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Tel (404) 223-2486 | Fax (866) 786-9811 | www.LiveDrugFree.org

People at risk of developing an alcohol use disorder can be identified using a Screening, Brief Intervention, and Referral to Treatment (SBIRT) approach. **www.LiveDrugFree.org**

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Information in this newsletter is based on research conducted by the National Institute on Drug Abuse (NIDA). NIDA's mission is to lead the nation in bringing the power of science to bear on drug abuse and addiction.

Reasons for Drug Use

Research has shown that people generally take drugs to either feel good (i.e., sensation seekers or anyone wanting to experiment with feeling high or different) or to feel better (i.e., self-medicators or individuals who take drugs in an attempt to cope with difficult problems or situations, including stress, trauma, and symptoms of mental disorders).

How Drugs Affect the Brain

Drugs exert their effects largely on the motivation and pleasure pathways of the brain which makes people feel good or feel better. Often, the chemical structure of drugs is similar to brain chemicals or neurotransmitters. Similarity in structure allows them to be recognized by neurons and to alter normal brain messages. For example, dopamine is a brain chemical involved in many different functions including movement, motivation, reward—and addiction. Nearly all drugs of abuse, directly or indirectly, increase dopamine in the pleasure and motivation pathways, and in so doing, alter the normal communication between neurons.

Chemical Messengers

The brain consists of billions of neurons, or nerve cells that communicate via chemical messages. The soma, or cell body, is where neurotransmitters are made. Extending outward from the cell body are dendrites, which receive information from other neurons. When the cell body is sufficiently stimulated, an electric pulse called an action potential is generated and subsequently travels down the axon of the cell to the terminal region of the cell. Fast transmission of this electrical message is aided by an insulator material covering the axon called myelin. Once the impulse reaches the nerve terminal, neurotransmitters, such as dopamine are released into the synapse or gap between neurons. These chemicals can then attach to receptors located on the dendrites of neighboring neurons, thus transmitting information from one cell to the next within the brain and other parts of the body. Some axons can travel a long distance, extending all the way from your brain to your toes!

When a signal comes down the axon, dopamine is released into the synapse. It then crosses the synaptic cleft to the second neuron, where it binds to and stimulates dopamine receptors, generating a signal in the second neuron. The dopamine is then released from the receptor and crosses back to the first neuron where it is picked up by dopamine transporters (reuptake molecules) for re-use. Eating something that you enjoy or being stimulated in other ways can cause dopamine levels to increase.

What Happens When a Person Takes Drugs?

When someone takes a drug such as cocaine, the cocaine attaches to dopamine transporters and blocks dopamine from being taken back up by the first neuron. Thus, dopamine can continue

to stimulate (maybe over-stimulate) the receptors of the second neuron because it remains in the synapse for a longer period of time. This duration of stimulation and amount of dopamine in the synapse is far greater than what normally occurs when a person engages in an enjoyable activity and is what produces cocaine's intense euphoria and potential for abuse.

Almost All Drugs of Abuse Increase Dopamine Neurotransmission

All drugs of abuse have different mechanisms of action. However, they all increase activity in the brain reward pathway by increasing dopamine neurotransmission. It's because drugs activate these brain regions—usually more effectively and for longer periods of time than natural rewards—that they have an inherent risk of being abused.

Dopamine is an important brain chemical in drug abuse and addiction, but other brain systems and brain chemicals are also involved. Serotonin and glutamate neurotransmitter systems, for example, are among those affected. These neurotransmitters are important regulators of mood, sleep, learning and memory, and more.

Brain Pathways Affected by Drugs of Abuse

The dopamine and serotonin pathways are two brain systems affected by drugs of abuse. By altering activity in these pathways, abused substances can influence their function. Dopamine neurons influence pleasure, motivation, motor function, and saliency of stimuli or events. Serotonin plays a role in learning, memory, sleep, and mood.

Drug Abuse Changes the Brain

Prolonged drug abuse changes the brain in fundamental ways that reinforce drug taking and lead to addiction. These changes are difficult to un-do and may last a long time. Drug abuse changes both the structure of the brain and its functioning. Research in humans and in animal models demonstrates that repeated exposure to drugs of abuse alters brain function and behavior. Therefore, early intervention is key—before brain changes take hold and drug abuse becomes compulsive.

Exposure to some drugs of abuse can change the structure of neurons in the brain. Stimulants like amphetamines can alter the structure of neurons. The effects of these brain changes include impaired mental and motor functions, such as memory deficits and slowed motor reactions.

Research has identified a number of brain circuits that are affected by drug abuse and addiction. Drug use impacts brain circuits that underlie feelings of reward, learning and memory, motivation and drive, and inhibitory control. Addiction is a complex and chronic disease of the brain with many contributors to its expression in individuals.

The Importance of Prevention

Research shows that brain development continues throughout adolescence and into early adulthood. Because addiction is a developmental disease that usually begins in adolescence (for example, 67 percent of those who try marijuana for the first time are between the ages of 12 and 17), prevention efforts are therefore of primary importance—to stop drug abuse before it ever starts.