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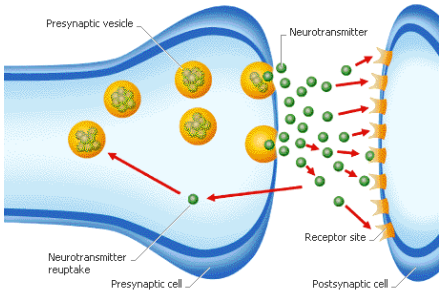
How Drugs and Alcohol Affect the Brain

HOW DRUGS AFFECT THE BRAIN



Drugs are chemicals that affect the brain by tapping into its communication system and interfering with the way neurons normally send, received and process information. Some drugs such as marijuana and heroin, can activate neurons because their chemical structure ***mimics*** that of a natural ***neurotransmitter***. Neurotransmitters are chemicals released by the nerve cells that act as "chemical messengers" from one neuron to another.

The similarity in structure "fools" the ***receptors*** and allows the drugs to attach onto and activate the neurons. Although these drugs mimic the brain's own chemicals, they do not activate neurons in the same way as a natural neurotransmitter and they lead to abnormal messages being transmitted through the network.

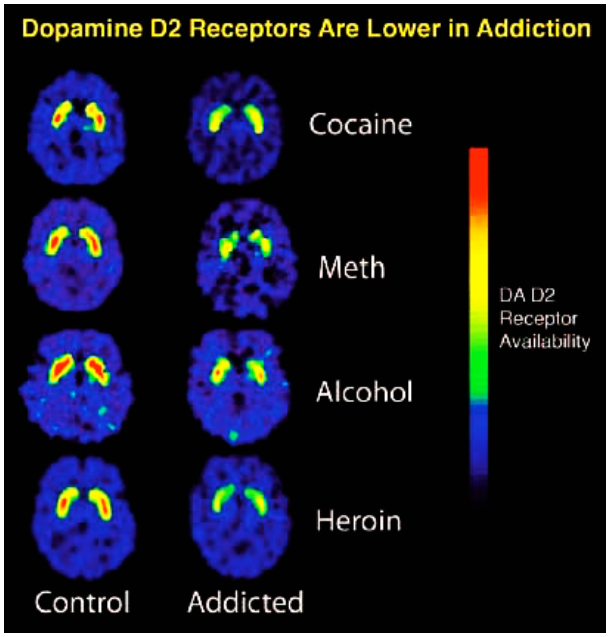
HOW DO DRUGS WORK IN THE BRAIN TO PRODUCE PLEASURE?

Most drugs 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, motivation and feelings of pleasure.

When activated at normal levels, this system rewards out natural behaviours. Overstimulating the system with drugs, however, produces euphoric effects, which strongly reinforce drug use that leads to addiction.

Neurotransmitter	What it does	What drug affects it
Dopamine	Involved in regulation of movement, reward and punishment, pleasure and energy.	Every drug that affects feelings of pleasure, including cocaine, amphetamine, opiates, marijuana, phencyclidine (PCP) and heroine.
Norephinephrine	Involved in arousal and alertness, energy and feelings of pleasure.	Stimulants.
Serotonin	Involved in regulation of mood and impulsivity.	Alcohol, hallucinogens and stimulants.
Acetylcholine	Inhibitory neurotransmitter involved in movement, memory function, motivation and sleep.	PCP and hallucinogens, marijuana and stimulants.
GABA (Gamma Aminobutyric Acid)	Inhibitory neurotransmitter involved in arousal, judgment and impulsiveness.	Depressants and marijuana
Endorphins	Substances involved in pain relief, rewards and punishment.	Opioids and depressants.

WHAT HAPPENS TO THE BRAIN WITH CONSTANT DRUG USE?



For the brain, the difference between normal rewards and drug rewards can be described as the difference between someone whispering into your ear and someone shouting into a microphone. 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 signals. As a result, dopamine's impact on the reward circuit of the brain of someone who abuses drugs can become abnormally low, and that person's ability to experience *any* pleasure is reduced.

This is why a person who abuses drugs eventually feels flat, lifeless, and depressed, and is unable to enjoy things that were previously pleasurable. Now, the person needs to keep taking drugs again and again just to try and bring his or her dopamine function back up to normal—which only makes the problem worse, like a vicious cycle. Also, the person will often need to take larger amounts of the drug to produce the familiar dopamine high—an effect known as ***tolerance***.

The brain is the control center of the body. It is part of the central nervous system (CNS). The CNS is composed of billions of ***neurons*** or nerve cells located in the brain and the spinal cord.

HOW ALCOHOL AFFECTS THE BRAIN

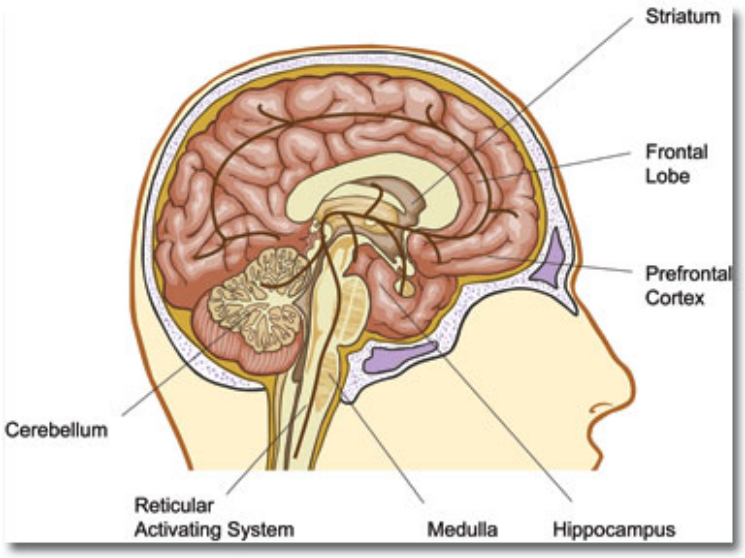
The CNS is greatly affected by alcohol because alcohol can pass through the blood-brain barrier, directly reaching the neurons. Once the alcohol touches these cells, they are changed. This results in behavioural changes in the individual.

WHAT HAPPENS TO THE CNS AFTER DRINKING?

Alcohol is a ***depressant***. This means, it makes the neurons less active, causing brain activity to slow down. This causes drinkers to become more animated and less reserved. This is because the first areas affected by small amounts of alcohol are those involved in inhibiting behavior. Other signs that the brain is slowing down are: altered speech, hazy thinking, slower reaction time, dulled hearing, impaired vision, weakened muscles and foggy memory.

While excessive alcohol drinking does not kill brain cells, it it inhibits the growth of new brain cells.

How Alcohol Affects Different Brain Areas and Functions in Teens



Ventral striatum and prefrontal cortex:
These parts have connections that make up the brain's reward system and regulate impulsive behavior. In a young person, drinking too much alcohol can affect those connections, which are not finished developing yet. As a result, teens may do impulsive things that they probably would not do under normal circumstances. This is also the part of the brain that is affected first, causing behavior to become looser and less guarded.

Hippocampus:
This is the part of the brain that stores memory. It is still maturing during adolescence. Even a small amount of alcohol can make teens forget what they did or learned while drinking.

Cerebellum:
This part works with the primary motor cortex to control movement, balance and complex motor functions. Drinking alcohol can decrease motor function and slow reaction time. For example, when a person is drunk, he or she may not be able to stand or walk in a straight line.

Cerebral cortex:
This section controls the senses and inhibitory centers. That is why an individual who drinks becomes more talkative, self-confident and less socially inhibited. It also controls thought processes that is why judgment and clear thinking is impaired.

Frontal lobe:
This section controls judgment, behavior and emotion. Alcohol may affect emotions, leading to crying, fighting or a desire to be closer to another person.

Reticular activating system:
This part is in the midbrain and it controls sleeping and waking. Alcohol can depress these systems, causing a person to pass out.

Hypothalamus:
The hypothalamus is a small portion of the brain responsible for a variety of functions of the automatic nervous system. When alcohol affects the hypothalamus, the individual's blood pressure increases. In addition, the individual becomes hungry, thirsty and needs to urinate frequently. The individual's body temperature and heart rate, on the other hand, decreases.

Medulla:
This part is in the hindbrain and it controls heartbeats, breathing and other functions. During heavy drinking, these may slow down or stop working altogether, endangering an individual's life.

Neurons:
These are the nerve cells. High alcohol levels can damage and inhibit the growth of new neurons.

Blood vessels:
At intoxicating levels, alcohol causes blood vessels to relax and widen. At higher levels, it can shrink the vessels and increase blood pressure.

MAKING BAD DECISIONS

Teens who drink are prone to making bad decisions. This is because their prefrontal cortex is not yet mature and is heavily affected by alcohol. This leads teens to do thing because "it's fun" or "feels good". They may take risks they usually would not take. The connection between the prefrontal cortex and ventral striatum are still maturing, as well. As a result, teens may do impulsive things such as drinking and driving or having unprotected sex.

ALCOHOL INTERFERES WITH PRESCRIPTION MEDICATION

Some teens take medication for conditions such as attention deficit disorder (Ritalin), bipolar disorder (lithium) and depression (Prozac). Alcohol can increase the effects of some of these medications. For example, alcohol mixed with Ritalin may damage the teen's ability to perform tasks that require total concentration. Large amounts of alcohol mixed with lithium may impair judgment, thinking and motor skills.

The following are photographs by Marcos Alberti documenting the effects of drinking one to three glasses of alcohol.