransmitter and its receptor operate like a "key and lock," an exquisitely specific mechanism that ensures that each receptor will forward the appropriate message only after interacting with the right kind of neurotransmitter.

Transporters - The Brain's Chemical Recyclers ~ Located on the cell that releases the neurotransmitter, transporters recycle these neurotransmitters (i.e., bringing them back into the cell that released them), thereby shutting off the signal between neurons.



How do drugs work in the brain? Drugs are chemicals. They work in the brain by tapping into the brain's communication system and interfering with the way nerve cells normally send, receive, and process information. Some drugs, such as marijuana and heroin, can activate neurons because their chemical structure mimics that of a natural neurotransmitter. This similarity in structure "fools" receptors and allows the drugs to lock onto and activate the nerve cells. Although these drugs mimic brain chemicals, they don't activate nerve cells in the same way as a natural neurotransmitter, and they lead to abnormal messages being transmitted through the network.

Other drugs, such as amphetamine or cocaine, can cause the nerve cells to release abnormally large amounts of natural neurotransmitters or prevent the normal recycling of these brain chemicals. This disruption produces a greatly amplified message, ultimately disrupting communication channels. The difference in effect can be described as the difference between someone whispering into your ear and someone shouting into a microphone.

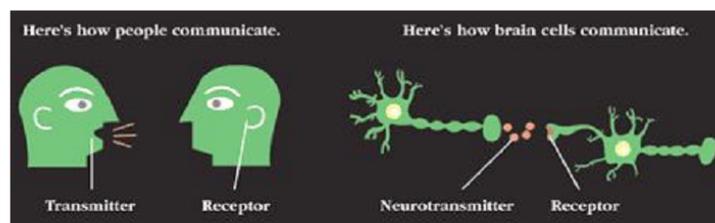
How do drugs work in the brain to produce pleasure? All drugs of abuse directly or indirectly target the brain's reward system by flooding the circuit with dopamine. Dopamine is a neurotransmitter present in regions of the brain that regulate movement, emotion, cognition, motivation, and feelings of pleasure. The overstimulation of this system, which rewards our natural behaviors, produces the euphoric effects sought by people who abuse drugs and teaches them to repeat the behavior.

How does stimulation of the brain's pleasure circuit teach us to keep taking drugs?

Our brains are wired to ensure that we will repeat life-sustaining activities by associating those activities with pleasure or reward. Whenever this reward circuit is activated, the brain notes that something important is happening that needs to be remembered, and teaches us to do it again and again, without thinking about it. Because drugs of abuse stimulate the same circuit, we learn to abuse drugs in the same way.

Why are drugs more addictive than natural rewards?

When some drugs of abuse are taken, they can release 2 to 10 times the amount of dopamine that natural rewards do. In some cases, this occurs almost immediately (as when drugs are smoked or injected), and the effects can last much longer than those produced by natural rewards. The resulting effects on the brain's pleasure circuit dwarfs those produced by naturally rewarding behaviors such as eating and sex. The effect of such a powerful reward strongly motivates people to take drugs again and again. This is why scientists sometimes say that drug abuse is something we learn to do very, very well.



“Long-term drug abuse impairs brain functioning.”

What happens to your brain if you keep taking drugs?

Just as we turn down the volume on a radio that is too loud, the brain adjusts to the overwhelming surges in dopamine (and other neurotransmitters) by producing less dopamine or by reducing the number of receptors that can receive and transmit signals. As a result, dopamine's impact on the reward circuit of a drug abuser's brain can become abnormally low, and the ability to experience any pleasure is reduced. This is why the abuser eventually feels flat, lifeless, and depressed, and is unable to enjoy things that previously brought them pleasure. Now, they need to take drugs just to bring their dopamine function back up to normal. And, they must take larger amounts of the drug than they first did to create the dopamine high - an effect known as tolerance.

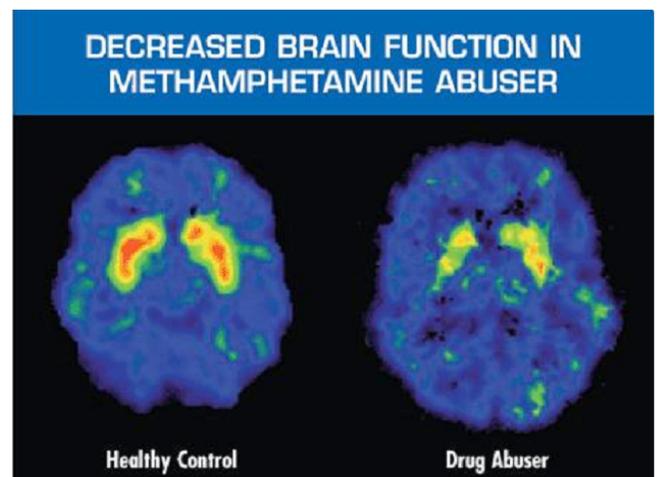
How does long-term drug taking affect brain circuits?

We know that the same sort of mechanisms involved in the development of tolerance can eventually lead to profound changes in neurons and brain circuits, with the potential to severely compromise the long-term health of the brain. For example, glutamate is another neurotransmitter that influences the reward circuit and the ability to learn. When the optimal concentration of glutamate is altered by drug abuse, the brain attempts to compensate for this change, which can cause impairment in cognitive function. Similarly, long-term drug abuse can trigger adaptations in habit or nonconscious memory systems.

Conditioning is one example of this type of learning, whereby environmental cues become associated with the drug experience and can trigger uncontrollable cravings if the individual is later exposed to these cues, even without the drug itself being available. This learned "reflex" is extremely robust and can emerge even after many years of abstinence.

What other brain changes occur with abuse?

Chronic exposure to drugs of abuse disrupts the way critical brain structures interact to control behavior - behavior specifically related to drug abuse. Just as continued abuse may lead to tolerance or the need for higher drug dosages to produce an effect, it may also lead to addiction, which can drive an abuser to seek out and take drugs compulsively. Drug addiction erodes a person's self-control and ability to make sound decisions, while sending intense impulses to take drugs.



“This learned “reflex” is extremely robust and can emerge even after many years of abstinence.”

**Source: National Institute on Drug Abuse
“The Science of Addiction”**

**Additional information can be found on their
website: www.nida.nih.gov**

*** FREE HELP IS AVAILABLE ***

If you, a co-worker, or a family member needs help with a substance abuse issue the following resources are free of charge and available to all employees:

Contact numbers for Civilian Employee Assistance Program - CEAP

- Fleet & Industrial Supply Center, Norfolk: (800) 950-3434
- NCTAMSLANT BCO Mechanicsburg employees: (800) 869-0276
- Norfolk Naval Shipyard, Portsmouth: (800) 950-3434
- All other employees serviced by Human Resources Office, Norfolk: (866) 443-3277

For additional information, please visit HRO Norfolk's website at:
<http://www.hronorfolk.navy.mil> - CEAP link

Department of the Navy Civilian Human Resources Manual, Subchapter 792.3
DON Website: <https://www.donhr.navy.mil/DFWP.asp>

Human Resources Office, Norfolk, Drug-Free Workplace Program Office:
<http://www.hronorfolk.navy.mil> - DFWP link

"A safe, healthy and drug-free workplace is everybody's responsibility."